SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1916.

No. 7, Original.

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY.

IN EQUITY.

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At the Capitol of the United States, in the city of Washington and District of Columbia, being the present seat of the National Government of the United States, on the second Monday of October (being the 10th day of the same month), in the year of our Lord one thousand nine hundred and ten, and of the independence of the United States the one hundred and thirty-fifth, The Supreme Court of the United States met agreeably to law.

And afterwards, to wit, on the 29 day of May, A. D. 1911, the following entry appears of record, viz:

No. 20, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

Mr. Douglas A. Preston, of counsel for the complainant, submitted to the consideration of the Court a motion for leave to file a bill of complaint.
May 29, 1911.

Which said motion is in words and figures following, viz:

In the Supreme Court of the United States, October Term, 1910.

In Equity.

No. —, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Application for Leave to File Original Bill of Complaint.

Comes now the complainant in said cause by Douglas A. Preston, Attorney-General for the State of Wyoming and solicitor and of counsel for the complainant, and makes this the application of the said complainant for leave to file in this Court the Bill of Complaint in said cause, and said complainant herewith presents the Bill of Complaint which it proposes to file.

DOUGLAS A. PRESTON,
Attorney-General for the State of Wyoming and Solicitor and of Counsel for Complainant.

(Endorsed:) Supreme Court U. S., October Term, 1910. No. 20, Original. The State of Wyoming, complainant, vs. The State of Colorado et al. Motion for leave to file bill of complaint. Filed May 29, 1911.

And on the same day, to wit, the 29th of May, A. D. 1911, the following order appears of record, viz:

No. 20, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On consideration of the motion for leave to file bill of complaint herein,

It is now here ordered by the Court that said motion be, and the same is hereby, granted, and process is ordered to issue, returnable on October 9th next.

May 29, 1911.

And on the same day, towit, on the 29th day of May, A. D. 1911, a bill of complaint was filed in the words and figures following, viz:

In the Supreme Court of the United States, October Term, 1910.

In Equity.

No. —, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Bill of Complaint.

To the Honorable the Justices of the Supreme Court of the United States, sitting in equity:

The State of Wyoming by Douglas A. Preston, its Attorney General, he being hereunto directed by the Governor of the State of Wyoming, by leave of this Honorable Court first had, brings this its Bill of Complaint against the State of Colorado, The Greeley-Poudre Irrigation District, a municipal corporation, and The Laramie Poudre Reservoirs and Irrigation Company, a corporation, and

Humbly complaining showeth unto your Honors your Orator, The State of Wyoming,

That your Orator is one of the States constituting the United

States of America, with all the privileges, rights and powers and with all the duties, including the duty of protecting the rights and interests of its citizens possessed or devolved upon any State; that said defendant, The State of Colorado, is one of the States, and as your Orator is credibly informed and verily believes the other defendants, to-wit, The Greeley-Poudre Irrigation District and The Laramie Poudre Reservoirs and Irrigation Company, are corporations created by said defendant The State of Colorado.

That the Laramie River is a natural stream of water originally and immemorially flowing through the public domain of the United States, rising in the mountainous district of Northern Colorado and flowing in a general northwesterly course for about twenty-seven miles in Colorado, thence northerly and northeasterly for a distance of about one hundred and fifty miles in Wyoming and emptying into the North Platte River in the latter mentioned State.

The greater extent of the drainage basin of the Laramie River in Colorado is a mountainous and heavily timbered country, where snows fall in winter to a great depth, which, melting in the spring and summer, have from time immemorial supplied the waters flowing in the channel of the Laramie River and its tributaries, taking its course through, over and across the lands in the valley of said stream, both in Colorado and in Wyoming, thereby both naturally and with artificial aid moistening and irrigating the said lands and rendering the same valuable for domestic, pastoral and agricultural purposes.

Divers tributaries of said Laramie River likewise rise in the mountainous regions of Northern Colorado and discharge their waters into the said Laramie River, either in Colorado or Wyoming, among others being the following, to-wit: East Fork, West Fork, Mill Creek, Fall Creek, Rapid Creek; Springer Creek, Rawah Creek, Spring Creek, McIntyre Creek, Dead Man, Nunn Creek, Brinker Creek, Sand Creek, Porter Creek, Columbine Creek, La Grande Creek, Forrester Creek, Grace Creek, Stuck Creek, Jim Creek and various small tributaries.

Other than said tributaries which originate in Colorado, the water in the Laramie River receives no substantial accession through any tributary stream from the point where the Laramie River intersects the common boundary line between the said States of Colorado and Wyoming except the following streams, to-wit: Chugwater, North Laramie, Sybille, Little Laramie and Fox Creek. A general map of the said drainage basin of the Laramie River and its tributaries and also showing the irrigated lands thereunder within the State of Wyoming, and also showing the location of the tunnel through which defendants are threatening to divert said waters from the said water shed and the region where defendants are proposing to use said waters, is hereto attached marked "Exhibit A."

A further topographical map of so much of the said drainage basin as lies within the State of Colorado is hereto attached marked "Exhibit B."

The area of the water shed or drainage basin of the Laramie River

and its tributaries in Colorado amounts to about three hundred and ninety-five square miles, and the area of the water shed or drainage basin of said River and its tributaries in Wyoming amounts to about three thousand six hundred and thirty-two square miles.

The surface character of the water shed or drainage basin aforesaid in Colorado is chiefly that of a mountainous, rocky, timbered, rough and broken country, while that of the said drainage basin in Wyoming is generally open, rolling, gently sloping or level and arable land. Only a comparatively small part of the said land within the drainage basin of said River in Colorado is of arable character even by the use of artificial irrigation, while much the greater portion of the said drainage basin or water shed in Wyoming is arable and productive when water is used as hereinafter stated.

The lands riparian to the said Laramie River and its tributaries, including all the lands in said drainage basin or water shed both in Colorado and Wyoming, except as watered and rendered fertile by the natural flowage of said stream, in their natural state are for the most part arid and unproductive and require the use of water applied in the form of irrigation to produce agricultural crops or to render the use of such lands profitable to any considerable degree, the annual precipitation upon said lands being insufficient for the growth of profitable crops without such irrigation.

Prior to the commencement of the wrongs herein complained of, and prior to the creation of the Territory of Wyoming under the Act of Congress of July 25, 1868, that portion of the water shed and drainage basin of said Laramie River and its tributaries which is now within the State of Wyoming was within the boundaries and subject to the laws, customs and decisions of the Territory of Dakota. During said time the customs and usages of the people of said Territory of Dakota and the statutes and laws thereof and the decisions of its courts declared, enacted, held and established that each riparian proprietor on said streams, and each of them, had the right to have the waters thereof flow perpetually across and along his lands unpolluted and undiminished save to the extent made necessary by the reasonable use of the waters thereof by other riparian proprietors while passing over and along the lands of said other riparian proprietors.

Since the admission of your Orator as one of the States, in the region in which said lands lie, in accordance with the customs and usages of the people, recognized by the laws and decisions of the Courts of both Colorado and Wyoming, in all cases where prior rights to the contrary have not intervened it has been the custom to divert and apply the waters of the natural streams to supply the deficiency in the annual precipitation to cultivate the lands within the drainage basin of said streams and make the same productive. Under the said customs, usages, laws and decisions it has been established, enacted, held and decided in both States as to the waters of all streams and other sources of water supply where prior rights to the contrary have not intervened that such waters are open for a reasonable appropriation and use for irrigation purposes; that except as aforesaid priority of appropriation gives priority of right; that neither

the point of diversion nor the place nor kind of use of any appropriation or any water appropriated may be changed in such way as to injure any other appropriator from the said stream or source of supply whether such other appropriator be prior or subsequent in point of time. It has likewise in both States for the time aforesaid, by the customs, laws and decisions of the Courts, been established, enacted, held and decided that no appropriation of waters is effected until such waters are applied to a beneficial use, but at the same time that in every case where the waters are actually applied to a beneficial use the date of priority of the appropriation, except as aforesaid, is the time when the work of such appropriation was actually and in good faith commenced, provided that the work proceed with diligence from the commencement to the actual application of the water to the beneficial use, and further that the amount of the appropriation to which each appropriator is entitled is the amount of water actually used not exceeding the amount reasonably necessary for the actual beneficial use to which it is applied.

Long before the creation of the State of Colorado or the State of Wyoming, and long before the adoption within said water shed of any custom, law or doctrine of prior appropriation, and long prior to the commencement of the wrongful acts and threatened acts herein complained of, the United States of America, the owner and proprietor at the time of all the lands within said water shed, by the Act of Congress entitled "An Act To aid in the construction of a railroad and telegraph line from the Missouri river to the Pacific ocean, and to secure to the government the use of the same for postal, military, and other purposes," approved July 1st, 1862, and the Acts of Congress amendatory thereof and supplemental therto, granted to the Union Pacific Railroad Company, a corporation created and organized under the said Acts, a large amount, to-wit, more than three hundred and fifty thousand acres of the said lands within the State of Wyoming riparian to the said Laramie River and its said tributaries arising within the State of Colorado and within the drainage basin of said Laramie River and its tributaries last aforesaid. Since said grants the said lands so granted have passed to many different owners, for the most part citizens of your Orator, by means of conveyances and mesne conveyances from, through and under said Union Pacific Railroad Company, by means whereof said lands are owned, possessed and occupied by a large number, to-wit, by more than fifteen hundred persons, for the most part citizens of your Orator. That through and by means of the said grant and conveyances the right to a continued flow of the said water in its accustomed channel was granted by the United States, and is now vested in the said citizens of your Orator owning, possessing and occupying the said lands.

In 1865 and the succeeding years, and as your Orator is credibly informed and believes long prior to the acts of the defendants hereinafter complained of, the occupation and settlement of the lands within the said water shed and drainage basin within Wyoming was begun, and continued in an increasing degree so that for many years prior to the commencement of said wrongful acts the lands

in Wyoming lying along the said Laramie River and its tributaries and in its drainage basin had been settled, cultivated, improved and rendered highly productive by the practice of irrigation and the use of the waters of the said Laramie River and its tributaries for the irrigation of the said lands, about twenty thousand people, citizens of Wyoming, being then and now settled and established and residing upon said lands along the said Laramie River and its tributaries in Wyoming, all of which population had thereby become and still is directly or indirectly dependent for its livelihood upon the continued flow and use of the said waters; and expenditures to the amount of about twenty million dollars had then been made and are now being continued and increased in the development of such waters and in reservoirs, canals and other appliances for the purpose of making beneficial use of the said waters as aforesaid; that a large part, to-wit, more than nine-tenths of the lands so settled upon, aggregating more than four hundred thousand acres of land, were patented by the United States to divers persons prior to the commencement of the wrongs hereinafter complained of, which said lands are now owned and possessed and occupied by citizens of your Orator. And the said waters are likewise used by the said citizens in the towns and villages along the said stream for domestic purposes in addition to their use for purposes of irrigation, as aforesaid. All of which appropriations and use of said waters were long prior to the commencement of the wrongs herein complained of.

Your Orator receives a large share of the moneys necessary for the purpose of governing, protecting and carrying on the business of your Orator and its citizens from the property and people of the said drainage basin in Wyoming, and without the said moneys so received would be greatly crippled in carrying out the proper business of your Orator as one of the States of the Union.

And your Orator is the proprietor of extensive and numerous tracts of land, to-wit, tracts of land aggregating more than fifty thousand acres, lying along the banks of the said Laramie River and its tributaries and within the said water shed or drainage basin, and within the State of Wyoming, title to which it acquired prior to the acts and threatened acts of defendants herein complained of, some of which lands are naturally watered in varying degrees by the waters of the said stream, and others of which have for many years been artificially irrigated by the use of said waters, and the value of all of the said lands of your Orator, as well as the value of all of the lands of its citizens within the said drainage basin, as aforesaid, depends almost wholly upon the continued use and enjoyment of the said waters.

Prior to the commencement of the wrongs herein complained of, your Orator had also established at the City of Laramie and near the margin of the said Laramie River, its State University, including among others the Agricultural College, the College of Mines, the State Normal School, the College of Liberal Arts, the Agricultural Experiment Station, at which the funds granted by the divers Acts of Congress to the State of Wyoming for experimental

research in agricultural and the mechanic arts are expended, employed and used, the successful and continued conduct of which institutions is largely dependent upon the use of the waters of the said River.

Prior to the commencement of the wrongs and threatened wrongs of the defendants as hereinafter set forth, as your Orator is credibly informed and verily believes, the defendant, The State of Colorado, and certain of its citizens had appropriated for the purpose of irrigating certain lands within the drainage basin and water shed of the said Laramie River in the State of Colorado, certain waters of the said River and its tributaries, but upon the like information and belief your Orator avers that the total amount of lands for which said appropriations were made in the State of Colorado did not and does not exceed three thousand acres of land, and the total amount of water that could reasonably or beneficially be used upon the said lands does not exceed six thousand acre feet of water per annum, an acre foot of water being such a flow of water as would without deduction for seepage or evaporation, cover one acre of land to the depth of one foot in one year.

And your Orator further avers that the use of the said waters as so appropriated by the said defendant. The State of Colorado, and its citizens, was as your Orator is credibly informed and verily believes, at all times prior to the wrongs herein complained of, kept within the drainage basin of the said Laramie River, and that all the seepage and overflow from the irrigation of the said lands by the said State of Colorado and its citizens again returned to the said Laramie River for use of others within the said drainage area, including your Orator and its citizens, at points below the places of irrigation in the said State of Colorado. And upon like information and belief your Orator avers that owing to the character of the said drainage basin in the said State of Colorado and the character of the soil and its underlying strata at the places where the said irrigation in Colorado was accomplished a large proportion, to-wit, more than seventy-five per cent. of the waters so used within the said drainage basin in Colorado for irrigation actually returned to the said Laramie River and its tributaries before the said stream crossed into the State of Wyoming and above the points of diversion of said water by your Orator and its citizens, and above the points where the natural flow of the said waters of said Laramie River and its tributaries have immemorially been accustomed to flow upon and across the said lands of your Orator and its citizens.

And upon the like information and belief your Orator further avers that no other appropriation or use of the said waters of said Laramie River or its tributaries had been made by the said State of Colorado or its citizens or within the said State of Colorado prior to the appropriation of said waters by your Orator and its citizens as herein set forth, and no appropriation by said State of Colorado or its citizens had been made prior to the grants, patents and conveyances of the said lands by the United States under which your Orator and its citizens hold title to the lands herein alleged and

shown to be owned and possessed by your Orator and its citizens occupying the said lands.

And your Orator further avers that prior to the commencement of the wrongs or threatened wrongs hereinafter set forth, your Orator and its citizens within the area of the drainage basin of said Laramie River and its tributaries in the State of Wyoming had appropriated all of the available waters of the said Laramie River and its tributaries above the required flow thereof for riparian proprietors as herein set forth for the actual irrigation of the lands of your Orator and its citizens within the drainage basin and water shed of the said Laramie River, to-wit, for the irrigation of more than three hundred and twenty-five thousand acres of land within the said water shed and drainage basin, and had likewise enjoyed the waters of said stream and its tributaries for the sub-irrigation of more than twenty-five thousand acres of the lands riparian to said River and its tributaries so as aforesaid owned and possessed by your Orator and its citizens, and for watering large numbers of livestock and for domestic uses within the said water shed within the State of Wyoming.

And your Orator further avers that without the use of the said waters as aforesaid the lands of your Orator and its citizens within the said water shed within the State of Wyoming would be to a very large extent valueless and incapable of supporting any considerable population, and that with the use of the said waters as aforesaid, the said lands are very valuable, to-wit, of a value of more than ten million of dollars, and support a large population, to-wit, a population of more than twenty thousand people, and that the wrongs and threatened wrongs of the said defendants as hereinafter set forth if persisted in would render the lands of your Orator and its citizens in the said water shed and drainage basin to a very large extent valueless.

And your Orator well hoped that no disputes would have arisen touching the use of the said waters, or touching the rights of your Orator or its citizens in relation thereto, but that the said defendants and each of them would have complied with the reasonable requests of your Orator to permit said waters to be used in accordance with the rights of the parties as above set forth as in conscience and equity the said defendants, and each of them, ought to have done.

But now so it is, may it please your Honors, that the said defendants, The State of Colorado, The Greeley-Poudre Irrigation District, a municipal corporation, and The Laramie Poudre Reservoirs and Irrigation Company, a corporation, combining and confederating together and with divers persons at present unknown to your Orator, whose names when discovered your Orator prays it may be at liberty to insert herein, with apt words to charge them as parties defendant hereto, and contriving how to wrong and injure your Orator in the premises, threaten to take from the said Laramie River and its tributaries within the State of Colorado and to carry the same outside of the water shed of the said Laramie River for use in irrigation at points where the said waters cannot return to the said River, to-wit, at a distance of one hundred miles or more from the said water shed large volumes of the said waters, to-wit, more than one hundred

thousand acre feet per annum of the said waters, and that for the purpose of carrying out their said threats and purposes the said defendants have already begun the construction of a tunnel or tunnels through the walls of the said water shed and drainage basin of said River for the purpose of so as aforesaid diverting and carrying off the said waters, all of which has been done and is now being done and threatened contrary to the requests and protests of your Orator in the premises. The ditches and canals through which said defendants are now diverting said waters so far as at present known to your Orator are as follows, to-wit; Rawah or West Side Ditch gathering water from McIntyre, Rawah, Mill, Fall and Rapid Creeks, the said ditch being about six miles in length; the East Side Ditch gathering water from Dead Man, Nunn and Porter Creeks, the said ditch being about eight miles in length; said works having been commenced, as your Orator is informed and believes, on or about the first day of December, 1909.

And the said defendants absolutely refuse to comply with the said reasonable requests of your Orator to cease and refrain from the said diversion, at times pretending that they are merely changing the places of use of the waters appropriated within the State of Colorado for irrigation within the drainage basin of the said Laramie River as aforesaid, and at other times alleging and pretending that the State of Colorado is the full and absolute owner and entitled of right to dispose absolutely of all of the waters found within her borders regardless of the rights of your Orator and its citizens; and your Orator alleges and charges the contrary of the said claims and pretenses to be the truth, and that in truth and in fact the amount of water already diverted and taken away from the said drainage basin as aforesaid within the State of Colorado is itself largely in excess of any appropriations of water for the irrigation of lands in the State of Colorado within the drainage basin of the said Laramie River so far as such appropriations were made prior to the acquiring of the rights of your Orator and its citizens as aforesaid, and the amount so as aforesaid threatened to be diverted and carried away from the said drainage basin is also itself largely in excess of the quantity of water ever used for irrigation within the said drainage basin in the State of Colorado, and largely in excess of any amount of water that could be reasonably or beneficially used for the irrigation of any lands in said drainage basin in the State of Colorado, including all lands in said water shed that were ever irrigated from the waters of said stream or its tributaries, and also all of such lands that have not been irrigated, and the amount of water already taken added to the amount threatened to be taken as aforesaid is many times the amount of water that ever has been or could be reasonably or beneficially used upon the lands in Colorado within said drainage basin that were ever irrigated from the waters of said stream and its tributaries, or are irrigable therefrom.

And your Orator further avers that the diversion of the said waters from said drainage basin instead of using them upon lands within the said drainage basin deprives your Orator and its citizens of all the return flow and seepage of the said waters, which return flow and

seepage is very large in amount as above stated, and is of great value to and is necessary to your Orator and its citizens.

And your Orator further avers that in truth and in fact the said State of Colorado is not the owner of all or any of the waters within the said State with the full right to dispose of them as it may choose, but on the contrary that the rights of the said State of Colorado in reference to the disposition of the said waters were at all the times aforesaid, and now are subject to the rights acquired by your Orator and its citizens as aforesaid in said waters, nor have the defendants, or either of them, the right to so dispose of the said waters as to deprive your Orator or its citizens of the use thereof in accordance with their rights as aforesaid acquired by appropriation, or to deprive your Orator or its citizens of the waters so as aforesaid appropriated by them of the use of the said water in its accustomed channels for the sub-irrigation of the lands of your Orator and its citizens in the said drainage basin acquired as aforesaid, or to deprive the citizens of your Orator of the use of the said waters for watering their livestock or for domestic use.

All which actings, doings, and pretenses of the said defendants are contrary to equity and good conscience and tend to the manifest wrong, injury, and oppression of your Orator and its citizens in the premises. In consideration whereof, and for as much as your Orator is entirely remediless in the premises according to the strict rules of the Common Law, and can only have relief in a Court of Equity where matters of this nature are properly cognizable and relievable;

To the end, therefore, that the said defendants, The State of Colorado, The Greeley-Poudre Irrigation District, a municipal corporation, and The Laramie Poudre Reservoirs and Irrigation Company, a corporation, may, if they can, show why your Orator should not have the relief hereby prayed for, and may according to the best and utmost of their several and respective knowledge, remembrance, information, and belief, full, true, direct, and perfect answer make to all and singular the matters hereinbefore stated and charged as full and particularly as if the same were hereinafter repeated, and they were thereunto distinctly interrogated (but not under oath, answer under oath being hereby expressly waived).

May it please your Honors to grant unto your Orator the most gracious writ or writs of subpœna of the United States of America to be directed to the said defendants, The State of Colorado, The Greeley-Poudre Irrigation District, a municipal corporation, and The Laramie Poudre Reservoirs and Irrigation Company, a corporation, and the rest of their confederates when discovered, thereby commanding them and every one of them at a certain day and under a certain pain and penalty therein to be specified, personally to be and appear before your Honors in this Honorable Court and then and there to answer all and singular the premises (but not under oath, answer under oath being specially waived), and to stand to, perform, and abide such order and decree therein, as to your Honors shall seem meet.

And your Orator prays that the said defendants, and each of them,

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may be enjoined from diverting the said waters, or any of them, from the said water shed, and for all other proper relief, and your Orator will ever pray, etc.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

N. E. CORTHELL,
JOHN W. LACEY,
Of Counsel.

STATE OF WYOMING,
County of Laramie, ss:

Douglas A. Preston, being duly sworn on his oath according to law, deposes and says, that he is the Attorney General of the State of Wyoming, and as such at the direction and upon the request of the Governor of said State exhibits the foregoing Bill of Complaint; that he has read the said Bill of Complaint, and that the facts therein set forth, save and excepting where averred on information and belief, are true, and that as to the facts therein alleged as upon information and belief affiant is credibly informed and verily believes that the said facts are true.

DOUGLAS A. PRESTON.

Subscribed in my presence and sworn to before me this 22nd day of May A. D. 1911.

[Seal of Jennie M. Tupper, Notary Public, Laramie County, Wyoming.]

JENNIE M. TUPPER, *Notary Public.*

(Here follow maps marked pages 27 and 27½.)

(Endorsed:) Supreme Court U. S., October Term, 1910. No. 20. Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Bill of Complaint. Filed May 29, 1911.

And on the same day, to wit, on the 29th day of May, A. D. 1911, an order for appearance for complainant was filed in words & figures following, viz:

Order for Appearance.

Supreme Court of the United States, October Term, 1910.

No. 20, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for the Complainant.

(Name) DOUGLAS A. PRESTON.

(P. O. Address:) Cheyenne, Wyoming.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

(Endorsed:) Supreme Court U. S., October Term, 1910. Term No. 20. Original. Appearance for Compl't. Filed May 29, 1911.

And afterwards, to wit, on the tenth day of June, A. D. 1911, a subpœna was issued.

And afterwards, to wit, on the 18th day of August, A. D. 1911, the subpœna and proof of service of same was filed in words & figures following, viz:

THE UNITED STATES OF AMERICA, ss:

The President of the United States to the State of Colorado, the Greeley-Poudre Irrigation District, a Municipal Corporation, and the Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Greeting:

[SEAL.]

For certain causes offered before the Supreme Court of the United States, having jurisdiction in equity, you are hereby commanded that, laying all other matters aside and notwithstanding any excuse, you be and appear before the said Supreme Court, holding jurisdiction in equity, on the second Monday of October next, at the City

of Washington, in the District of Columbia, being the seat of the National Government of the United States, to answer unto a bill of complaint of the State of Wyoming in the said Court exhibited against you.

Hereof you are not to fail at your peril.

Witness the Honorable Edward D. White, Chief Justice of the United States, at the City of Washington, the tenth day of June, A. D. 1911.

JAMES H. McKENNEY,
Clerk of the Supreme Court of the United States.

UNITED STATES OF AMERICA,
District of Colorado, ss:

I hereby certify and return that I have duly served the within Subpœna on the therein named The Greeley-Poudre Irrigation District, by handing to and leaving with C. E. Latham as the president thereof, a true and correct copy of the said writ, together with a copy of the bill of complaint, at Greeley, in said District, on July 3rd, A. D. 1911; As to the Laramie Poudre Reservoirs and Irrigation Company, by handing to and leaving with S. H. Shields, as secretary thereof, a true and correct copy of the said writ, together with a copy of the bill of complaint, at Denver, in said District, on July 5th A. D. 1911; As to The State of Colorado, by handing to and leaving with John F. Shafroth, as Governor thereof, a true and correct copy of said writ, together with a copy of the bill of complaint, at Denver, in said District, on July 7th, 1911.

This writ is therefore returned executed as the law directs, this 7th day of July, A. D. 1911.

D. C. BAILEY,
United States Marshal,
By E. G. JEFFERDS, *Deputy.*

Fees and costs: $9.12.

Service of the within subpœna accepted:

BENJ. GRIFFITH,
Attorney General, State of Colorado.

Returned executed in full by service on defendants as evidenced by certificate endorsed hereon and by written acceptance of service on the part of the Attorney General of the State of Colorado.

Washington, August 15, 1911.

J. M. WRIGHT,
Marshal Supreme Court U. S.

(Endorsed:) Supreme Court U. S. October Term, 1911. Term No. 20, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Subpœna and proof of service. Came to my hand at my office this 10th day of June, 1911, and for the purpose of executing this process. I hereby deputize and authorize Dewey C. Bailey, United States Marshal for the District of Colorado, or

any of his deputies indicated by him, to serve this subpœna on all or any one of the defendants herein and make due return thereof. Witness my hand this 10th day of June, 1911, at Washington City, D. C. J. M. Wright, Marshal Supreme Court of the United States. Filed August 18th, 1911.

And afterwards, towit, on the 9th day of October, A. D. 1911, orders for appearance for defendants were filed in words and figures following, viz:

Order for Appearance.

Supreme Court of the United States, October Term, 1911.

No. 9, Orig'l.

STATE OF WYOMING
vs.
STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for the State of Colorado (one of the def'ts).

(Name) BENJAMIN GRIFFITH,
Attorney General of Colorado.

(P. O. Address) State Capital, Denver, Colorado.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

(Endorsed:) Supreme Court U. S., October Term, 1911. Term No. 9. Orig'l. Appearance for def't, the State of Colorado. Filed Oct. 9, 1911.

Order for Appearance.

Supreme Court of the United States, October Term, 1911.

No. 9, Orig'l.

STATE OF WYOMING
vs.
STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for *the* The Laramie Poudre Reservoirs & Irrigation Company (a def't).

(Name) CLYDE C. DAWSON.

(P. O. Address) Equitable Bld'g, Denver, Colorado.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

(Endorsed:) Supreme Court U. S., October Term, 1911. Term No. 9. Orig'l. Appearance for def't, The Laramie-Poudre Reservoirs & Irrigation Co. Filed Oct. 9, 1911.

Order for Appearance.

Supreme Court of the United States, October Term, 1911.

No. 9, Orig'l.

STATE OF WYOMING
vs.
STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for The Laramie-Poudre Reservoirs & Irrigation Company (a def't).
(Name) CHARLES D. HAYT.

(P. O. Address) Equitable Building, Denver, Colorado.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

(Endorsed:) Supreme Court U. S., October Term, 1911. Term No. 9, Orig'l. Appearance for Def't, The Laramie Poudre Reservoirs & Irrigation Co. Filed Oct. 9, 1911.

Order for Appearance.

Supreme Court of the United States, October Term, 1911.

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for The Laramie-Poudre Reservoirs and Irrigation Company (a def't).
(Name) JULIUS C. GUNTER.

(P. O. Address) 529-535 Equitable Building, Denver, Colorado.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

[Endorsed:] Supreme Court U. S. October Term, 1911. Term No. 9, Orig'l. Appearance for Def't, The Laramie-Poudre Reservoirs & Irrigation Co. Filed Oct. 9, 1911.

Order for Appearance.

Supreme Court of the United States, October Term, 1911.

No. 9, Orig'l.

THE STATE OF WYOMING
vs.
STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for The Greely-Poudre Irrigation District (a def't).

(Name) JULIUS C. GUNTER.

(P. O. Address) 529-535 Equitable Bldg., Denver, Colorado.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

[Endorsed:] Supreme Court U. S. October Term, 1911. Term No. 9, Orig'l. Appearance for Def't, The Greeley-Poudre Irrigation Dist. Filed Oct. 9, 1911.

And on the same day, to wit, October 9, A. D. 1911, a Stipulation to extend time for defendants to plead was filed in words & figures following, viz:

In the Supreme Court of the United States, October Term, 1910.

In Equity.

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Stipulation.

Come now the parties above named, by their respective solicitors and counsel, and at the request of defendants who state that no sufficient time has elapsed since service, to prepare their pleadings and otherwise arrange their defense, stipulate and agree that the said defendants and each of them, may have the full period of ninety (90) days from and after the return day herein, to-wit: the

9th day of October, A. D. 1911, within which to plead to the bill of complaint as they, the said defendants may be advised.

D. A. PRESTON,
Attorney General, Wyoming;
——— ———,
Solicitors and of Counsel for Complainant.
BENJAMIN GRIFFITH,
Attorney General, Solicitor and of Counsel.
For the State of Colorado.
CHARLES F. TEW,
JULIUS C. GUNTER,
Solicitors and of Counsel for the
Greeley-Poudre Irrigation District.
JULIUS C. GUNTER,
Solicitor and of Counsel for the Laramie-
Poudre Reservoirs and Irrigation Company.

Dated the 4th day of October, 1911.

Supreme Court U. S. October Term, 1911. Term No. 7 Original. The State of Wyoming, Complainant, vs. The State of Colorado et al., Stipulation to extend time for defendants to plead. Filed October 9, 1911. *190.*

And on the same day, to wit, October 9, A. D. 1911, the following entry appears of record, viz:

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On motion of Mr. Julius C. Gunter of counsel for the defendants,
It is now here ordered by the Court that the time to plead in this cause be extended for ninety days from this date.
October 9, 1911.

And afterwards, to wit, on the 9th day of January, A. D. 1912, a notice of motion for leave to file Demurrer was filed in words & figures following, viz:

In the Supreme Court of the United States.

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation, and The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Notice.

To the State of Wyoming, Complainant herein, and to the Honorable Douglas A. Preston, Attorney General of the said State and Solicitor for said Complainant:

You will please take notice that at the incoming of the Supreme Court of the United States, at 12:00 o'clock M., at the Capitol building in the City of Washington, District of Columbia, upon Monday, January 8th, 1912, or as soon thereafter as solicitors can be heard, the above named defendants will appear by their solicitors and present to said Court the joint demurrer of said defendants to the bill of complaint herein, and ask leave of Court to file the same; a copy of which demurrer is presented herewith: When and where you may be present if you so desire.

BENJ. GRIFFITH,
Attorney General of the State of Colorado and Solicitor for said State.
JULIUS C. GUNTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.
JULIUS C. GUNTER,
CHARLES D. HAYT,
CLYDE C. DAWSON,
Solicitors for the Laramie Poudre Reservoirs and Irrigation Company, Defendant.

STATE OF WYOMING,
County of Laramie, ss:

Service of the above motion, by the delivery to me of a copy thereof, with a copy of the aforesaid demurrer, is hereby acknowledged this 3rd day of January, A. D. 1912.

D. A. PRESTON,
Attorney General of the State of Wyoming and Solicitor for Complainant.

(Endorsed:) Supreme Court U. S. October Term, 1911. Term No. 7, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Notice of motion for leave to file demurrer and proof of service of same. Filed January 9, 1912.

And on the same day, to wit, the 9th day of January, A. D. 1912, the following entry appears of record, viz:

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On motion of Mr. Benjamin Griffith of counsel for the defendants, leave is hereby granted to file the demurrer of the defendants to the bill of complaint in this cause.
January 9, 1912.

And on the same day, to wit, on the 9th day of January, A. D. 1912, the demurrer was filed in words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 20, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Demurrer.

To the Honorable the Judges of the Supreme Court of the United States:

The defendants, by protestation, not confessing or acknowledging all or any of the matters or things in the said bill of complaint contained to be true in such manner and form as the same are therein set forth and alleged, demur to the said bill, and for cause of demurrer show:

I.

That said bill of complaint is wholly without equity, in that it does not state or show any such cause as doth or ought to entitle complainant to the relief sought or prayed for against these defendants or against either thereof, or to any relief whatever.

Wherefore, and for divers other good causes for demurrer appearing on the face of said bill, these defendants demur thereto and pray the judgment of this Honorable Court whether they or either of them shall be compelled to make further or any answer to said bill;

and they humbly pray to be hence dismissed with their reasonable costs in this behalf sustained.

BENJ. GRIFFITH,
Attorney General of the State of Colorado, Defendant.
JULIUS C. GUNTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.
JULIUS C. GUNTER,
CHARLES D. HAYT,
CLYDE C. DAWSON,
Solicitors for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

——— ———,
——— ———,
——— ———,
——— ———,
Of Counsel.

We hereby certify that we are solicitors and of counsel for each of the defendants above named, and that in our opinion the foregoing demurrer of said defendants respectively to the bill of complaint of the said State of Wyoming is well founded in point of law and proper to be filed in the above cause.

BENJ. GRIFFITH,
JULIUS C. GUNTER,
CHARLES D. HAYT,
CLYDE C. DAWSON,
Solicitors and of Counsel for Defendants Above Named.

UNITED STATES OF AMERICA,
District of Colorado, ss:

Benjamin Griffith, being duly sworn, deposes and says that he is the Attorney General of the State of Colorado, one of the defendants named in the foregoing demurrer, and is authorized to verify the same on behalf of said defendant and the other defendants named, and that the foregoing demurrer is not interposed to delay the cause or any proceding therein.

BENJAMIN GRIFFITH.

Subscribed and sworn to before me this 28th day of December, A. D. 1911.
My commission expires December 13, 1914.

[Seal John B. Betts, Notary Public, City and County of Denver, Colorado.]

JOHN B. BETTS,
Notary Public.

(Endorsed:) Supreme Court U. S. October Term, 1911. No. 9, Original. The State of Wyoming, Complainant, v. The State of Colorado et al. Demurrer. Filed January 9, 1912.

And afterwards, to wit, on the 24 day of January, A. D. 1912, an order for appearance was filed in words and figures following, viz:

Order for Appearance.

Supreme Court of the United States, October Term, 1911.

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for the State of Colorado and Greeley-Poudre Irrigation District.
(Name) CHARLES F. TEW.

(P. O. Address) Greeley, Colorado.

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

(Endorsed:) Supreme Court U. S., October Term, 1911. Term No. 9, Original. Appearance for Colorado & Greeley Poudre Irrigation Dist. Filed Jan. 24, 1912.

And afterwards, to wit, on the 5th day of March, A. D. 1912, a motion to set demurrer for hearing was filed in words and figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 20, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY POUDRE IRRIGATION DISTRICT, a Municipal Corporation, The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Comes now the Complainant in said cause, by Douglas A. Preston, Attorney General for the State of Wyoming and solicitor and of counsel for the Complainant and prays the Court to set down for argument, at some convenient date, the demurrer in said cause to the Bill of Complaint.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

In the Supreme Court of the United States.

In Equity.

No. 20, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Corporation, The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Notice.

To the State of Colorado, The Greeley Poudre Irrigation District and The Laramie Poudre Reservoirs and Irrigation Company, Defendants:

You will please take notice that at the incoming of the Supreme Court of the United States at twelve o'clock M., at the Capitol Building, March 4, 1912, or as soon thereafter as solicitors can be heard, the above named Complainant will appear by its solicitors and present to said Court an application to have set for hearing the Demurrer of the Defendants heretofore filed to the Bill of Complaint herein: Where and where you may be present if you so desire. A copy of which application is presented herewith.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

STATE OF COLORADO,
County of Denver, ss:

Service of the foregoing notice, by the delivery to me of a copy thereof with a copy of the foregoing application to set down for argument the Demurrer to the Bill of Complaint, is hereby acknowledged, this 23d day of February, A. D. 1912.

BENJAMIN GRIFFITH,
Attorney General of the State of Colorado and Solicitor for said State, Defendant.
CHARLES F. TEW,
Solicitor for the Greeley Poudre Irrigation District, Defendant.
JULIUS C. GUNTER,
CHARLES D. HAYT,
CLYDE C. DAWSON,
Solicitor for the Laramie Poudre Reservoirs and Irrigation Company, Defendant.

(Endorsed:) Supreme Court of the U. S. October Term, 1911. Term No. 7, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Motion to set demurrer for hearing, notice and proof of service. Filed March 5, 1912.

And on the same day, to wit, on the 5th day of March, A. D. 1912, the following entry appears of record, viz:

No. 9, Orig'l.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On motion of Mr. Douglas A. Preston of counsel for the complainant,

It is now here ordered by the Court that the demurrer in this cause be, and the same is hereby, assigned for hearing on Tuesday, October 15th next.

March 5, 1912.

And afterwards, to wit, on the 15th day of October, A. D. 1912, the following entry appears of record, viz:

8, Original.

STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

The argument of the demurrer in this cause was commenced by Mr. C. D. Hayt, of counsel for the defendants in support of the demurrer; continued by Mr. Benjamin Griffith, of counsel for the defendants in support of the demurrer and by Mr. John W. Lacey, of counsel for the complainant, in opposition to the demurrer, and concluded by Mr. Julius C. Gunter, of counsel for the defendants, in support of the demurrer.

October 15, 1912.

And on the same day, to wit, the 15th day of October, A. D. 1912, and order for appearance was filed in words & figures following, to wit:

Order for Appearance.

Supreme Court of the United States, October Term, 1912.

No. 8, Orig'l.

THE STATE OF WYOMING
vs.
THE STATE OF COLORADO et al.

The clerk will enter my appearance as Counsel for the State of Wyoming, Compl't.

(Name) JOHN W. LACEY,
(*P. O. Address*) *Cheyenne, Wyo.*

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

(Endorsed:) Supreme Court U. S. October Term, 1912. Term No. 8, Orig'l. Appearance for Compl't. Filed Oct. 15, 1912.

And afterwards, to wit, on the 21st day of October A. D. 1912, the following entry appears of record, viz:

8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

This cause came on to be heard on the demurrer of the defendants to the bill of complaint herein, and was argued by counsel.

On consideration whereof, It is now here ordered by the Court that the said demurrer be, and the same is hereby, overruled without prejudice to any question, and leave is hereby granted the defendants to file answer herein within ninety days.

October 21, 1912.

And afterwards, to wit, on the 7th day of January, A. D. 1913, an order for appearance was filed in words & figures following, viz:

Order for Appearance.

Supreme Court of the United States, October Term, 1912.

No. 8, Orig'l.

THE STATE OF WYOMING, Compl't,
vs.
THE STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for the State of Colorado.

(Name) FRED FARRAR,
(*P. O. Address*) *Capitol Bldg., Denver, Colo.*

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

[Endorsed:] Supreme Court U. S. October Term, 1912. Term No. 8, Orig'l. Appearance for defendant the State of Colorado. Filed Jan. 7, 1913.

And afterwards, to wit, on the 8th day of January, A. D. 1913, the following entry appears of record, viz:

8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On motion of Mr. Fred Farrar of counsel for the defendant, The State of Colorado, leave is hereby granted to file answers in this cause.
January 8, 1913.

And on the same day, to wit, *on* the 8th day of January, A. D. 1913, an order for appearance was filed in words & figures following, viz.:

Order for Appearance.

Supreme Court of the United States, October Term, 1912.

No. 8, Orig'l.

THE STATE OF WYOMING, Compl't,
vs.
THE STATE OF COLORADO et al.

The Clerk will enter my appearance as Counsel for the Greeley-Poudre Irrigation District, one of the defendants.

(Name) DELPH E. CARPENTER,
(*P. O. Address*) *Greeley, Colorado.*

☞NOTE.—Must be signed by a member of the Bar of the Supreme Court United States. Individual and not firm names must be signed.

[Endorsed:] Supreme Court U. S. October Term, 1912. Term No. 8, Orig'l. Appearance for defendant The Greeley-Poudre Irrigation Dist. Filed Jan. 8, 1913.

And on the same day, to wit, the 8th day of January, A. D. 1913, the answers of defendants were filed in words and figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Answer of the State of Colorado.

This defendant, the State of Colorado, now and at all times hereinafter saving to itself all and all manner of benefit or advantage of exception or otherwise that can or may be had or taken to the many errors, uncertainties and imperfections in the said bill of complaint contained, for its answer thereto, or to so much thereof as it is advised it is material and necessary for them to answer to, saith:

I.

Admits that the greater extent of the drainage basin of the Laramie River in Colorado is in a mountainous and heavily timbered

country, where snows fall in winter, but denies that the run-off from said drainage basin supplies all of the waters flowing in the channel of the Laramie River and its tributaries. Defendant avers that less than one-half of the run-off of the Laramie River is supplied by the drainage basin of the Laramie River and its tributaries within the State of Colorado. Defendant avers that among the tributaries of the Laramie River rising in the mountainous regions of Colorado and discharging their waters into the Laramie River, in addition to those enumerated in the bill of complaint, are Johnson Creek and Beaver Creek. Defendant denies that Complainant's Exhibit A shows either the drainage basin of the Laramie River and its tributaries, or the irrigated lands thereunder, within the State of Wyoming, and avers that the map attached to the joint and several answer of the Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs and Irrigation Company, marked Exhibit I and made a part of this answer, shows the drainage basin of the Laramie River and its tributaries, and the irrigation ditches and works taking water therefrom, within the State of Wyoming, but avers that only about 25,000 acres of the lands designated on Exhibit I as irrigated lands were under irrigation at the time of the inception of the defendants. The Laramie-Poudre Reservoirs and Irrigation Company's rights to divert water through the tunnel mentioned in the bill of complaint, and which diversion is sought to be enjoined herein. Defendant denies that the map marked Exhibit B, attached to the bill of complaint, is a correct map of the drainage basin of the said river and its tributaries within the State of Colorado, and avers that Exhibit I, heretofore mentioned, and made a part of this answer, is a true map of the last-mentioned drainage basin. Defendant admits that the larger part of the watershed of said river and its tributaries in Colorado is mountainous, rocky, and timbered, and avers that a large portion of the 3,865 square miles of the drainage area of said river and its tributaries in Wyoming is also mountainous, rocky, and timbered, upon which the precipitation of moisture is great, and from which the run-off is about 500,000 acre-feet annually Defendant avers that a considerable part of the run-off from the drainage area of said river and its tributaries within Colorado enters the Laramie River after it enters the State of Wyoming Defendant avers that about 4,000 acres of the drainage basin of said Laramie River and its tributaries within Colorado are of irrigable character. Defendant denies that the greater portion of the drainage area of said river and its tributaries in Wyoming is irrigable and productive, and avers that not to exceed 100,000 acres of the drainage area of the said river and its tributaries within the State of Wyoming are productive under irrigation; that of this area about 50,000 acres lie in said drainage area between the Colorado line and the Wheatland Reservoir, as shown on Defendant's Exhibit I, which last-mentioned area is located at a high altitude—to wit, about 7,500 feet—where the irrigation season is short—to-wit, about six weeks—commencing about the fifteenth of June, and the lands of which are of inferior quality, unproductive, adapted to raising only limited crops. Defendant further avers that the remaining portion of the

lands in the drainage basin of said river and its tributaries, lying in the vicinity of Wheatland, aggregate about 50,000 acres. This land has some productivity, but the greater part of the irrigation rights therefor were initiated long after the inception of the rights through which these defendants make claim to divert a part of the waters of said river and its tributaries, through the tunnel mentioned in the bill of complaint. Defendant admits that prior to the act of Congress of July 25, 1868, creating the Territory of Wyoming, that portion of the watershed and drainage basin of the Laramie River and its tributaries which is now within the State of Wyoming was within the boundaries and subject to the laws of the Territory of Dakota; but denies that at any time the riparian proprietors on said stream had the right to have the waters of said stream or its tributaries flow across or along their lands unpolluted and undiminished. Defendant avers at no time did the doctrine of riparian ownership of waters obtain in that part of Dakota Territory, since said act of Congress a part of the State of Wyoming. Defendant avers that at no time has it been the law that diversions of water from said stream or its tributaries in Wyoming, or diversions therefrom made in Colorado for application in Wyoming, could be made to the prejudice of the rights of the State of Colorado in the exercise of her inherent sovereign power to divert from the section of the Laramie River within Colorado the entire run-off of said section for use within the State of Colorado. Defendant avers that change in the point of diversion, the place of use, and the kind of use, where the same is made from the section of the stream within Colorado, may at any time be made within the State of Colorado, provided the same can be done without prejudice to any existing appropriations within the State of Colorado. Defendant further avers that the waters of said stream and its tributaries within the State of Colorado constitute a part of the natural resources of, and were and are owned by, the State of Colorado, subject to the right of appropriations thereof under her laws. Defendant avers that the right of appropriation and use of the waters of said stream and its tributaries within Colorado is to no extent affected by, or subject to, the laws of any other sovereignty than that of the State of Colorado. As to whether or not the United States of America in 1862, or at any other time, granted to the Union Pacific Railway Company 350,000 acres of land, or any part thereof, within the State of Wyoming, riparian to the Laramie River and its tributaries, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. As to whether or not the last-mentioned lands, or any part thereof, have passed from said railroad company, or are at this time owned or possessed by 1,500 or any other number of people, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. This defendant denies that the right to the continuous flow of the waters of said river, or any part thereof, or any of the waters of its tributaries, is vested in the citizens of complainant; denies that the doctrine of continuous flow or of riparian rights at any time obtained in the drainage basis of the Laramie River and its tributaries within the State of Wyoming; admits that, prior to the com-

mencement of construction of the system of irrigation having for its purpose the diversion by the defendants of a part of the waters of the Laramie River and its tributaries, some of the lands lying along said river and its tributaries had been settled and improved, and that some part thereof had been rendered more productive by irrigation from said stream and its tributaries, but avers that the run-off of said river and its tributaries was ample to supply the demands and rights so created, and leave an abundance of water to supply the diversions sought to be enjoined herein. Defendant denies that the lands of said area without the use of water,, the diversion of which is sought to be enjoined herein, would be rendered valueless, and also denies that 20,000 people, or any number in excess of 2,000, residing upon said lands, are supported, directly or indirectly, by reason of the irrigation and cultivation of said lands; denies that $20,000,000, or any sum in excess of $500,,000, had been expended within the State of Wyoming in the development or use of the waters of said stream or its tributaries, prior to the initiation of the rights of the defendant, the Laramie-Poudre Reservoirs and Irrigation Company. As to whether or not 400,000 acres of land lying in the drainage basin of said river and its tributaries within the State of Wyoming had been patented by the United States of America prior to the commencement of construction of its said system of irrigation by defendant, the Laramie-Poudre Reservoirs and Irrigation Company, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. As to what number of acres of the last-mentioned land are now owned, possessed, or occupied by citizens of complainant, defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant admits that certain of the waters of said river and its tributaries are used by citizens of towns and villages in Wyoming, but avers that there is more than sufficient run-off in said stream and its tributaries to satisfy such needs and to supply the rights of the defendants sought to be enjoined in this suit; admits the existence of certain appropriations from said river and its tributaries prior to the commencement of construction of the defendant's system of irrigation, mentioned in the bill of complaint, but avers that the run-off of said stream and its tributaries was and is more than sufficient to satisfy the same and the diversions sought to be enjoined in this action. As to whether or not complainant is the proprietor of 50,000 acres of land within said watershed, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant admits that prior to the commencement of construction of the irrigation system for the purpose of the diversions, sought to be enjoined herein, certain citizens of the State of Colorado had appropriated, for the purpose of irrigating certain lands within said drainage basin, certain waters of said river and its tributaries, and avers that such appropriations amounted to about 8,000 acre-feet of water per annum. As to what part of said waters, applied within the drainage basin of Colorado, has heretofore returned to the stream and its tributaries, this defendant has not and cannot obtain sufficient knowledge or informa-

tion upon which to base a belief. Defendant avers that other appropriations of said waters of said Laramie River and its tributaries had been made by the State of Colorado and its citizens within the State of Colorado, prior to the appropriations of said waters by complainant and its citizens, as set forth in the complaint, and avers that on the 25th day of August, 1902, the defendant The Laramie-Poudre Reservoirs and Irrigation Company, and its predecessors in title, by commencement of construction, initiated its rights to the diversion, for the purpose of irrigation and domestic use, through the tunnel mentioned in the bill of complaint, to 1235 second-feet of water, and that at the time of the initiation of such rights of the defendant The Laramie-Poudre Reservoirs and Irrigation Company and its predecessors in title, there was abundant water in the said stream to satisfy all prior appropriations then in existence in the State of Colorado and in the State of Wyoming. Defendant denies that, prior to the threatened diversion sought to be enjoined in the complaint, the plaintiff and its citizens had appropriated all of the available waters of the said Laramie River and its tributaries, but avers that at such time there was ample run-off in said stream, and that there is now ample water therein, to supply the threatened diversions of these defendants and all prior rights in the State of Wyoming. Defendant avers that at no time prior to the institution of this suit had more than 50,000 acre-feet annually been taken from said stream and its tributaries for use in the State of Wyoming. Defendant avers at the time of the initiation of the rights, the exercise of which is sought to be enjoined in this suit, rights for the appropriation of water for irrigation and domestic use in the State of Wyoming had been created or initiated for not exceeding 50,000 acre-feet, and avers that at such time there was available to supply such last-mentioned rights or initiated rights more than 800,000 acre-feet annually in the run-off of said stream. As to whether or not the plaintiff had, and its citizens had, at any time employed the waters of said stream and its said tributaries, for the subirrigation of 25,000 acres of land riparian to said stream and its said tributaries, said land being owned and possessed by said complainant and its citizens, and for live-stock and domestic uses, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant denies that the waters sought to be diverted through the tunnel mentioned in the bill of complaint would render the lands lying within the basin of said stream and its tributaries, within the State of Wyoming, to a large extent valueless and unable to support any considerable population; denies that the use of the waters so sought to be enjoined would add the value of $10,000,000 to the lands within said watershed within the State of Wyoming, or would enable said land to support a population of 20,000 people, or any other considerable number of people; denies that the diversion sought to be enjoined herein would render the lands in the water-shed of said stream and its tributaries within Wyoming valueless. Defendant denies that it and its co-defendants are threatening to divert, by the tunnel mentioned in the bill of complaint, or otherwise, more than 100,000 acre-feet per annum of the

waters of said stream and its tributaries, and avers that the maximum diversion which can be made through said tunnel, or the irrigation system in aid thereof, does not and cannot exceed 70,000 acre-feet annually from the run-off of said stream, which run-off amounts to about 800,000 acre-feet annually. Defendant denies that there has been diverted in any manner within the State of Colorado, for application to a beneficial use within the drainage basin of said river and its tributaries, a larger amount of water than was necessary to the appropriations made prior to the acquired rights of complainant and its citizens. Defendant avers that at no time has a greater amount of water been diverted from said stream for application to a beneficial use within the State of Colorado than the appropriations within the State of Colorado called for, and that at such time there was ample water in said stream to satisfy such appropriations and all prior appropriations within the State of Wyoming. Defendant avers that the State of Colorado is the owner of all waters within said State of Colorado, with the full right to dispose of them as it may choose, and denies that such rights are subject to the rights acquired by the complainant and its citizens, as alleged in the bill of complaint; avers that it is the right of the defendant commonwealth to dispose of the waters of that portion of said stream lying within the State of Colorado, without let or hindrance by the complainant or its citizens; and defendant avers that the defendant commonwealth can so dispose of the waters of said stream regardless of the prejudice that it may work to the complainant or its citizens within the State of Wyoming, and need give no reason for its will.

II.

Further answering said bill of complaint, this defendant, the State of Colorado, alleges that on the first day of August, 1876, it was admitted into the Union, and then became, and ever since said date has been, and now is, a sovereign state; that within the boundaries of its own territory it possesses the full rights and prerogatives of sovereignty, save as to that portion of power delegated to the federal government by the Constitution of the United States; and that this defendant, the said State of Colorado, is foreign to the State of Wyoming for all but federal purposes; that, being so sovereign within its own territory, it has the plenary and exclusive right and power to control and regulate the use of non-navigable waters within its boundaries, including non-navigable rivers and other streams, and that it has never surrendered this sovereign power over water rights and streams, nor delegated this power, or any portion thereof, to any other sovereign, either national or state.

Defendant further alleges that the territory of the State of Colorado is the apex of the Continental Divide, dividing the waters flowing into the Atlantic and the Pacific, and that streams originating in the mountain heights within the State of Colorado flow in every direction out of the state; that the original of these streams is generally near the center of the state, and at no place within the state do any of these streams attain any considerable size in comparison with

rivers in the less arid sections of the country; that, owing to the topographical nature of the territory within the State of Colorado, these streams, as a rule, and particularly upon the eastern slope of the Rocky Mountains, after leaving the mountains in which they originate, flow across lands of a nature usually described as plains, and from which, owing to the lack of rainfall, these streams receive no additional supply of water, but, on the contrary, the water in said streams is very rapidly diminished by evaporation and by absorption by the soil through which they pass; that these lands have a soil of unusual fertility, and when irrigated produce crops unexcelled and almost unequalled in quantity and quality.

This defendant alleges that the Laramie River, named in the complainant's bill of complaint, is a stream having its sources within the boundaries of the State of Colorado and flowing within said state for a distance of twenty-seven miles, until it crosses the northern boundary thereof and enters the State of Wyoming; that said river is not navigable within either the State of Colorado or the State of Wyoming, and that the same is not an avenue or instrumentality of interstate commerce as between the States of Colorado and Wyoming. The use of the waters of said stream by diversion thereof, and application of the same upon lands within the territorial limits of the State of Colorado, is essential to the life and well-being of the inhabitants of a large area within Colorado, and the right of continued use of the said waters is as vital to the inhabitants of the lands upon which said waters are to be applied as is the land itself. This defendant alleges that the jurisdiction and rights of the State of Wyoming, either in its sovereign capacity or as a proprietor of lands, and the rights of the citizens of Wyoming, do not extend into the State of Colorado, and this defendant further alleges that, under the laws and principles of international and interstate law, the sovereign rights of this defendant over the waters of the section of the Laramie River and its tributaries lying within the State of Colorado are not subservient to the sovereignty or rights of the State of Wyoming, and that the State of Wyoming has no dominant estate, rights, or jurisdiction as against this defendant, or its people, in that part of the Laramie River and its tributaries flowing in the State of Colorado, and that the State of Colorado cannot be subjected to the burden of arresting its development, or of denying to its inhabitants the use of an element which nature has supplied entirely within its own territory, and without which, and the free use thereof, the lands to which said water is sought to be applied would be uninhabitable.

III.

This defendant, further answering the bill of complaint, says that the Laramie River and certain of its tributaries rise within the State of Colorado; that the drainage area thereof within the State of Colorado is about 428 square miles, and that the length of the said stream in Colorado is about twenty-seven miles; that the drainage area of said stream and its tributaries within the State of Wyoming is 3,865 square miles, and that the total drainage area of said stream

within the States of Colorado and Wyoming is 4,293 square miles, and that the length of said stream within Wyoming is about 150 miles; that the annual run-off of the sections of said stream lying within the State of Colorado is about 300,000 acre-feet, and that the annual run-off of the sections of said stream lying within the State of Wyoming is about 500,000 acre-feet; that the diversion system, the operation of which is sought to be enjoined herein, taps only the upper sections of said stream and its tributaries lying within the State of Colorado, and only about seventy-five square miles of the said drainage area of 428 square miles lying within Colorado. Further, that said diversion system sought to be enjoined herein cannot divert annually more than 70,000 acre-feet of the annual run-off of 800,000 acre-feet of said stream and its tributaries. Further, that by reason of natural conditions, there cannot be diverted from said stream for said use within the State of Colorado more than 90,000 acre-feet annually Defendant further alleges that said stream and its tributaries rise in the mountains of Colorado, at an altitude of from about 8,000 to 14,000 feet, that its waters flow through a deep valley and mountain canyons within Colorado, and thence along the same into the section of the stream lying within the State of Wyoming; that the bed of said stream within Colorado is so low that water can only be diverted from the upper sections of said stream and its tributaries for use in Colorado; and defendant alleges that, under and by the system the operation of which is sought to be enjoined herein, and all other practicable means, no more than 90,000 acre-feet annually can be diverted from said stream and its tributaries for use upon lands lying within the State of Colorado.

Defendant avers that long prior to the institution of the present suit, and at a time when all of the diversion from said stream and its tributaries for use within the State of Wyoming did not exceed 50,000 acre-feet, citizens of this defendant and predecessors in title to the co-defendants of this defendant, acting under the authority and by the permission of this defendant, the State of Colorado, diverted from said stream about 8,000 acre-feet annually, and applied the same to irrigation and domestic uses within the watershed of said stream. Defendant further avers that on, to-wit, August 25, 1902, the predecessors in interest of the co-defendants of this defendant conceived an extensive system of irrigation for the conveyance of about 70,000 acre-feet of the run-off of the upper reaches of the said stream to a body of 125,000 acres of rich land, lying in the valley of the Cache la Poudre River in the County of Weld, State of Colorado, and necessary for the reclamation of said body of land; that, in pursuance thereof, and in accordance with the laws of this defendant and by its permission, irrigation rights for said system were initiated by the predecessors in interest of the co-defendants of this defendant, on August 25, 1902, by the commencement of actual construction on said system; and since the last-mentioned date, in further pursuance of said undertaking, a collection system for gathering the upper water of said river and its tributaries, a reservoir for impounding the same, and a tunnel of about 12,000 feet in length for

the carriage of the same through the mountain range constituting the eastern boundary of the watershed of said river and its tributaries, have all been constructed and are now practically completed, at a cost of about $1,200,000. Defendant further avers that, in addition to said expenditure and construction, water rights and other interests, including reservoir sites, have been purchased, and construction work done thereon, at a further cost of about $1,500,000. Defendant avers that said system is practical and will with due diligence be completed. Defendant avers that, in aid of said irrigation system, an irrigation district, the defendant The Greeley-Poudre Irrigation District, a municipal corporation, was formed under the laws of the State of Colorado, embracing about 125,000 acres of land; that bonds for said purpose were voted and issued to the amount of $5,100,000 par value, and made a first lien on the lands of said district, and that a total of about $2,700,000 of said bonds, par value, have been expended in the purchase of water rights and in the construction of said irrigation system. Defendant further avers that about $2,300,000 of said bonds are in the treasury of said district, and are available for the completion of said system.

Defendant avers that, relying upon the diversion of said 70,000 acre-feet annually from said Laramie River and its tributaries, citizens of this defendant have filed upon large bodies of public lands in said district under the homestead and desert land laws of the United States, and have placed valuable improvements thereon, and are preparing at great expense to make homes thereon; that large bodies of other land in said district have been purchased relying on said diversion from the Laramie River, and valuable improvements have been made on the same; that if the said diversion from the Laramie River is permitted, it will enhance the value of said land about $50,000,000; if denied, it will largely destroy the value of said lands, and will defeat the acquisition of title to all of said lands filed upon under the desert land laws of the United States. Defendant further avers that at the time of the initiation of the irrigation rights, the exercise of which is sought to be enjoined in this proceeding, there was, and after this proposed diversion is made will be, abundant water left in the Laramie River and its tributaries to supply all the irrigation rights in the State of Wyoming which had their origin prior to the inception of the rights, the exercise of which is sought to be enjoined herein. The defendant further avers that the lands within the State of Wyoming, to the irrigation of which the water of the Laramie River and its tributaries has been applied and can be applied, are greatly inferior in productiveness to the lands within the State of Colorado to which the waters herein involved will be applied; and, further, that the lands within the State of Wyoming, in addition to being non-productive, require a greatly increased quantity of water over the necessities of the lands in the State of Colorado for their irrigation; and, further, that the application of water thereto—that is, to the lands within the State of Wyoming—will produce less returns.

This defendant, having now fully answered all the allegations in plaintiff's bill of complaint, or so much thereof as the defendant is

advised ought to be answered, asks to be hence dismissed with costs and charges in this behalf sustained.

BENJ. GRIFFITH,
Attorney-General of Colorado and
Solicitor for Defendant.

FRED FARRAR,
Of Counsel.

(Endorsed:) Supreme Court U. S. October Term, 1912. No. 8, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Answer of Defendant, The State of Colorado. Filed January 8, 1913.

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Joint and Several Answer of the Defendants, the Laramie-Poudre Reservoirs and Irrigation Company and the Greeley-Poudre Irrigation District, to the Bill of Complaint of the State of Wyoming, Complainant.

These defendants, The Laramie-Poudre Reservoirs and Irrigation Company and The Greeley-Poudre Irrigation District, and each of them, now and at all times hereinafter saving to themselves all and all manner of benefit or advantage of exception or otherwise that can or may be had or taken to the many errors, uncertainties, and imperfections in the said bill of complaint contained, for their joint and several answer thereto, or to so much thereof as they are advised it is material and necessary for them to answer to, severally answering, saith:

I.

Admit that the greater extent of the drainage basin of the Laramie River in Colorado is in a mountainous and heavily timbered country, where snows fall in winter, but deny that the run-off from said drainage basin supplies all of the waters flowing in the channel of the Laramie River and its tributaries. Defendants aver that less than one-half of the run-off of the Laramie River is supplied by the drainage basin of the Laramie River and its tributaries within the State of Colorado. Defendants aver that among the tributaries of the Laramie River rising in the mountainous regions of Colorado

and discharging their waters into the Laramie River, in addition to those enumerated in the bill of complaint, are Johnson Creek and Beaver Creek. Defendants deny that Exhibit A shows either the drainage basin of the Laramie River and its tributaries, or the irrigated lands thereunder, within the State of Wyoming; and aver that the map hereto attached, marked Exhibit I and made a part of this answer, shows the drainage basin of the Laramie River and its tributaries, and the irrigation ditches and works taking water therefrom, within the State of Wyoming, but aver that only about 25,000 acres of the lands designated on Exhibit I as irrigated lands were under irrigation at the time of the inception of the defendant's, The Laramie-Poudre Reservoirs and Irrigation Company's, rights to divert water through the tunnel mentioned in the bill of complaint, and which diversion is sought to be enjoined herein. Defendants deny that the map marked Exhibit B, attached to the bill of complaint, is a correct map of the drainage basin of the said river and its tributaries within the State of Colorado, and aver that Exhibit I, hereunto attaehed and made a part of this answer, is a true map of the last-mentioned drainage basin. Defendants admit that the larger part of the watershed of said river and its tributaries in Colorado is mountainous, rocky, and timbered, and aver that a large portion of the 3,865 square miles of the drainage area of said river and its tributaries in Wyoming is also mountainous, rocky, and timbered, upon which the precipitation of moisture is great, and from which the run-off is about 500,000 acre-feet annually. Defendants aver that a considerable part of the run-off from the drainage area of said river and its tributaries within Colorado enters the Laramie River after it enters the State of Wyoming. Defendants aver that about 4,000 acres of the drainage basin of said Laramie River and its tributaries within Colorado are of irrigable character. Defendants deny that the greater portion of the drainage area of said river and its tributaries in Wyoming is irrigable and productive, and aver that not to exceed 100,000 acres of the drainage area of the said river and its tributaries within the State of Wyoming are productive under irrigation; that of this area about 50,000 acres lie in said drainage area between the Colorado line and the Wheatland reservoir, as shown on Defendants' Exhibit I, which last mentioned area is located at a high altitude—to-wit, about 7,500 feet—where the irrigation season is short—to-wit, about six weeks—commencing about the fifteenth of June, and the lands of which are of inferior quality, unproductive, and adapted to only limited crops. Defendants further aver that the remaining portion of the lands in the drainage basin of said river and its tributaries, lying in the vicinity of Wheatland, aggregate about 50,000 acres. This land has some productivity, but the greater part of the irrigation rights therefor were initiated long after the inception of the rights through which these defendants make claim to divert a part of the waters of said river and its tributaries, through the tunnel mentioned in the bill of complaint. Defendants admit that prior to the Act of Congress of July 25, 1868, creating the Territory of Wyoming, that portion of the watershed and drainage basin of the Laramie River

and its tributaries which is now within the State of Wyoming was within the boundaries and subject to the laws of the Territory of Dakota, but deny that at any time the riparian proprietors on said stream had the right to have the waters of said stream or its tributaries flow across or along their lands unpolluted and undiminished. Defendants aver that at no time did the doctrine of riparian ownership of waters obtain in that part of Dakota Territory since said Act of Congress a part of the State of Wyoming. Defendants aver that at no time has it been the law that diversions of water from said stream or its tributaries in Wyoming, or diversions therefrom made in Colorado for application in Wyoming, could be made to the prejudice of the right of the State of Colorado in the exercise of her inherent sovereign power to divert from the section of the Laramie River within Colorado, the entire run-off of said section for use within the State of Colorado. Defendants aver that a change in the point of diversion, the place of use, and the kind of use, where the same is made from the section of the stream within Colorado, may at any time be made within the State of Colorado, provided the same can be done without prejudice to any existing appropriations used within Colorado. Defendants further aver that the waters of said stream and its tributaries, within the State of Colorado, constitute a part of the natural resources of the last-mentioned state, and were and are owned thereby, subject to the right of appropriation thereof under the laws of the State of Colorado for use therein. Defendants aver that the right of appropriation and use of the waters of said stream and its tributaries within Colorado is to no extent affected by or subject to the laws of any other sovereignty than that of the State of Colorado. As to whether or not the United States of America in 1862, or at any other time, granted to the Union Pacific Railway Company 350,000 acres of land, or any part thereof, within the State of Wyoming, riparian to the Laramie River and its tributaries, these defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. As to whether or not the last-mentioned lands, or any part thereof, have passed from said railroad company, or are at this time owned or possessed by 1,500 or any other number of people, these defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. These defendants deny that the right to the continuous flow of the waters of said river, or any part thereof, or any of the waters of its tributaries, is vested in the citizens of complainant. Deny that the doctrine of continuous flow or of riparian rights at any time obtained in the drainage basin of the Laramie River and its tributaries within the State of Wyoming. Deny that riparian rights in the waters of said river and its tributaries at any time attached to said 350,000 acres or any part thereof. Admit that prior to the commencement of construction of the system of irrigation having for its purpose the diversion by the defendants of a part of the waters of the Laramie River and its tributaries, some of the lands lying along said river and its tributaries had been settled and improved to a limited extent, and that some part thereof had been rendered more productive by irrigation from said stream

and its tributaries; but aver that the run-off of said river and its tributaries was ample to supply the demands and rights so created and leave an abundance of water to supply the diversions sought to be enjoined herein. Defendants deny that the lands of said area, without the use of the water, the diversion of which is sought to be enjoined herein, would be rendered valueless, and also deny that 20,000 people, or any other number in excess of 2,000, residing upon said lands, are supported, directly or indirectly, by reason of the irrigation and cultivation of said lands. Deny that $20,000,000, or any sum in excess of $500,000, had been expended in the development or use of the waters of said stream or its tributaries, prior to the initiation of the rights, the exercise of which is sought to be enjoined herein. As to whether or not 400,000 acres of land lying in the drainage basin of said river and its tributaries within the State of Wyoming, had been patented by the United States of America prior to the commencement of construction of its said system of irrigation by defendant The Laramie-Poudre Reservoirs and Irrigation Company, these defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. As to what number of acres of the last-mentioned land are now owned, possessed, or occupied by citizens of complainant, defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendants admit that certain of the waters of said river and its tributaries are used by citizens of towns and villages in Wyoming, but aver that there is more than sufficient run-off in said stream and its tributaries to satisfy such needs and to supply the rights of the defendants sought to be enjoined in this suit. Admit the existence of certain appropriations from said river and its tributaries prior to the commencement of construction of defendant's system of irrigation, mentioned in the bill of complaint, but aver that the run-off of said stream and its tributaries was and is more than sufficient to satisfy the same and the diversions sought to be enjoined in this action. As to whether or not complainant is the proprietor of 50,000 acres of land within said watershed, these defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendants admit that prior to the commencement of construction of defendant's irrigation system for the purpose of the diversions sought to be enjoined herein, certain citizens of the State of Colorado had appropriated, for the purpose of irrigating certain lands within said drainage basin, certain waters of said river and its tributaries, and aver that such appropriations amounted to about 8,000 acre-feet of water per annum. As to what part of said waters, applied within the drainage basin of Colorado, has heretofore returned to the stream and its tributaries, these defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendants aver that other appropriations of said waters of said Larrmie River and its said tributaries had been made by the State of Colorado and its citizens within the State of Colorado, prior to the appropriations of said waters by complainant and its citizens, as set forth in the complaint, and aver that on the 25th day of August, 1902, this defend-

ant, The Laramie-Poudre Reservoirs and Irrigation Company, and its predecessors in title, by commencement of construction, initiated its rights to the diversion, for the purpose of irrigation and domestic use, through the tunnel mentioned in the bill of complaint, to 1,235 second-feet of water, and that at the time of the initiation of such rights of the defendant, The Laramie-Poudre Reservoirs and Irrigation Company, and its predecessors in title, there was abundant water in the said stream to satisfy all prior appropriations then in existence, or theretofore initiated, in the State of Colorado and in the State of Wyoming. Defendants deny that, prior to the initiation or existence of the rights of diversion sought to be enjoined in the complaint, the plaintiff and its citizens had appropriated all of the available waters of the said Laramie River and its tributaries, but aver that at such time there was ample run-off in said stream, and that there is now ample water therein, to supply the proposed diversions of these defendants and all prior rights in the State of Wyoming. Defendants aver that at no time prior to the institution of this suit had more than 50,000 acre-feet annually been taken from said stream and its tributaries for use in the State of Wyoming. Defendants aver that, at the time of the initiation of the rights, the exercise of which are sought to be enjoined in this suit, rights of appropriation of water for irrigation and domestic use in the State of Wyoming had been created or initiated for not exceeding 50,000 acre-feet annually, and aver that at such time there was available, to supply such last-mentioned rights or initiated rights, more than 800,000 acre-feet annually in the run-off of said stream. As to whether or not the plaintiff had, and its citizens had, at any time employed the waters of said stream and its said tributaries, for the sub-irrigation of 25,000 acres of land riparian to said stream and its said tributaries, said land being owned and possessed by said complainant and its citizens, and for live-stock and domestic uses, these defendants have not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendants deny that the waters sought to be diverted through the tunnel mentioned in the bill of complaint, would render the lands lying within the basin of said stream and its tributaries, within the State of Wyoming, to a large extent valueless and unable to support any considerable population. Deny that the use of the waters so sought to be enjoined would add the value of $10,000,000 to the lands within said watershed within the State of Wyoming, or would enable said lands to support a population of 20,000 people, or any other considerable number of people. Deny that the diversions sought to be enjoined herein would render the lands in the watershed of said stream and its tributaries within Wyoming valueless. Defendants deny that they are threatening to divert by the tunnel mentioned in the bill of complaint, or otherwise, more than 100,000 acre-feet per annum of the waters of said stream and its tributaries, and aver that the maximum diversion which can be made through said tunnel, or the irrigation system in aid thereof, does not and cannot exceed 70,000 acre-feet annually from the run-off of said stream, which run-off amounts to about 800,000 acre-feet annually. Defendants deny

that there has been diverted in any manner within the State of Colorado, for application to a beneficial use within the drainage basin of said river and its tributaries, a larger amount of water than was necessary to the appropriations made prior to the rights of complainant and its citizens. Defendants aver that at no time has a greater amount of water been diverted from said stream, for application to a beneficial use within the State of Colorado, than the appropriations within the State of Colorado required; and that at such time there was ample water in said stream to satisfy such appropriations and all prior appropriations within the State of Wyoming. Defendants aver that the State of Colorado is the owner of all waters within said State of Colorado, with the full right to dispose of them as it may choose, and deny that such rights are subject to rights acquired by the complainant and its citizens. Aver that it is the right of the defendant commonwealth to dispose of the waters of that portion of said stream lying within the State of Colorado, without let or hindrance by the complainant or its citizens, and defendants aver that the defendant commonwealth can so dispose of the waters of said stream regardless of the prejudice that it may work to the complainant or its citizens within the State of Wyoming, and need give no reason for its will.

II.

Defendants aver that defendant state was admitted into the Union August 1, 1876, and that at such date its Constitution contained, and ever since has contained, the following provisions, to-wit:

"The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided."

"The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."

That in aid of such provisions, and of the pre-existing rights of appropriation of water for domestic, irrigation and manufacturing purposes from the natural streams of the defendant state, its successive legislatures have passed laws regulating such rights, and providing for their adjudication and administration at public expense; that at all times the courts of defendant state, its legislature, and administrative and judicial authorities, have considered and declared the waters of the natural streams of the defendant state to be the exclusive property of the people of the state, subject to appropriation for domestic and irrigation purposes exclusively within the state by the people of the defendant state; that the Laramie River rises in the mountains of Colorado, and flows therein for a distance of about

27 miles, and thereafter for the distance of about 150 miles in the State of Wyoming. Defendants aver that the proposed diversion sought to be enjoined herein is being undertaken by these defendants—citizens of defendant state—for domestic, irrigation, and manufacturing purposes, within the boundaries of defendant state; and, further, that such diversion is proposed from a section of said stream within defendant state. Defendants further aver that such proposed diversion is being undertaken under the authority and approval of defendant state, and that these defendants in so doing are exercising, with the approval and by permission of defendant state, one of its inalienable and inherent sovereign rights; that is, the right to avail itself, through its citizens, of one of its great natural resources. Defendants aver that, in making the diversion threatened, the defendant state, through its citizens, its co-defendants, is exercising one of its sovereign rights.

III.

Defendants aver that the Laramie River rises in the mountains of Colorado, flows therein about 27 miles, and thence 150 miles in the State of Wyoming, to its union with the North Platte River; thence its waters pass into the State of Nebraska and join with the South Platte River at the city of North Platte, Nebraska; the two rivers forming the Platte River, which proceeds in an easterly direction through the State of Nebraska to its junction with the Missouri River at Plattsmouth, near the city of Omaha. Irrigation is carried on from these streams in the States of Colorado, Wyoming, and western Nebraska, to a point on the Platte River as far east as the one hundredth Meridian, which crosses about fifty miles below the city of North Platte, at the junction of the two rivers, the North Platte and the South Platte. Aver that the drainage area of said stream in Colorado and Wyoming is about 4,293 square miles, the drainage area within Colorado about 428 square miles, and the drainage area in Wyoming about 3,865 square miles; that the drainage area of the section of the stream tapped by the diversion in question is about 75 square miles, lying along the upper reaches of the said stream and some of its tributaries, and within defendant state; that the total run-off of the Laramie River and its tributaries within said states, or for the full length of said stream, is about 800,000 acre-feet annually; that the annual run-off of the Laramie River and its tributaries within the State of Wyoming is about 500,000 acre-feet, and within Colorado about 300,000 acre-feet; that of this run-off within Colorado the diversion sought to be enjoined herein will take from the stream and its tributaries not exceeding 70,000 acre-feet annually.

Defendants aver that if the proposed diversion sought to be enjoined herein is made, it will take from the run-off of said stream and its tributaries of 800,000 acre-feet annually, not to exceed 70,000 acre-feet, and that 300,000 of said total acre-feet is supplied by the watershed of said stream within the State of Colorado. Defendants further aver that the natural conditions are such that at no time can there be diverted from the section of said stream within

Colorado, or any other part of said stream, for application to a beneficial use—that is, for irrigation and domestic purposes—within Colorado, exceeding 90,000 acre-feet annually, and if the diversion sought to be enjoined herein is made, at no time can the diversions from said river and its tributaries for use within Colorado exceed 90,000 acre-feet annually.

Defendants aver that defendant irrigation district is the owner of the right to divert about 8,000 acre-feet annually of the waters of said stream for application to irrigation and domestic purposes within the State of Colorado; that such right was initiated and perfected by construction and application to beneficial uses—to-wit, irrigation of lands and domestic use—by the predecessors in title of the defendant district, long prior to the institution of the present suit, and at a time when there was ample water within the Laramie River to satisfy the last-mentioned diversion and all appropriations theretofore initiated from said stream within the State of Wyoming; that such rights for many years last past have been applied by the defendants and their predecessors in title, for irrigation purposes and domestic uses, within the watershed of said stream within the State of Colorado.

Defendants also, as other and further rights by appropriation and initiated appropriation to the waters of the Laramie River and its tributaries, aver that prior to the institution of the present suit, and on, to-wit, August 25, 1902, one of the predecessors in title of these defendants conceived and planned an extensive irrigation system, consisting of collection ditches along the upper reaches of the Laramie River and its tributaries, a tunnel reservoir on the upper part of said stream, a tunnel through the mountain range forming the eastern watershed of the Laramie River, the use as a part of the system of a section of the Poudre River, and the building of an extensive system of ditches and reservoirs for the application of the water sought to be so diverted to about 125,000 acres of land in the Poudre Valley; that prior to the institution of this suit—that is, on August 25, 1902—the construction of said system was begun by a predecessor in title of these defendants, and the construction has with diligence been pursued since; that at the time of such commencement of construction, and long after, there was ample unappropriated water in said stream, after satisfying all priorities that had theretofore been initiated in the States of Wyoming and Colorado, to supply the water so sought to be appropriated from the Laramie River by such proposed system of irrigation; that defendants are the owners of all rights so initiated on August 25, 1902.

Defendants aver that prior to the institution of this suit—that is, in April, 1909—under and pursuant to the laws of the State of Colorado, an irrigation district—that is, the defendant, The Greeley-Poudre Irrigation District—was formed, embracing 125,000 acres of land; that the land so erected into an irrigation district is in the Poudre Valley, in Weld County, in defendant state; is at an altitude of about 5,000 feet, and under irrigation, of great productivity, but of little value without irrigation; that about an acre-foot of water artificially supplied annually to the annual precipitation on said

lands will render said lands very productive in growing alfalfa, fruits, potatoes, sugar beets, and various kinds of grains; that $5,000,000 of bonds were voted by said district and levied upon the said lands—that is, the said 125,000 acres—which, or the proceeds of which, were to be used for the procuring of an adequate system of irrigation for the lands of said district; that in September, 1909, prior to the institution of the present suit, a contract was entered into between the defendant The Laramie-Poudre Reservoirs and Irrigation Company, and the defendant The Greeley-Poudre Irrigation District, whereby the defendant district agreed to pay to defendant company the said $5,000,000 of bonds for the above system of irrigation completed; that at the time of the contract a large amount of construction had been done by the defendant company and its predecessors in title, and large sums had been paid out on such construction and the acquisition of valuable water rights and rights of way; that at the date of the institution of this suit there had been expended on the construction of said system and in the purchase thereof about $2,000,000, and that there has now been expended on the purchase and construction of the system about $2,700,000; that about $500,000 of said amount has been expended on the said tunnel reservoir and collection ditches, and about $600,000 on the said tunnel; that there now remains in the treasury of said district about $2,300,000 of said bonds, par value, which are being devoted and will be applied to the completion of said system of irrigation; that, relying upon the adequacy of said system of irrigation and the carrying into effect of the said plans therefor, lands were purchased in said district by the citizens of this defendant state, and other citizens, lands were filed upon therein under the desert land laws and the homestead laws by various citizens, and much labor has been done and valuable improvements have been made in developing said lands; that the sufficiency of said water supply will be materially impaired, should the defendant district be deprived of the water—to-wit, about 70,000 acre-feet—relied upon through said proposed Laramie River diversion. Defendants aver that the value of said lands in said district, and of all of the improvements thereon, will be seriously impaired, should the said Laramie River diversion be denied to these defendants. Defendants further aver that, should said waters be denied to these defendants, and the same be applied upon lands within the State of Wyoming, the same will not procure the abundant results in crops as if applied upon the lands lying within the said irrigation district. Defendants aver that the greater part of the lands within the State of Wyoming, to which said water will be applied, if the proposed diversion is enjoined, lie at an altitude of about 7,500 feet; that the irrigation season there is short, being only about six weeks; that the land is of an inferior quality for all character of crops, and that water applied thereto for irrigation purposes produces comparatively small results.

Defendants aver that the plaintiff and its citizens, long prior to the institution of this suit and at all times, were fully advised of the said diversions and proposed diversion of these defendants and their predecessors in title, and have been advised of the formation of said

district, of the voting of the bonds thereof, of the sale of said bonds to innocent purchasers for value, of the said construction for the purpose of effecting said diversion, and of the steps taken by citizens in said district in reliance thereon.

Defendants aver that plaintiff and its citizens are equitably estopped from questioning the diversion sought to be enjoined herein.

IV.

Defendants aver that, long prior to the institution of the present suit, and while there was ample water in the Laramie River to satisfy all priorities theretofore initiated therein in the States of Wyoming and Colorado—that is to say, while there was an annual run-off in said stream of about 800,000 acre-feet, and the prior appropriations for irrigation and domestic purposes in the State of Wyoming did not exceed 50,000 acre-feet annually—the predecessors in title of these defendants diverted water from the Laramie River and applied the same to a beneficial use—that is, for irrigation and domestic purposes in the watershed of the Laramie River within the State of Colorado; that such last-mentioned diversions have for many years past been used in the cultivation of lands lying within the drainage area of the Laramie River within Colorado, and that the amount of such diversions is about 8,000 acre-feet annually; that the rights so created have been adjudicated under the Water Adjudication Statutes of Colorado, in favor of the predecessors in title of these defendants, and that the defendant district is now the owner of all rights so initiated.

Defendants also aver, as further and other rights, by appropriation and initiated appropriation, to the waters of the Laramie River and its tributaries, that long prior to the institution of this suit—to-wit, August 25, 1902—and while there was abundant unappropriated water in the run-off of the Laramie River and its tributaries within Colorado to supply all appropriations theretofore initiated for use in Wyoming, and also the diversion sought to be enjoined herein, that the predecessors in title of these defendants initiated, by the commencement of actual construction on August 25, 1902, the water rights which are sought to be exercised by diversion through the tunnel mentioned in the bill of complaint; that, since such initiation, the defendants and their predecessors in title have diligently, by continuous work and expenditures on the construction of an extensive irrigation system, preserved the rights so initiated. Defendants aver that, in perfecting the rights so initiated, the defendants and their predecessors in title conceived an extensive irrigation system, consisting of collection ditches, tunnel reservoirs, and other reservoirs on the upper reaches of the Laramie River, a tunnel over two and a quarter miles in length, now entirely completed, and extending from the Laramie River through the mountain range constituting the eastern boundary of the watershed of said stream, for the diversion, carriage, and distribution into the bed of the Cache la Poudre River, a public stream of Colorado, for carriage down and along said stream to and into the ditches, reservoirs, and distributing system of said district for irrigation, as permitted by the laws, usages, customs, and

judicial decisions of the courts of the State of Colorado—all for the purpose of applying the rights so initiated to a beneficial use; that is, for domestic purposes and for the irrigation of the lands lying within The Greeley-Poudre Irrigation District. Defendants aver that bonds were voted for the purpose of the purchase of the rights so initiated, and the construction partially made, and the construction to completion of said irrigation system; that said bond issue amounted to $5,000,000, and was made a first and prior lien upon all the lands of said district, and that, of said bond issue, approximately $2,700,000 has been sold to innocent purchasers for value throughout the United States, and the proceeds thereof used upon the purchase and construction of said system of works, and that said bonds for their payment, principal and interest, are largely dependent upon the use of the diversions from the Laramie River sought to be enjoined herein; that a contract was entered into between the defendants, The Laramie-Poudre Reservoirs and Irrigation Company and the Greeley-Poudre Irrigation District, for the purchase of said system completed; that parts of said system have already been conveyed by the defendant company to the defendant district, and that the defendant company is under contract to complete the construction of and make conveyance of all the remainder of said system to the defendant district; that the defendant district is planning to divert and will divert, through said system of irrigation works, from the Laramie River and its tributaries, not more than 70,000 acre-feet annually, and that it is not practicable, on account of the physical conditions surrounding the Laramie River and its tributaries to divert from the Laramie River and its tributaries within the state of Colorado, for application to a beneficial use within the State of Colorado, exceeding 90,000 acre-feet annually. Defendants aver that the annual run-off of said stream and its tributaries furnishes abundant water to satisfy all appropriations in Wyoming earlier in date than those sought to be enjoined herein, and also to satisfy those water rights claimed through defendants' said system of irrigation.

These defendants, now having fully answered all the allegations in the complainant's bill of complaint, or so much thereof as the defendants are advised should be answered, ask to be hence dismissed, with costs and charges in this behalf sustained.

THE LARAMIE-POUDRE RESERVOIRS
AND IRRIGATION COMPANY,
By JULIUS C. GUNTER,
CHARLES D. HAYT,
CLYDE C. DAWSON,
FRED F. WRIGHT, *Its Counsel.*
THE GREELEY-POUDRE IRRIGATION
DISTRICT,
By CHARLES F. TEW,
DELPH E. CARPENTER, *Its Counsel.*

(Here follows map marked p. —.)

(Endorsed:) Supreme Court U. S. October Term, 1912. No. 8, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Answer of the defendants Laramie-Poudre Reservoir & Irrigation Company & The Greeley Poudre Irrigation District. Filed January 8, 1913.

And afterwards, towit, on the 20th day of January, A. D. 1913, proof of service of answer was filed in words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Acknowledgment of Service.

Receipt of six (6) copies of the Answer on behalf of the State of Colorado in the above entitled matter, is hereby acknowledged at Cheyenne, Wyoming, this 6th day of aJnuary A. D. 1913.

D. A. PRESTON,
Attorney General of Wyoming.

And afterwards, towit, on the 7th day of April, A. D. 1913, motion for leave to file Replication was filed in words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Application for Leave to File Replications.

Comes now the said complainant, The State of Wyoming, and hereby makes application to the said Honorable Court for leave to file its replication to the separate answer of the defendant, The State

of Colorado, and its replication to the joint and several answer of the defendants, The Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs and Irrigation Company, in said cause, and complainant will ever pray, etc.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

——— ———,
——— ———,
Of Counsel.

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Notice.

To the State of Colorado, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company, Defendants:

You will please take notice that at the incoming of the Supreme Court of the United States at twelve o'clock M., at the Capitol Building, April 1, 1913, or as soon thereafter as solicitors can be heard, the above named complainant will appear by its solicitors and present to said court an application for leave to file its replication to the separate answer of the defendant, the State of Colorado, and its replication to the joint and several answer of the defendants, the Greeley-Poudre Irrigation District and the Laramie Poudre Reservoirs and Irrigation Company, in said cause: when and where you may be present if you so desire. A copy of which application is presented herewith.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

——— ———,
——— ———,
Of Counsel.

STATE OF COLORADO,
County of Denver, ss:

Service of the foregoing notice, by the delivery to me of a copy thereof with a copy of the foregoing application for Leave to File

Replications, is hereby acknowledged, this 24th day of March, A. D. 1913.

FRED FARRAR,
Attorney General of the State of Colorado and Solicitor for said State, Defendant.
CHARLES F. TEW,
D. E. CARPENTER,
Solicitor for the Greeley-Poudre Irrigation District, Defendant.
JULIUS C. GUNTER,
Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

(Endorsed:) Supreme Court U. S. October Term, 1912. No. 8, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Motion for leave to file Replications, with notice & proof of service of same. Filed April 7, 1913.

And on the same day, towit, on the 7th day of April, A. D. 1913, the following entry appears of record, viz:

8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On motion of Mr. Joseph W. Cox in behalf of Mr. Douglas A. Preston, of Counsel for the complainant leave is hereby granted to file replication to answers in this cause.
April 7, 1913.

And on the same day towit, on the 7th day of April, A. D. 1913, Replications were filed in words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Larramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Replication to the Answer of Defendant The State of Colorado.

The complainant, The State of Wyoming, repliant, saving and reserving unto itself all and all manner of advantage of exception to

the manifold insufficiencies of the answer of the defendant, The State of Colorado, for replication thereunto saith that it will aver and prove its bill of complaint herein to be true, certain and sufficient in the law to be answered unto, and that the said answer of the said defendant is uncertain, untrue and insufficient to be replied unto by this repliant; without this, that any other matter or thing whatsoever in the said answer contained, material or effectual to be replied unto, confessed and avoided, traversed or denied, is true; all which matters and things this repliant is, and will be, ready to aver and prove as this honorable court shall direct, and humbly prays as in and by its said bill it hath already prayed

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

——— ———,
——— ———,
Of Counsel.

(Endorsed:) Supreme Court, U. S. October Term, 1912. No. 8, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Replication to Answer of Defendant The State of Colorado. Filed April 7, 1913.

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION District, a Municipal Corporation; The Laramie Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

The Replication of the Complainant The State of Wyoming to the Joint and Several Answer of the Defendants The Laramie-Poudre Reservoirs and Irrigation Company and The Greeley-Poudre Irrigation District.

This repliant, The State of Wyoming, saving and reserving unto itself all and all manner of advantage of exception to the manifold insufficiencies of the joint and several answer of the defendants. The Laramie-Poudre Reservoirs and Irrigation Company and The Greeley-Poudre Irrigation District, to the bill of complaint of this repliant, for replication thereunto saith that it will aver and prove its said bill to be true, certain and sufficient in the law to be answered unto, and that the said answer of the said defendants is uncertain, untrue and insufficient to be replied unto by this repliant; without this, that any other matter or thing whatsoever in the said answer

contained, material or effectual to be replied unto, confessed and avoided, traversed or denied, is true; all which matters and things this repliant is, and will be, ready to aver and prove as this honorable court shall direct, and humbly prays as in and by its said bill it hath already prayed.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

——— ———,
——— ———,
Of Counsel.

(Endorsed:) Supreme Court U. S. October Term, 1912. No. 8, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Replication to answer of defendants. The Laramie-Poudre Reservoirs & Irrigation Company and The Greeley-Poudre Irrigation District. Filed April 7, 1913.

And afterwards, to wit, on the 9th day of April, A. D. 1913, a motion for leave to withdraw appearance was filed in words & figures following, viz:

Supreme Court of the United States, October Term, 1912.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation,

Now come Charles D. Hayt and Clyde C. Dawson, who have heretofore entered their appearance as appearance as counsel for The Laramie-Poudre Reservoirs and Irrigation Company, one of the defendants in the above entitled cause, and move the Court for leave to withdraw said appearance.

CHARLES D. HAYT.
CLYDE C. DAWSON.
FRED R. WRIGHT.

(Endorsed:) Supreme Court U. S. October Term, 1912. No. 8, original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Motion of Charles D. Hayt & Clyde C. Dawson for leave to withdraw their appearance as counsel for one of the defendants. Filed April 9, 1913.

And afterwards, to wit, on the 11th day of April, A. D. 1913, the following entry appears of record, viz:

8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On motion of Mr. Duane E. Fox in their behalf, leave is hereby granted Mr. Charles D. Hayt and Mr. Clyde C. Dawson to withdraw their appearance for the defendants in this cause.
April 11, 1913.

And afterwards, to wit, on the 26th day of May, A. D. 1913, motion to appoint Commissioners was filed in words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Application for Appointment of Commissioner to Take Testimony.

Come now the complainant and the defendants in the above entitled cause, by their respective attorneys, and move the Court that Clyde N. Watts, of Cheyenne, State of Wyoming, and Newton Garbutt, of Denver, State of Colorado, be appointed special commissioners to take the tesaimony in this cause as per stipulation hereto attached.

DOUGLAS A. PRESTON,
Attorney-General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.
FRED FARRAR,
Attorney-General of the State of Colorado and Solicitor for said State, Defendant.
CHARLES F. TEW,
D. E. CARPENTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.
JULIUS C. GUNTER,
Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

THE STATE OF WYOMING, Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION District, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Stipulation.

Subject to the order and consent of the Court, it is hereby stipulated by and between the complainant and defendants, by their respective attorneys, that Clyde M. Watts, of Cheyenne, State of Wyoming, be appointed a special commissioner to take and return the testimony in this cause, offered on behalf of the complainant.

That Newton Garbutt, of Denver, State of Colorado, be appointed a special commissioner to take and return the testimony in this cause offered on behalf of the defendants, or any of them.

That each shall have the power of a Master in Chancery, as provided in the rules of this Court, but said commissioners shall not make any findings of fact or state any conclusions of law.

It is further stipulated that the taking of testimony on complainant's behalf shall begin on the 15th day of August, 1913, at such place as counsel for complainant may designate, ten days' notice thereof to be given to counsel for defendants, and shall be concluded within one hundred days thereafter; and the taking of the testimony on behalf of the defendants shall commence on or before fifteen days after the conclusion of the testimony offered on behalf of the complainant and shall be concluded within one hundred days thereafter; and the testimony in rebuttal shall be commenced on or before ten days after the conclusion of the testimony offered on behalf of defendants, five days' notice of the place being given, and shall be concluded within forty days thereafter.

The said commissioners shall receive, as agreed by the parties, as their sole compensation for all services and for all testimony taken and transcribed, the sum of fifteen cents per folio for the original transcript and the further sum of five cents per folio for each carbon copy thereof, together with actual and necessary traveling ex-

penses incurred in the taking of the testimony as aforesaid. Dated this 26th day of May, 1913.

DOUGLAS A. PRESTON,
Attorney-General for the State of Wyoming and Solicitor and of Counsel for the Plaintiff.
FRED FARRAR,
Attorney-General of the State of Colorado and Solicitor for said State, Defendant.
CHARLES F. TEW,
D. E. CARPENTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.
JULIUS C. GUNTER,
Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

(Endorsed:) Supreme Court U. S. October Term, 1912. No. 8, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Motion for appointment of Commissioners to take testimony & stipulation in relation to taking testimony. Filed May 26, 1913.

And afterwards, to wit, on the 10th day of June, A. D. 1913, the following order appears of record, viz:

Supreme Court of the United States, October Term, 1912.

No. 8, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On consideration of the motion and stipulation of counsel for the respective parties in this cause for the appointment of Special Commissioners to take and return the testimony in this cause,

It is now here ordered by the Court that Clyde M. Watts be, and he is hereby, appointed Special Commissioner to take and return the testimony in this cause offered on behalf of the complainant, and that Newton Garbutt be, and he is hereby, appointed Special Commissioner to take and return the testimony in this cause offered on behalf of the defendants or any of them, and that each shall have the power of a Master in Chancery, as provided in the Rules of this Court, but said Commissioners shall not make any findings of fact or state any conclusions of law.

It is further ordered that the taking of testimony on behalf of the complainant shall begin on August 15th, 1913, at such place as counsel for the complainant may designate, ten days' notice thereof to be given to counsel for defendants, and shall be concluded within one hundred days thereafter; and the taking of the testimony on be-

half of the defendants shall commence on or before fifteen days after the conclusion of the testimony offered on behalf of the complainant and shall be concluded within one hundred days thereafter; and the testimony in rebuttal shall be commenced on or before ten days after the conclusion of the testimony offered on behalf of the defendants, five days' notice of the place being given, and shall be concluded within forty days thereafter.

It is further ordered, in pursuance of said stipulation, that the said Commissioners shall receive as their sole compensation for all services and for all testimony taken and transcribed, the sum of fifteen cents per folio for the original transcript and the further sum of five cents per folio for each carbon copy thereof, together with actual and necessary travelling expenses incurred in the taking of the testimony.

June 10, 1913.

And afterwards, to wit, on the 19th day of May, A. D. 1916, a joint motion was filed in the words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. 7, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

Motion.

Come now the above named parties by their respective counsel and show unto the court that the taking of evidence in said cause has been completed and that the parties have agreed upon an abstract thereof embracing such of the exhibits as may be readily reproduced, and to expedite the final hearing of said cause the parties do jointly move the court as follows:

1. That permission be granted to file herein for reference the original typewritten transcript of the evidence together with all exhibits introduced by the respective parties, and that the abstract of the testimony as agreed upon by the parties, together with the selected exhibits, be printed at the joint expense of the parties and filed herein in lieu of printing the entire transcript.

2. That an order be entered granting unto the plaintiff to and including July 15, 1916, within which to file a brief herein and granting unto the defendants to and including September 5, 1916, within which to file their briefs herein, and granting unto the plain-

tiff twenty days after the filing of the briefs on behalf of the defendants within which to file its reply brief.

3. That an order be entered herein advancing this cause upon the calendar and assigning it for argument upon the first day of the October, A. D. 1916, term of this court, or as soon thereafter within said term as to the court shall be convenient, and enlarging the time for oral argument to four hours upon each side.

DOUGLAS A. PRESTON,
Attorney General of Wyoming,
of Counsel for Plaintiff.
FRED FARRAR,
Attorney General of Colorado,
of Counsel for Defendant State of Colorado.
JULIUS C. GUNTER,
Attorney for Defendant Laramie-Poudre
Reservoirs & Irrigation Company.
DELPH E. CARPENTER,
Attorney for Defendant Greeley-
Poudre Irrigation District.

(Endorsed:) Supreme Court, U. S. October Term, 1915. No. 7, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Joint motion as to filing original type-written transcript of evidence and exhibits, abstract of evidence and briefs, and that cause be set down for hearing. Filed May 19, 1916.

And afterward, to wit, on the 22d day of May, A. D. 1916, the following entry appears of record, viz:

No. 7, Original.

STATE OF WYOMING, Complainant,
vs.
STATE OF COLORADO et al.

Mr. Charles S. Thomas in behalf of counsel submitted to the consideration of the Court a joint motion as to filing the original type-written transcript of evidence and exhibits, abstract of evidence, and briefs, and that the cause be set down for hearing.

May 22, 1916.

And afterwards, to wit, on the 5th day of June, A. D. 1916, the following order appears of record, viz:

Supreme Court of the United States, October Term, 1915.

No. 7, Original.

STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

On consideration of the joint motion of the parties as to filing original typewritten transcript of evidence, together with all exhibits introduced and the abstract of the testimony as agreed upon together with selected exhibits to be printed at joint expense of the parties, and as to the filing of briefs, that the case be set down for hearing, and to fix the time to be allowed for the oral argument.

It is now here ordered by the court that the said motion be, and the same is hereby, granted, and the case set down for hearing on the first Monday in December next.

It is further ordered that the motion to fix the time to be allowed for the oral argument be denied without prejudice.

June 5, 1916

And on the same day, to wit, on the 5th day of June, A. D. 1916, the abstract of evidence was filed in words & figures following, viz:

In the Supreme Court of the United States.

In Equity.

No. —, Original.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation, and The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

ABSTRACT OF THE EVIDENCE.

NOTE.—For convenience, the following exhibits have been reproduced in the abstract:

Compainant's Exhibits B. E. F. I. J. K. L. M. T-3, T-4, T-5, T-6, T-7, T-8 and T-9.

Defendants' Exhibits 113, 123, 124, 125, 126, 127, 128, 129, 131, 143, 144, and 145.

All other exhibits are filed with the transcript of the evidence.

NOTE.—The marginal numerals refer to the pages of the original transcript.

The complainant above named, to maintain the issues on its behalf, introduced the following evidence before Clyde M. Watts,

special commissioner, commencing at Cheyenne, Wyoming, August 18, 1913.

Appearances:

For the complainant: D. A. Preston, Esq., Attorney General of the State of Wyoming; N. E. Corthell, Esq.; John D. Clark, Esq.

For defendant, The State of Colorado: Fred Farrar, Esq., Attorney General of the State of Colorado.

For the defendant, The Greeley-Poudre Irrigation District: Delph E. Carpenter, Esq.; Charles F. Tew, Esq.

For The Laramie-Poudre Reservoirs and Irrigation Company: Julius C. Gunter, Esq., by Fred Farrar.

2 Stipulation waiving signatures of the witnesses.

Direct Evidence in Behalf of Complainant.

M. R. JOHNSTON, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

3 From November, 1888, to June 1, 1912, I was Superintendent of Wyoming Development Company and had full personal charge of its irrigation system. That Company's reservoir is sixteen miles east of the Union Pacific Railroad, and east of Lookout on the Laramie River. Sixteen miles further down the river a tunnel diverts the water into the Blue Grass whence into the Sybille.

4 About a mile and a half down we take out Canal No. 1. Eight miles on down the Sybille we take out No. 3, and two or three miles further down Canal No. 2.

The reservoir is about sixty-five miles below the Colorado line. The tunnel and Canals Nos. 1 and 2, and the diversion dam and connection from the tunnel to the river had been completed when I went there in 1888 and were in good condition. Water had then been run through the system which was used to full capacity at certain seasons every year I was there.

5 A few settlers were there when I came. They arrived in considerable numbers in 1893 and 1894. Beefore that the Company did the irrigating, after that the settlers. 35,000 to 40,000 acres of land were irrigated in 1912. When they first started in 1893 and 1894 the settlers irrigated three to five thousand acres. The principal change in the irrigating system since 1888 was the building of No. 1 and No. 2. reservoirs. No. 1 is located on the Company's land.

6 No. 2 is the reservoir up on the Laramie River. The survey for it was begun in 1894 or '95. Construction work began about 1899 and the reservoir was completed about 1900. The estimated capacity of that reservoir is 126,000 acre feet. Since 1888 the dam at the tunnel has been changed, and a new race-way into the tunnel built. This did not to any great extent increase the

capacity of the system. Canal No. 1 has also been extended over the Bordeaux land.

7 These lie adjoining and south and east of the original lands. Canal No. 1 had been built across the railroad in 1888. It has had no extensions since its original construction except the Bordeaux lateral. Canal No. 2 is as originally built.

Canal No. 3 was built in 1894 or '5.

The Sybille Canal was begun about four years ago and is not completed. The Bordeaux lateral was commenced six or seven years ago and completed the next year, and since then has been constantly in use.

8 The Bordeaux lateral diverts water from Canal No. 1 to the south. No enlargement made above that in Canal No. 1 except to clean it out at points. The canals were run to full capacity once each year during high water. Other times in the year we ran through practically all the water we could get; this did not equal the capacity of the ditches except two or three years while I was there; after the first of July generally we were short of water.

We aimed to take about all we could get except what filtered through. Of course we had to let some go down when the fellows below on the river 'hollered" too loud but we aimed to use most of the water. Never knew the water to run over the top of the diversion dam except in case of water spouts on one or two or three occasions.

9 One of the times we had extremely high water from about the first of June to the 10th of July. That is the only season I can recall when such a thing occurred. In 1888 the town of Wheatland was there with one building at that time, and a few farmers on the land farming for the Company. There are now on the Wheatland flats and in the town 4,500 to 5,000 people.

10 1,500 to 2,000 of these live in the town. Those who live outside the town are farmers who get their water for irrigating from the Development Company's canal. The new dam and race-way to the tunnel were constructed six or seven years ago. Prior to that the tunnel had been filled through the original race-way. The circular and map handed me were prepared by the Development Company before I was employed there. J. A. Johnston was then Superintendent.

11 The map shows the ditches as they were when I took charge, and is correct. The lands within the shaded boundary are the lands owned by the Development Company and to irrigate which the ditches were constructed. They amount to about 60,000 acres. Not all of it has been reduced to cultivation.

12 The map and circular were for advertising purposes. As a result of applying the water through this irrigation system the lands have been producing crops of all kinds. No crops were produced on the land prior to the irrigation. The use of water was necessary for the growing of crops.

M. R. JOHNSTON.

Cross-examination by Mr. Delph E. Carpenter:

13 J. A. Johnston, manager and superintendent of Wheatland project in 1888 is my brother. Clarence T. Johnston, formerly State Engineer of Wyoming, is my nephew. Clarence T. Johnston not engineer on original project. Before going into State Engineer's office he was engineer on No. 1 reservoir, located in Wheatland tract. Completed under his engineering supervision. G. W. Zorn was engineer on No. 2 reservoir on west side of Laramie mountains. Cannot say for what time J. A. Johnston was general
14 manager prior to 1888, but he took hold of project shortly after tunnel was started and completed it. Cannot give date when tunnel was started, but it was at least three or four years before I went on project. J. A. Johnston left Wyoming Development Company in 1888. I succeeded him as superintendent. After two or three years, general manager, Gilchrist, died. Cannot recollect date, but my brother was elected president and general manager for one year. Governor Carey was elected on my brother's resignation president and general manager and still is president. Robert D. Carey, his son, has been general manager for last three years, ever since Governor Carey was elected Governor. Have had immediate management of irrigation system and business at Wheatland since
15 1888. The supervision of entire tract has been in my hands from 1888 to 1912. All special matters involving expenditure of money or anything else were passed by general manager to board of directors. I simply executed orders.

In 1888 when I went into superintendence of this Wheatland irrigation system there were constructed canals 1 and 2 and the tunnel from the Laramie to the Blue Grass; also all ditches and the tunnel appearing on Plaintiff's Exhibit A. The enterprise as then contemplated is shown, Exhibit A. There may be minor defects in locatio nof ditches but general location given correctly. Lands intended to be reclaimed are correctly noted on Plaintiff's Exhibit A. My first duty superintendent was to reclaim as speedily as possible land shown on Exhibit A, which shows extent of then contemplated irrigation.

16 Subsequent to 1888 we enlarged tunnel from the Laramie to watershed of Blue Grass. This done on two different occasions, first about 1905 or '6, last about 1908 or '9. First enlargement work consisted principally in taking out material that had been working in for years at both ends of tunnel. That was about 1906. Slumping of material, combined with material never removed did not reduce tunnel to any extent. Purpose of enlargement was to increase flow of water through tunnel. The second enlargement (1908 or '9) consisted in lowering the tunnel through entire distance,
17 from a few inches to about two feet in different sections of tunnel. It consisted of blasting solid rock in floor of old tunnel.

A crib and rock dam (now gone) was in river at the Laramie river portal of the tunnel, when I was there in 1888. It was out

about 1895 or '6 through an ice jam and was replaced same spring. I put back same character of structure, which is still there. Neither dam of system has gone out within last two years. A portion of wasteway has washed away this year.

18 Raceway is ditch (400 or 500 feet long) leading from dam into mouth of tunnel. In 1888 we wasted water back into the Laramie at north portal of tunnel through an old wasteway. Now have wasteway in dam. In 1888 and since in wasting any excess of the capacity of the tunnel it went over the rock crib dam and down the river. Considerable leakage in old dam. If not repaired new dam leaks occasionally. In 1888 tunnel about one-half mile long. Big Laramie River at diversion dam (near the north portal of tunnel) is in a mountainous canyon, of Black Hills range. (Same range in which Laramie Peak is located.) From Lara-

19 mie Peak mountain runs south and a little east, perhaps. Union Pacific Railroad crosses this range at Sherman Hill. Continuous range from Sherman Hill to Laramie Peak. This general mountain range lies east of Laramie Plains. Diving line between Laramie Plains region and prairie region in vicinity of Wheatland. Also between prairie region in vicinity of Cheyenne, Iron Mountain and other similarly located places. River flows in these mountains about seven or eight miles before reaching diversion dam at tunnel portal. No Rocky Mountains east of this range of

20 mountains. A number of streams head at west toe of this range and flow easterly. Pole Creek, Horse Creek, Chugwater and all small creeks I am acquainted with, head in Laramie Plains and flow easterly. Duck Creek and all those head in Laramie Plains and come into Laramie River.

21 Laramie river and its tributaries in Colorado and Laramie river and its tributaries, in the Laramie Plains region, flow, unless diverted, through canyon at tunnel portal. When I took charge in 1888, whole Wheatland or Wyoming Development Company system commenced at this diversion in canyon. After water had passed through tunnel, as then constructed, it flowed into the Blue Grass,—a natural waterway,—thence into the Sybille, thence down Sybille Creek, about a mile, to head of Canal No. 1

22 (Exhibit A). Some of the water then flowed down Sybille below the head of Canal No. 1, to Canal No. 2. (Plaintiff's Exhibit A.) We used natural water courses of Blue Grass and Sybille creeks as a part of our canal system.

Entire system as then contemplated is shown on this Exhibit A. Settlement did not commence until about 1894 or '5 in vicinity of Wheatland. About 1893 or '5 I. W. Gray acted as Immigration and Settlement Agent for the Company, for about five or six years and was succeeded by J. R. Mason. Their business was to bring farmers. With the exception of possibly one or two cases, when I went in charge of system in 1888 there were no farmers who

23 owned their land irrigating from this canal. In 1894 and '5 there were not very many, about same number as in 1888. Railroad had been constructed and was in operation during this time. After 1894 or '5 immigration continued. Cultivation of these

ands in Wheatland area has been increasing staedily ever since we started to bring in first settlers. Greatest settlement was in 1894 or '6. Many of these farmers were drouth stricken and we then had them there farming and doing business. Record of contracts of sale between company and each farmer between 1893 to 1912, was kept in office of Wyoming Development Company at Cheyenne.
24 John Chaplin is its bookkeeper and secretary and treasurer. Record of these contracts would be a correct determination of record of settlement of the area. During this time part of the contracts lapsed and the land was resold and passed into different hands and great many of them sold their contracts. Every time a contract was resold a new man came in. Then the list of contracts would include in a sense a duplication of sales. Only in cases of lapses or surrenders would a new contract issue. These sales were evidenced by contract providing for yearly payments.
25 Canal No. 2 was constructed in 1888. Plaintiff's Exhibit A had been printed prior to 1888. Canal No. 3 is about half way between canal No. 1 and canal No. 2 on the Sybille. It heads in section 27, township 22 north, range 69 west. It was an afterthought conceived in years after I went in charge of the system, along abot the tie wume began to bring in settlers, '96 or '7. Shortage of water caused its construction, also for catching flood waters of Laramie river. Our ditches would carry the water that came through the tunnel, but we were short of water at flood season the first two years. We tried to farm two years. We brought in a great many Colorado people and they told us we would have to do something and to do it quick. After the first of July our water went to nothing. So we agreed that reservoir site for No. 1 reservoir would be sufficient. No. 3 ditch was built to fill reservoir, about the
26 time we constructed No. 1 reservoir to conserve the flood waters. The intent was to use waters stored in No. 1 reservoir for better irrigation of original tract. It was not contemplated at the time I went in control in 1888. I will later give the date of the beginning of construction of this No. 2 canal and No. 1 reservoir. There are about thirty-five thousand to forty thousand acres out of the original sixty-five thousand acres now under irrigation and farming, I should say that at least twenty-five to thirty thousand acres of this amount was in irrigation in 1900.
27 A greater development occurred between 1895 and 1900. I will produce the date on which the preliminary survey was begun on reservoir No. 2. No. 2 reservoir,—an afterthought—I think was completed about 1900. It was not considered before 1895. Scarcity of water for our people brought about its construction. After the flood season we were short of water every year.
28 A desire to deliver water to our contract holders at the date they wanted it brought about the construction of this reservoir. It was called to our attention first in 1895. Funds were obtained for the construction of reservoirs No. 1 and 2 by advances from the contractors. They called a meeting and demanded of the company that they make some move to store more water. That deal was pulled through by an advance of $2.50 an acre paid on the land

through the parties that held them at that time. Also an advance charge on all future sales. The company put up their portion of the money on the land not yet sold. They looked to future sales for their return. No. 2 reservoir is located on Laramie river,
29 townships 21 and 22, range 73, about sixteen miles above Laramie River portal of Wheatland tunnel, and across the river channel. It is made of earth, originally forty feet high, and was supposed to hold water from thirty-five to thirty-six feet in depth. Its safe impounding capacity in feet in depth from the bottom of the outlet tube would be about thirty feet. The dyke has settled
30 from the height to which it was built. There is a spillway at the extreme north end of the reservoir. At a point six or seven miles distant from the outlet tube, which point was originally intended as a spillway or wasteway. It was originally supposed to be a natural spillway at the northeast point of the lake where the spillway is now located. The main embankment on the river settled so that the spillway did not operate naturally. In 1909 when the lake was so full we let off the water wherever we could. I started a spillway that year with teams and horses, plowing out after the water got up where it looked a little dangerous. I sluiced out a
31 spillway at that point. There are four gates at the outlet tube at the river. These gates discharge their water into two tubes. Each outlet tube has two control gates. These gates and tubes are located practically in the old channel of the Laramie river. Waters discharged from reservoir flow back into old channel of river. Gates are seven feet high and about four feet wide. The outlet tubes are constructed of rock masonry. They form two arches five by five. In 1909, when the water was so high, they were raised to their
32 full height and were opened to their full carrying capacity. All of water we could possibly discharge through gates was going through these two arches. Water continued to rise in spite of that fact. It continued to rise in varying amounts over several days until we began to get the water out of the spillway. It rose three or four inches a day for at least eight or ten days. Even after we got the spillway operating it continued to rise for several days while the spillway was running water. The spillway was discharging water sixty feet wide and six or eight feet in depth. The water runs down hill quite rapidly after leaving spillway. I mean the same.
33 At the time I speak of the spillway was an open cut in the earth. We had no trouble in controlling that from washing out. The water ran over spillway for thirty-five days several feet in depth. This occurred during latter part of June and first of July. During all of this time we had the gates clear up so as to give them the maximum discharge capacity. We did not break our dam in river. That was the first year water ever flowed over what was originally intended as a wasteway.
34 We had filled the reservoir on previous years to its full impounding capacity. But we had always used the discharge tubes or outlet tubes at the dam and the gates as our means of waste prior to that time. It has been our custom to use them from year to year whenever it was necessary. There were several years it was

not necessary to slough off much. The Laramie river fluctuates. There was perhaps one year prior to '99 that we had to use the gates. Those were kept open while the water was flowing into the lake from the river for eight or ten days. At one time we had them open to their full capacity for three days. That was the time the wind got to blowing on us. We would not necessarily have to do so but the wind got to blowing and cutting into the riprapping and we had to do that to cut it off. We kept reservoir full that year. I think we did not open the waste gates more than one occasion during that year. In other years it was our custom to keep the gates shut on this reservoir except in drawing for irrigation. We have never wasted
35 water down the river in the early spring or late winter for fear of ice injuring our dam. If so it was without my instructions. A very small amount of water has been leaking out of those gates all the time. There is not enough water in the river below the reservoir when the gates are shut down to protect the fish. The year following the big flood that I have mentioned we put in that spillway and added a new wing to it so that by water flowing through it by turning a little stream with a coffer dam on the platform, we extended our operation there. The flood of 1909 did not damage the dam just below the point of discharge at the tubes. A hole had been growing there for several years, the hole in the water had been eating in there, and after the State Engineer and some more of them came out and demanded that we fix it we did so.
36 There is enough water coming into the Big Laramie river from springs and other sources between the reservoir and the diversion dam at the tunnel, for domestic purposes throughout the winter. These springs were there before our reservoir was constructed. No noticeable return seepage on account of the construction of the reservoir. There are one or two small ranches at this spillway and they still call for their irrigation water. It doesn't seem to have interfered with their hay lands down there. Some of the water which flows down to the tunnel from leakage, springs and other sources during the winter months when we are not irrigating at Wheatland, goes down the Blue Grass, through the tunnel, and we use it in Reservoir No. 1 ditch. That ditch is canal No. 3. We aim to keep that running all winter. No water leaks through the dam at low stages. The tunnel is so constructed that it draws water from the main river without the necessity of a diversion dam at low stages. No telephone to this reservoir from Wheatland. We have had a telephone from two or three years at the reservoir
37 house. We have a keeper at the reservoir. He is supposed to stay there twelve months in the year. Prior to the last two or three years nearest telephone was at McGill's ranch. It is about two and a half miles distant. It is our custom to have our ditch riders watch the water supply and to order from the reservoir as needed. The man at the reservoir does not operate on one order given at the beginning of the season. During winter he reports one to three times a month on the condition of the reservoir and the condition of everything in general. During the time we could get through with teams it is safe to say that from the time that reservoir

was built I was there at least during the irrigation months two to four times every month personally. My ditch rider would be there if there was a scarcity of water to regulate it. They were there two or three times a week. If we were running water in sections, which we had to do occasionally, we kept one man on the road constantly.

38 The reservoir marked on map Exhibit A attached to answer of Greely Poudre Irrigation District as the Wheatland Reservoir is this reservoir No. 2. The water has been delivered from this reservoir as demanded for the last number of years. Prior to that when our canals and laterals were in shape I ran water as soon as they needed it.

39 We do not obtain any water from Sybille Creek after a few days of high water in the spring, without there was a cloudburst. The Sybille is of considerable drainage and has a constant flow. The Blue Grass flows water naturally, a small amount, the other tributaries of the Sybille coming in above the Blue Grass all have a constant flow of some kind. Heavy rains produce a rise for a few hours in the Sybille creek. Sometimes we divert this water into our system, but very often, our ditch is set and it goes down the creek. Those are very uncertain, but sometimes we are fortunate enough to benefit by it. The water we do not catch goes to the Laramie river.

This entire system as finally completed at the time we completed the Reservoir No. 2 we use for the reclamation as near as we could of this original tract. The entire tract was not brought under irrigation and actual farming because there was quite a parcel of land sold to parties held for speculation and we were unable to control it and it is still in that condition. I could not state what por-

40 tion of the original tract the development company owned at the time I left it in June 1912. All the time that I was with the company we had been working to reclaim this acreage contained in the original tract.

The Bordeaux tract was conceived for development somewhere about 1908 or 1909. The Sybille or Cooney Hill tract some two years later was started. The Bordeaux tract will be reclaimed through extension of N.o 1 canal. The Sybille or Cooney Hill tract will be irrigated out of the canal taken directly from the Blue Grass creek. This is a new and independent canal taking water from the Blue Grass before it reaches the Sybille creek. The Sybille tract lies across the Sybille west of the original tract. They are about at the same elevation as the lands contained in the original tract.

41 The Bordeaux tract lies south and east of the original tract. In order to reach the Bordeaux tract it was necessary to build a tunnel to carry the water of No. 1 canal to that tract. There is a hill lying between the original tract and the Bordeaux tract through which the tunnel is made. The tunnel is constructed in sand rock.

This Bordeaux tract is a separate and a new tract of land added recently. We contemplate irrigating it through the No. 1 canal. We enlarged No. 1 canal for that purpose. The tunnel was deepened in later years and an enlargement of No. 1 canal was made for the

purpose of obtaining an additional water for the Bordeaux and Sybille tracts.

42 These two tracts were not in contemplation when I went in charge of the system in 1888 nor when we constructed our reservoir No. 2 in 1900.

We carried over a small quantity of water during the winter in reservoir No. 2 every year since it was built, but only two or three years any great quantity. There were at least two years that we drew practically every drop off that we had in storage. The total capacity of reservoir No. 2 is supposed to be 126,000 acre feet approximately. When we held water over we had more than enough to meet the demands of all needing water on our project. After that service we had water not used. During one season of high

43 water we held over as much as one-fourth of the original amount. About 30,000 acre feet. On another year about 10,000 acre feet. Other years from eight to ten thousand acre feet. On other years some small amount. During our administration we did not have any record from year to year or month to month showing the gauge height depth of water in reservoir No. 2.

44 Examination by Mr. Charles F. Tew:

I ceased connection with the enterprise in 1912. We have not filled the Wheatland reservoir irrespective of storage in James Lake and Hattie Lake as we formerly did and emptied it for the irrigation of Wheatland project every year. We did not stop them from taking water, but we complained. During 1912 we stopped them from drawing water.

45 I know from hearsay that James Lake was filled at the beginning of the irrigation season of 1913. I heard they had considerable water in Hattie Lake. I do not think the Wheatland reservoir was filled that year. When at full capacity the water stands above the wasteway gates. If the wasteway had not

46 been obstructed it would have flowed over the wasteway in 1912. It was this full notwithstanding the taking of water for those two large new reservoirs. From the year 1909 to the year 1913, inclusive, under our works we served full area of about 35,000 acres.

47 Cross-examination by Mr. Delph E. Carpenter:

I would like to have the record show more accurately the discharge from the wasteway out of No. 2 reservoir, during 1909. The water ran over the wasteway for thirty-five days, starting at a few inches in depth and increasing until the last few days, and ran the depth as stated in my former testimony. The hole that was washed in the wastewey kept increasing and I think perhaps the last three or four days before the river began to fail the volumes lowered about as I stated in my former testimony. Then it continued down until it finally stopped. When at its maximum it was about sixty feet wide and six feet in depth. That was in 1909. During all

48 this time we had the outlet gates at the dam open and were discharging water at their full capacity. This reservoir was

completed July 1901. It was located October 1894; the first payment appearing on the company's books, being October 31, 1894, for the expenses for the general manager and the engineer; surveyed and plats made prior to September 11, 1895, the company's books showing a payment of $221 to Clarence T. Johnston, an engineer, for making the survey on that date; application for permit was filed January 29, 1898; actual construction work commenced June, 1899, and the reservoir completed July 1901.

49 This information is from the books of the Wyoming Development Company, and is within my personal knowledge. Canal No. 3, work of construction commenced June 1, 1894; completed May 10, 1895; no record of the date of survey; Reservoir No. 1, construction work commenced March 1897; completed May, 1897; permit issued May 7, 1897, from the State Engineer. No record of date of survey. The caretakers of the No. 2. reservoir were:—1901, Tom Graves, now dead; 1902, Merrill Waitman, now dead; 1903 to 1907 inclusive, Jess Reed, now living in Montana; 1908 and 1909, Frank Wickham, now in the employ of the Swan Land and Cattle Company; 1910 to now, Leo Sheldon, whose address is McGill. The year in which the second greatest amount of water was stored in Reservoir No. 2 and when the gates were open to permit its discharge was June, 1907. June 1, 1912, the acreage of land in the original project which had been sold, exclusive of cancellation, 30,453.36 acres.

No. 2 reservoir was located with J. A. Johnston during 1894 and engineer MacFarland. Clarence Johnston made his survey later. The first survey was made by MacFarland and verified by Clarence

50 P. Johnston. Clarence P. Johnston did not have supervision of the construction work. Work of construction began in June, 1899, and continued constantly until the work was completed. The contractor was Shaw, from Omaha. The dam and rip rapping were all completed July 1901. Water was impounded immediately thereafter. It was used for irrigation. A very small amount was impounded the first year. In 1902 we were short of water. We had some winter accumulation in the reservoir. Also

51 from flood flow in the spring. The year 1903 was an average year. The gates were shut down from fall of 1902 until we began to irrigate in the spring of 1903 In the spring of 1903 we did not avoid impounding the full capacity of this reservoir as a precautionary measure to avoid any possible breakage. We carried over a small amount of water after the irrigation was completed for the summer of 1903. There was a fair supply of water for 1904. We never wasted any water during those years. We carried over a small amount of water after the summer irrigation in 1904. We were short of water in 1905. I think we were short in 1905.

52 The present manager, J. A. Elliott, who is present, can give you the data regarding the last few years. We carried some water over in the fall of 1905, also in 1906. In 1907 we had an abundance of water. That is when we had our outlet gates raised for preventing further filling of the lake for a few days. The water was about five feet from the top of the embankment when the

water was at the high water line. We had a freeboard of
53 five feet of embankment above the high water line. I do not think the present dam has settled since 1907. I think it had stopped by the years 1906 and 1907. I do not think the water rose in the reservoir in 1907 after we opened the outlet gates. Water was flowing into the reservoir from the river when it was being discharged through the gates. We carried over a good supply of water, larger than usual, after the irrigation during the
54 summer of 1907.

No. 2 reservoir consists of two basins with a narrow neck between the two. The easterly basin was used in the first years of the use of the reservoir. Between the reservoirs we have been doing some excavating during different seasons when the water was
55 low in the fall. There is several feet of water left in the east basin which we cannot draw off. We had a fair supply of water in 1908. I do not believe we filled the reservoir as full as we did in 1907. It was somewhere nearly as full as in the spring of 1913. There is a stage when safety will forbid the further filling. It held in 1907 and 1909. We had a number of men and appliances there awaiting the break in 1909. It is an earth fill, the rip rapping is of stone laid loose. No concrete under the rip rapping. The loose rock rip-rapping was obtained from the surrounding
56 country. It was laid on by hand. In 1909 we took an additional precaution to prevent the dam from breaking. We carried over a small amount of water from 1908. That spring we had the reservoir prtty well filled, but I cannot state definitely whether another foot would have filled the reservoir in 1908 to its stage in 1907. That is a reasonable approximation, somewhere along there. In 1908 and '9, there was a very full supply of water and 1909 was the year of our battle with the water to keep from destroying the reservoir. From 1901 to and including 1909, water was run-
57 ning into the reservoir when we were drawing it out for irrigation. The inlet capacity to this reservoir is limited only by the capacity of the river. The amount of the discharge is regulated by our will. After the reservoir has been filled then we raise the gates for the waste. No water went over the wasteway during 1908. In the fall of 1909, after irrigating, we had a good
58 supply of water that we carried over, about 30,000 acre feet. We did not carry water over in the fall of 1910. In 1911 we were short of water. We did not carry over any water in the fall of 1911. That year we drew out of the reservoir all the water. We practically drew all of the water from the reservoir dur-
59 ing 1902 and 1903. During the early stages of its use. In 1911 we drew the reservoir dry. I believe 1902, 1903 and 1911 were all notoriously dry years. In this reservoir we have experienced the extremes, from the very dryest of seasons to the very wet season of 1909. In 1912 the reservoir was practically full to the safety margin. I don't think we wasted any water in 1912. I ceased active service as superintendent in June 1912. I am fa-

miliar nevertheless with conditions during 1912. From 1901
60 to 1913, I would say that the spillway was used only during the season of 1909. The capacity of Reservoir No. 2 was computed by our engineers at 126,000 acre feet. I believe Reservoir No. 1 covers about 340 acres.

61 In 1908 or 1909 the rock was blasted out and this tunnel deepened from a few inches to a few feet. J. A. Elliott was in personal supervision of the work. Canal No. 1 was enlarged and the tunnel deepened the same season. The enlargement of the tunnel and the capacity of Canal No. 1 were for supplying water to the Bordeaux and Sybille tracts. The enlargement of Canal No. 1 was for carrying water for the Bordeaux tract and for supplying the original tract.

62 The capacity of the tunnel and raceway since enlargement and deepening is about 770 cubic feet per second.

It was the custom of the company to have the reservoir gates at Reservoir No. 2 closed when there was a heavy flow of water in Sybille creek. Once we depended entirely upon the Sybille
63 for our supply. Outside of a few days in the early part of April or May perhaps, there is very little water available in Sybille creek. The snows on the Laramie mountains melt away very quickly and during the months of April and May the melting causes a flow in the Sybille and its tributaries. The Sybille springs form a constant source of supply to Sybille creek. The melting snows and springs make an early spring flow except in years of no snowfall. This water flows into the Laramie river. We take it into No. 1 reservoir. Since we constructed No. 3 canal, we have always diverted out of the creek into the canal and never allowed any to do to the river. We have used that to fill No. 1 reservoir. During heavy summer rains the Sybille and Blue Grass and tributaries have heavy flows of short duration. It is our custom to
64 direct all water we can, not only into our ditches, but into reservoir No. 1. What we cannot divert into canals numbers 1 and 2, and canal No. 3 or reservoir No. 1, goes into the Laramie river for appropriators there.

There is water flowing at Uva all the time. The North Laramie river has a small constant flow at its mouth. This flow comes largely from return waters from irrigation up the valley of the North Laramie. The valley of the North Laramie varies in width from half a mile to a mile. It is used principally for hay meadows. There are one or two large irrigation projects higher up on the North Laramie. The projests are on the bench land adjoining the North Laramie river. These projects have no connection with and are in no ways operated by the Wyoming Development Company.

65 Governor Carey is in no way interested in this project.

Other than this larger project, the irrigation on the North Laramie is quite similar to that in the Big Laramie river valley between the Wyoming Development Company tunnel and Fort Laramie. There is a constant flow of water in the Big Laramie river at Uva and below that point. There is a certain amount of return water flowing in the Big Laramie river from the mouth of the

Sybille to the mouth of the Chugwater. That is natural seepage from the heavy irrigation on the flats near Wheatland. It also adds to the supply of water in the Big Laramie river. The flow is constant.

In 1905 water flowed in the Sybille Creek until the 10th day of July. In two or three other years the water flowed in Sybille creek in a limited amount up until the first to the tenth of July. That creek furnishes a limited amount of water for our system.

66 It has occasionally happened that the company has permitted the water diverted from the Laramie river to flow down the Sybille Creek and back into the river, when not required by the users on the Wheatland flats. We have not wasted water out of the lower ends of our canals with perhaps one or two exceptions. It has not been our custom to order the caretaker at the reservoir to turn out what in our judgment would be amply sufficient to supply our customers, and to turn the balance of the water down the Sybille. It has been our custom to waste water down the Sybille only in case of high water. We do not figure any waste from our system. If on August 8, 1913, 24 cubic feet of water per second of time was passing from the Sybille into the Laramie river, that water must have come from flood waters or some break or damage in the ditch. If on August 8, 19 cubic feet of water per second of time was flowing in Sybille creek immediately below No. 2 headgate, that would indicate that water was being wasted down the Sybille creek. I

67 think that is rather unusual in the distribution of water from our system. The irrigation on the Sybille above our headgates to canal No. 1 is confined to the irrigation of little strips of land on either side of the creek by the ranchmen up in the mountain districts. The same is true of the Blue Grass and other tributaries.

The Sybille tract is supplied from Blue Grass creek, the ditch is not yet completed. The Bordeaux track is supplied by a continuation of No. 1 canal, the upper line, which passes through a ridge by means of a tunnel and around the Bordeaux tract. The Bordeaux tract is about the same soil as the original tract, but it does not lie so nicely for irrigation. The bulk of it is very uneven, and traversed by many draws and waterways. Some of that soil is de-

68 composed brule clay, but there is quite a per cent of first class land on the tract. The Sybille tract, for agricultural value, compared with the original tract, does not come up to the standard as a whole. I prefer the Sybille tract to the Bordeaux, from an agricultural standpoint. The southerly portion of the Sybille tract is quite rolling. The best land in the Sybille tract is at the extreme north and central part. Some good agricultural land there. The original Wheatland tract was comparatively uniform and easy to irrigate. Both of these new tracts are difficult of irrigation as a whole. The net irrigable and tillable acreage of the new tract, will be much smaller than that of the original

69 tract. Out of the original 60,000 acres in the original tract about 30,000 acres are under cultivation and irrigation. The tract is about fifty per cent under cultivation. The project was

commenced in 1883, so that thirty years have been consumed. During that thirty years, fifty per cent of the total acreage has been reclaimed. Out of the remaining thirty thousand acres some small per cent is not irrigable. Some of the outlying sections are a little rough and broken. At the places where the flats break over into the drainage channel. Very little of the remaining thirty thousand acres is above water and too high to be reached. At
70 least eighty or ninety per cent of the remaining thirty thousand acres can be made into irrigable agricultural land. The most desirable out of the original 60,000 acres was first selected by settlers when buying. Those lands now under irrigation are the most uniform. I previously stated that about 25,000 acres was irrigated in 1900. I desire to correct that by stating that about 10,000 acres was irrigated that year. 1894 or -5 about two thousand acres of the original tract were under irrigation. Only about one thousand acres were farmed prior to 1895. From 1895 to
71 1900 we had an increase of about nine thousand acres in farmed irrigated land. There has been a proportionately small increase of irrigated cultivated land since 1910 or 1911. The real active development began about twelve years after we had commenced work. The latter part of one season and during part of another season in 1889 or 1890 no water was taken through ditch No. 1. We were taking water through ditch No. 2 during those seasons. We were not taking water through ditch No. 1, because one of our large flumes went out. The flumes went out over Deadhead creek.

72 Except for those times we supplied water through those two ditches continuously. Water then may have been wasted through the laterals for a few days at a time, but we did not make a practice of it. The beginning of active irrigation in the
73 Wheatland project varies according to the season, from the first to the middle of May. As a usual thing the heavy part of the irrigation started from the first of June on through the middle of July. The demand for water ceases about the middle of September. They cease irrigation on young alfalfa and that class of crops. It may be true that in the year 1899 water was turned into the canals of the Wyoming Development Company at Wheatland June 11th and that a little was used for irrigation before June 20th.

74 Alfalfa requires the greatest volume of water. The irrigation of alfalfa commences the fore part of June. The time of the heaviest irrigation is a matter of practice among various farmers. Usually we commenced irrigation of alfalfa for the first time from the middle to the 20th of May. To secure three crops, we figured on harvesting the first crop the latter part of June, as a general thing, and it takes about thirty days. As a general rule we only have cut two crops of alfalfa each year. The irrigation of alfalfa varies. We have successful farmers who irrigate their alfalfa two times to each crop. We have others who irrigate once to each crop. It depends very often on the locality and the difference in
75 the ground. They could produce good crops on much of the land there with an irrigation to each crop. The demand

for water diminishes about the 7th of August. The demand is undoubtedly much smaller the latter part of August and fore part of September than it was in June or July. Clarence P. Johnston was not in error when he said in the same Bulletin and on the same page "from the 12th of June to the 7th of August, the alfalfa was irrigated three times or more." Oats are irrigated from one to three times, according to the season and the nature of the land. In the earlier stages of our development we required more water to produce a crop. The duty of water on the Wheatland tract has been gradually increasing. The production of alfalfa on the Wheatland area varies with the season.

76 The average production for the first cutting for good farmers would be from a ton to a ton and a half. Over the whole tract about a ton per acre would probably come nearer the general average. The second cutting would not average so much. It would probably be a little in excess of three-fourths of a ton per acre. If the farmer is figuring on three cuttings he would cut his first crop from the 20th of June to the first of July. His second cutting the last days of July, but if they figure on only two cutting- he will let his alfalfa stand a little longer into August. For hay of the greatest strength and best condition they cut but two cuttings per year on the Wheatland area. Their second cutting would be about

77 the middle of August. Under the general rule of two cuttings a year, the third growth makes very good pasturage and is used for forage. It is used in the same manner and makes about the same growth as the fourth growth of alfalfa in the Poudre valley. About 1900 I bought considerable hay paying from $3.50 to $5 a ton in stack. Later years hay has been generally selling much higher. Higher prices for that class of hay have been generally prevalent throughout the west for the last few years. Within

78 the past few years the prevailing prices at Wheatland for baled alfalfa have been between eight and ten dollars a ton. That is f. o. b. car Wheatland. The prevailing price per ton for baling this hay is about a dollar and I would state that it costs about seventy-five cents per ton to transport the hay from the stackyards to the railroad track. The actual value of the hay in the stack would be obtained by deducting $2.75 from the prevailing price of from eight to ten dollars a ton for the baled product delivered at the tracks. Baled alfalfa is of necessity the choicest of the crop.

79 Oats yield in the average season in the Wheatland area about fifty or sixty bushels per acre. They test about thirty-eight or forty pounds. We raise both winter and spring wheat. The growers, prefer the spring, and the millmen prefer the winter hard wheat. There is considerable of both varieties raised. Many of the farmers have raised as high as forty-five to fifty bushels per acre of spring and winter wheat both. Quite a few of the farmers have crops running from twenty to thirty bushels per acre. I would give forty-five to fifty bushels per acre, as the production, under the most favorable conditions with the best of farmers. The grain tests as a rule sixty pounds. There has been little corn raised in the Wheatland

area. I would guess that about twenty-five bushels to the
80 acre would come nearer to the average of the better crops.

Our first frosts occur from the first to the tenth of September. The last ones from the first to the tenth of May. The river and creek bottom lands are most subject to frost. Frosts occur earlier in the fall on these lands. There have been seasons that frosts have come much earlier than I have stated in my first answer and much later in the spring.

81 I kept the records for the Weather Bureau at Wheatland for a number of years.

We have raised sugar beets to some extent during the past few years. We have had beets that ran into twenty-odd tons per acre. I believe 1911 was the first season when sugar beets were cultivated commercially at Wheatland.

82 I have raised potatoes myself on the Wheatland tract as high as one hundred and twenty-five to one hundred and fifty sacks to the acre. A sack will average one hundred and ten pounds. It is approximately two bushels in measurement. These crops I raised were under the highest state of cultivation. I cannot recall any crops over comparatively large areas which exceeded this production. The greatest acreage of potatoes that I produced in any one year in the Wheatland district was ten acres. The first crop I raised was on section 6, township 24, range 67. The next crop I raised was on the same land. I raised potatoes for several
83 years on section 12, township 24, range 68. The large yield I have spoken of came from that land on one or two occasions. In different seasons they were quite extensively cultivated, but there being no market stopped raising them for several years. Potatoes in our district have been afflicted with the blight. That blight has affected potatoes in all irrigated districts for the past few years. The crops mentioned are the principal crops produced in the Wheatland area in recent years. Small fruits grow in the Wheatland area very abundantly. Berries of all kinds. I have seen good crops of apples on young trees there for several seasons. We have made very creditable showings from the Wheatland district at
84 different state fairs. It is still in its experimental stage. We do not raise peaches or pears. Cherries and plums do very well.

The elevation at Wheatland station is 4,738 feet.

In the Bordeaux tract about four hundred and fifty acres irrigated and cultivated during 1911. I do not think that there was as much as 1,067 acres irrigated in 1913. No land has been irrigated in the Sybille tract as yet. There is a small parcel of land in that tract irrigated from private ditch.

85 The population of Wheatland is something in excess of one thousand and there are considerably more than 1800 to 2000 people in the neighborhood outside of the town. The population of the district exceeds thirty-five hundred people.

Cross-examination.

By Mr. Fred Farrar:

The company that developed this land at Wheatland is The Wyoming Development Company. The Wheatland Industrial Company is formed of the members of The Wyoming Development
86 Company. It undertook the development of the Bordeaux tract, the Sybille tract and No. 2 reservoir. The two companies are distinct corporations. The original Wheatland tract was not a Carey Act, but a desert land project. There was considerable difficulty in securing the title. It was under the Stark's administration the troubles commenced, and we were delayed for a term of years owing to the Government Inspector's reports. There seem-d to be a sentiment against us for a certain length of time. Finally the matter was taken up and a commission sent there. They reported
87 favorably, in latter part of 1893. The 60,000 acres was patented at different times.

The Bordeaux tract is a Carey Act project. The Sybille is also a Carey Act project. No land has been patented in the Sybille tract. What I term reservoir No. 2 is on defendant's map designated as Wheatland reservoir. The water in this reservoir is impounded by a dam across the channel of the Laramie river. The water
88 is impounded in two depressions off to the side of the river. The reservoir is about twelve to fourteen miles long. It includes at high water line some seven thousand acres. We have regulated the flow of the river at the reservoir according to the needs on the system. It has been our practice to impound all the water of the river until the reservoir was full, then we allowed the flow to pass through the reservoir gates. That water which was
89 allowed to pass went down the river. If it was irrigation season we used it at the tunnel, otherwise allowed it to go down the Laramie river. We have gates at the mouth of our tunnel. We can intercept all the water in the river. If we need it for irrigation we take it through the tunnel and through this irrigation system. During the year since the Wheatland or Reservoir No. 2 has been constructed, we have had not only the amount of water impounded in this reservoir, which I have estimated to be
90 126,000 acre feet, but have also had the normal flow of the river. There have been no records until recently. The water drawn from this reservoir through a series of years was used for the irrigation of the Wheatland tract. None of it was allowed to to go to waste. In 1909 we had high water which caused trouble at the reservoir. At that time the reservoir was filled to overflowing. I estimate we had 126,000 acre feet impounded. And in addition we had the flow of the river, which was above that of a normal year. Flood water was used for the irrigation of the Wheatland tract after the reservoir had returned to its normal state. During the time the excess water was passing down the river from the reservoir we were using it for irrigation. We had under cultivation that year close to the same acreage we have now, about 30,000 acres. 30,000 acres is the largest amount of land that has ever

been irrigated under this system. Since the construction of the reservoir, we have had not only the reservoir, but the natural
91 flow of the river to irrigate. The duty of water is the amount of land a given quantity of water will irrigate. We have in a general way an irrigation season at Wheatland. Without taking into consideration exceptional cases, the length of our irrigation season would be from ninety to one hundred days. The water is applied more or less constantly to the land for that period. Our practice is to irrigate, then discontinue and then later irrigate again. The amount of time water is actually applied would depend entirely on the different crops raised. We start in with alfalfa and
92 apply the water to that first and follow on the grain crops and then change back to alfalfa. Many of the farmers on 80 acres, with their diversified crops practically use their water constantly. We ordinarily irrigate alfalfa for two crops about three times. It has been a practice among many of our farmers who have a large acreage in alfalfa, 80 or 100 acres, to start in with the water and keep irrigating until they went to harvest. As soon as they commenced to harvest that 80 acres they would apply the water and follow up right after the machine. On part of our land that amount of irrigation was necessary. We irrigate grain from
93 one to three times. Our winter wheat is harvested along the early days of July. Winter wheat is generally irrigated once. Spring wheat is generally harvested about first of August. The irrigation of beets depends entirely on the season, many of them as high as four or five times. That irrigation continues after the irrigation on the other crops has ceased.

94 Since the construction of the tunnel and the diversion of water the authorities of Wyoming have not directed the amount of water which we could take. There was interference with our taking water only during 1911. We were notified to let water go down to parties below.

95 I know of the reservoir Lake Hattie. It is junior in appropriation to Wheatland Reservoir No. 2. I am acquainted with the reservoir on the Laramie Plains known as the James Lake. That is also junior to our reservoir. Lake James is a large reservoir.

96 I took charge of the Wheatland system in 1888. Then there was practically no land in the Wyoming Development tract in cultivation. During the early years of the history of the project and before there was any considerable amount of actual settlement the company itself put about 1,000 acres in actual crops each year. That was practiced several years before I commenced work for the company. At times during that period water from the ditches was turned on the prairie land. There was no cultivated land upon which to use it. That is not done today. That
97 continued until they began to bring in settlers. The water was turned on the prairie lands for hay and pasture. In certain sections we cut hay and pastured and we rented our pastures to the stock men of that country at different times. We were in

effect merely irrigating the prairie lands for purpose of pasture. There were about thirty or forty thousand acres of this land irrigated. Ditches were constructed. Many laterals were constructed. The company continued to farm on this tract until 1894 or '95.

98 This water put on the prairie was applied primarily for preserving our water rights. Also to a certain extent to secure our titles under the desert land laws. These and the desire to derive a revenue from the pasture were the principal motives. There would have been pasture there without the water. Our actual settlement began in about 1894. There was a uniform price,—$15.00 per acre,—for these lands, including the water rights appurtenant. The price gradually increased. We have different prices on different grades. When I left the company it was about $60 per acre upon the better grades of land. That included the water rights, unimproved land. After the settlement had pro-

99 gressed quite an amount of these land were abandoned. They reverted back to the company. In many cases the contracts were transferred to someone else. The lands marked abandoned on the map are those which reverted to the company. Several thousand acres of land are shown on the map and so marked. There were lands that were entered by purchasers and afterwards reverted to the company. I don't think the map correct. I don't think there was at any time in the history of the Development Company that number of acres in an abandoned condition. That map is an ex-

100 hibit of our company in a previous case. I have only a general knowledge whether the title to the original tract is taken to the company or to individuals. The years when we began to settle our land, unfortunately, were the years following the extreme drouth through Nebraska, Kansas and eastern Colorado, and of course, after we acquired our title, like every other enterprise, we were anxious to sell lands. We sold regardless of the condition of the buyer. Our aim was to get in settlers, many coming without a dollar, from the drouth stricken districts, and the consequence was wherever there was one success there were many failures. The company assisted these people, but in the end many of them failed.

101 The wasteway at Reservoir No. 2 is at the northeast end of the reservoir. No water is allowed intentionally to spill over the reservoir dam itself. Neither the company nor I have records of the amount of water taken out of the reservoir during the years since its construction.

Cross-examination by Mr. Delph E. Carpenter:

The company have not until recently used gauge rods or weirs. Up to that time we ran without any record. Defendant's exhibit No. 1 is a publication by the Wyoming Development Company.

102 Cross-examination by Mr. Fred Farrar:

The State Engineer compelled our company to draw water out of Reservoir No. 2 at different times on account of the amount of water we had in it. I believe during the high water season of

1909. Such an order was not given to me the year following or in the year possibly I discontinued my connection with the company.

Am familiar in a general way with the lands along Laramie river from our diversion dam to mouth of river testified to by Mr. Whitney. They are the usual class of our bottom lands all over the state. They are different from the uplands. Hay is natural in certain places to those bottom lands. In other places it requires
103 irrigation. They are commonly called native hay meadows. Generally the ranchmen owning these meadows have reclaimed them as hay meadows. For the reason that the hay which can be produced on them is a profitable crop.

Reservoir No. 1 was intended to be filled with flood waters from Sybille creek. Lake No. 2 lies northwest of Wheatland. It is not a storage reservoir. It derives its water from No. 2 canal and partially from seepage. Surface water to a certain extent. Sybille creek is approximately 50 or 60 miles in length. Chugwater is somewhat longer than Sybille. I hardly think the greater portion of the cultivated lands on the Wheatland tract is devoted to alfalfa.
104 They raise a large amount of grain there each year. I think the list of irrigated lands that Hadsell prepared some three or four years ago was correct. That was for 1910. I believe there were several lists prepared prior to 1910 but I cannot say whether there was any record kept of them. There is considerable
105 land in the Wheatland tract farmed by renters and land farmed by the owners.

There has been no marked increase in the land farmed in the lower Laramie valley, during the last twenty years and no marked change in the population in that region. The increase has come almost entirely around Wheatland.

There is meadow farming,—ranching—on Sybille creek similar to that carried on on the Big Laramie, both above and below our headgate to canal No. 1. There is considerable more farming
106 on the Sybille now than there was twenty years ago. There is quite a considerable being done above the headgate to ditch No. 1. Up in the mountainous district, and on the headwaters of the Sybille, the conditions are practically the same as they were twenty years ago. That territory is devoted entirely to the stock business.

There were various reasons which caused the trouble in our desert land entries. Many people were aiding the administration against us. People on the head of the Sybille
107 We had some opposition from the cattle interests. At that time 640 acres was the largest amount of land that could be taken up by one entryman.
108 The surveys for the Bordeaux ditch commenced on February, 1904, the construction in June, 1907. The ditch was completed in June, 1908. The surveys for the Sybille ditch were commenced in August, 1907; construction work in July, 1910.

109 Cross-examination by Mr. Delph E. Carpenter:

Clarence P. Johnston made the first survey of Bordeaux tract in 1904. The surveys made under supervision of Governor Carey. Companies took up seriously the consideration of the irrigation of the Bordeaux tract some two or three years perhaps after 1904. The first survey made by Mr. Johntson was for the preliminary line. It was to ascertain whether the project was feasible. The Bordeaux tract and its development was taken up in earnest for actual construction according to the company's books in 1907. I do not believe that surveys were made that year and construction was begun and that the engineer then went over to the work and began to work on the survey for the Sybille tract.

110 Engineering work was carried on on these two tracts during those years. In one instance the actual construction followed the permanent survey of that year, and in another instance the preliminary survey began.

Redirect-examination by Mr. Clark:

111 In giving the capacity of reservoir No. 2, I am referring to the original engineer's notes of its capacity. Have no knowledge myself of its capacity.

We had the distributing ditches No. 1 and No. 2 filled to their capacity before any work was done on the tunnel. Filled them from water taken through the tunnel. The present supply ditch to the tunnel was constructed the same time the tunnel floor was lowered. It is not the original supply ditch. The headgate of the new race-way is from a quarter to half a mile from the head-gate of the old. The fall in that distance is quite heavy.

112 A new diversion dam at this new race-way across the river was constructed at the same time, of about the same character as the old one at the old race-way. Failure to colonize from 1888 to 1894 was caused by the difficulty in securing titles from the Interior Department. The high water in 1909 was exceptional. Never knew of any flow to compared with it, before or since. In 1907 we wasted water at the dam as a precautionary measure. The winds were blowing from the east and the dam was settling unevenly and the rip-rapping was not setting as it should, and it became unsafe.

113 Think some of the wasted water in 1907 went through our tunnel and some down the river. In 1909 it largely went down the river. These were the only times water went down the stream except when there was an accident and we were repairing breaks.

Since constructing Reservoir No. 2 we have quite frequently had trouble with lower appropriators demanding water.

All the streams mentioned by me as having a continuous flow vary from time to time as to quantity. I was present when Reservoir No 2 was located at its present site in 1894.

114 The settlers under our canals had held meetings and offered to increase the price to be paid us per acre under their contracts if we would build the reservoir. At that time there were

2,000 acres under cultivation. There had been difficulty in securing water enough for the 2,000 acres. We were in position to divert and had been diverting all the natural flow of the river. Prior to constructing Reservoir No. 2 we ran short of water the first of July in some seasons, and from the middle of July on in some years.

We worked on the cut connecting the two portions of the reservoir in the fall of 1902 and 1903. The water in the reservoir was all drawn off those years.

115 Prior to constructing Reservoir 2, our source of water supply was the direct flow of the river. No. 2 was built to conserve the flood waters. In the early part of the season we sti' divert the natural flow of the river. No. 2 furnishes a supplementary supply for the Wheatland lands, and is the only supply for the Bordeaux and Sybille projects.

116 There is considerable seepage water from the Wheatland flats into the Sybille and also into the Chugwater and the Laramie river.

The map Exhibit A with the bill is generally correct.

The North Laramie river is correct on the map. It flows through the Black Hills and is a tributary of the Laramie. The map correctly shows the Sybille.

117 Duck Creek is correctly shown on the map. It flows into the river below our tunnel.

Cross-examination by Mr. Farrar:

117 By the Laramie Plains I mean that part of the country lying west and south of the Black Hill range. It includes not only the plain country but the mountainous country, it borders up on the foothills of the Black Hills range. The North Laramie heads on Laramie Plains.

118 Further cross-examination by Mr. Delph E. Carpenter:

Referring to Exhibit A and particularly to that portion in heavy blue in the vicinity of Wheatland which is designated as irrigated land, that part of the plat is in error as showing that all of the tract is irrigated, when only about fifty per cent of it is actually irrigated.

119 J. M. WHITNEY, a witness in behalf of Complainant.

Direct examination by Mr. Clark:

I have lived in Wheatland and vicinity since the spring of 1880. Live about 25 miles below the Wyoming Development Company's dam, and about 25 miles from the mouth of the Laramie. Have been familiar with the irrigation from the Company's ditches. Know Cross T. Ditch No. 2.

120 I own that ditch. It diverts water from the Laramie River due north from Wheatland and was built before I came to that country. Has always been used to irrigate 318 acres for me and 150 acres of Ralston's land. Ralston commenced to irrigate in 1884. The ditch has sufficient capacity. Know the Scissors Ditch. It was

constructed before I came, was running water when I came. Takes its water from the Laramie ten miles below my ditch.

121 Irrigates more than 250 acres. Tolland Company owns it. Know Laramie Ditch No. 1 owned by Mullins & Bradley. It was running water in 1881. Takes water from Laramie River two and a half miles below my ditch. Irrigates 800 acres. They have since changed the line.

122 Know Cross T. Ditch No. 1 owned by Osgood Johnson. Diverts water from the Laramie three-fourths of a mile above my ditch. It was constructed about '84 or '85. Irrigates 90 to 100 acres.

The ditch of James Gallagher is taken from the Laramie and was built about 1890.

Know ditches of A. N. Spencer. They are further up.

123 And below the Development Company's dam. They were constructed about 1890. Know Bright & Sutherland Ditch which takes water from the Laramie east of the Tolland Company ditch. Built about 1890. The ditch has carried water regularly since. Carmichael & Gallagher also constructed a ditch about 1890.

124 The Cramer ditch takes water from the Laramie further up towards the Development Company's dam.

Reitz No. 1 and Reitz No. 2 are ditches built in the early 1890's. Know Thompson Enlargement to Scissors ditch. That was built in the early 1890's.

125 Know the Phillips ditch. It diverts water just below Uva. Built in 1890. Irrigates 30 or 40 acres. Uva ditch owned by Tolland Company. Built in 1890.

126 Irrigates 200 acres.

The Wyoming Development Company has taken at its dam in some years the whole flow of the river.

Cross-examination by Mr. Delph E. Carpenter:

126 Have lived in Wheatland seven years last spring. Before that lived on Laramie River, just above mouth of North Laramie. Ralston's ranch is at mouth of North Laramie. Some of his land is irrigated from Cross Ditch No. 2. Between 1880 and 1891, I was employed by a Cattle Company. Was manager for it in store and hotel at Uva. Railroad was built through Uva in 1887. Store prior to 1887 at old Uva, at present wagon bridge over Laramie River. Cattle business was then general business of ranches

128 in that country. From 1880 to 1887 Scissors ranch and other ranches were irrigating between Uva and Fort Laramie. Irrigation was along river bottom. Principal crop irrigated hay. Ranches then irrigated have been irrigated ever since for alfalfa and hay. Some now raising wheat, but hay principally. Between 1880 and '87 some irrigation at Uva on north side from North Laramie. Part of same still irrigated for hay. North Laramie tributary of Laramie River. Enters from north side. All ditches from Uva station to Fort Laramie are below mouth of North Laramie River.

129 Sybille and Chugwater enter Laramie river from south. Ranches from Uva to Fort Laramie below mouths of these streams. Cross T. Ditch No. 2 used for irrigation of about 318 acres since 1880, mostly to hay, some oats, some alfalfa. Land in valley of Laramie river on north side. Ralston has irrigated since 1884 about 150 acres from an extension of said Ditch No. 2. Principally hay, some oats, and some alfalfa.

130 Both my ranch and Ralston's ranch on river bottom. Probably from eight to ten feet to water under this land which lies at extreme limits probably three-fourths of mile from river, running from that width on irrigated area to narrow strip. Cross T. Ditch No. 1 of Osgood Dunton about three fourths of mile above my ditch and on south side of river, irrigating about 100 acres, built in 1884 and 1885. Crops irrigated principally hay and some oats. Object of owners of Ralston ranch, Osgood Johnson ranch and of my ranch in '80s was to raise crops for feeding stock. Of my 380 acres I broke 40 acres of sod for oats and alfalfa in about 1893. Prior to that it was in native hay.

131 Raised two crops of oats and seeded it to alfalfa second year. Never raised oats after that, just grew hay. Johnson, whose farm is under Cross T. ditch, plowed some of his land, putting about 20 acres of the 90 in oats and alfalfa. Next canal from Laramie river down stream is Tolland Cattle Company or Uva ditch. Neither of Cross T. Ditches divert water below mouth of North Laramie, nor obtain water from that stream. Of 200 acres under Uva ditch, constructed in '90s, part irrigated to native hay, and part in oats for several crops, then seeded to alfalfa. In latter

132 part of '90s they raised two or three crops of oats on 50 or 60 acres then seeded to alfalfa. Land in alfalfa ever since. This ditch takes water from Laramie below mouths of the North Laramie and Sybille, and above mouth of Chugwater. Tolland Cattle Company still in cattle business.

Next ditch down stream is owned by Yates, diverting water about three miles below Uva headgate on north side of stream irrigating about 100 acres. Constructed between '98 and 1900. Hay is principal crop. Has been put to same use as other ranches I mentioned. Dams of four canals of which I have spoken constructed principally of brush rock and small timber, called beaver dams, and

133 are of the character used by most small ditches along stream. Water flows over and through them. Are repaired from year to year as irrigation goes on.

134 Scissors ditch next down stream, about eight miles below Uva, constructed prior to 1880 and irrigates about 250 acres of river-bottom. This land extends about three-quarters of mile from bed of stream, lying in strip along floor of valley. Bluffs arise about it to north. In 1880 this land was cultivated to native hay. Its owners engaged in cattle business. This ditch located below mouth of Chugwater, gets benefit of North Laramie,

135 Sybille and Chugwater creeks.

McCormick & Bright ditch constructed in '90s next down

stream. Has dam similar to ones mentioned and irrigates approximately three or four hundred acres river-bottom in native hay and some alfalfa. So used since construction. Owners in stock
136 business. This canal gets benefit of North Laramie, Sybille, and Chugwater creeks, known as the Bright & Sutherland.

Next ditch about 5 miles down-stream is the Ryan. Constructed in early '90s, and used for irrigation of river-bottom. Not familiar with rest of ditches down stream. General character of irrigated land between there and Fort Laramie is river-bottom.

Lands irrigated from Uva to Fort Laramie generally river-bottom. This varies in width from half mile to mile. Country to north and south is hilly and used for pasture and is not irrigated, very little is susceptible of irrigation. Cattle pastured on this hilly land, wintered in river valley on hay raised on meadows mentioned.
137 Certain per cent of water diverted from Laramie by ditches mentioned returns to the river in immediate vicinity of meadows irrigated. Some evaporates. Would hardly think this valley was native hay meadows prior to white settlement. Underlying this meadow land is well defined water plane corresponding in a large measure with surface of Laramie river. Water runs in river between Uva and Fort Laramie year around.
138 Kept no record of flow at Uva station during years I lived there. Considerable meadow land irrigated on North Laramie above Uva. On main Laramie above Uva small ranches extend for probably 25 miles, used in same manner as ranches below Uva, generally producing native hay and alfalfa.

Mullin & Bradley ditch located next above diversion works of Cross T No. 1. Constructed in latter part of '70s.

Irrigates section or more. It is about three miles up stream on north side. They have raised oats there, but mostly native hay. Owners are engaged in cattle business.

Their lands extend about three miles along river valley. Ditch has same kind of headgate and dam as other ditches mentioned.
139 Native hay harvested about middle of August. Generally begin irrigating native hay about May 1st. Water is spread over land through lateral ditches and is kept flowing constantly. Same manner of irrigation practiced there as on upper Laramie river valley. Water turned off latter part of August, Some
140 cut hay and irrigate at same time. A few days required for meadow to dry so that machines can work.

These meadows vary, some don't produce much, and others produce about a ton per acre. The general hay meadows in that valley produce probably half ton per acre of native hay per year. Some of it does not produce on account of character of soil, and in some places they get too much water and in other places they can't get enough.
141 The land does not get enough water where it is not perfectly true and uniform and where it undulates and rolls a little. In some portions the water accumulates in pools. Where this water accumulates it either kills the grass or causes slough grass to grow. This grass is not as good for hay as the native grass. It is

inferior but is usually cut. I include slough grass in my general tonnage production.

In Laramie valley in my vicinity we got two cuttings of alfalfa ear year. First about first week in July. Average alfalfa goes about ton per acre at first cutting. Usually of first class quality.
142 Second cutting usually last week of August or first of September. Production a little less than first cutting, probably three-quarters of ton. Total per acre per annum of alfalfa about one and three-quarters tons. Begin irrigating alfalfa about May first. In irrigating alfalfa we keep water constantly in ditches and spread it on land in rotation. We stop irrigating alfalfa latter part of August.

Usually obtained about fifty pushels per acre of oats on land I cultivated, a fair average of production of oats on those ranches in Laramie Valley mentioned. Irrigation of oats begins latter part of June. Usually two irrigations. Harvested latter part of
143 July. These conditions as to irrigation generally prevail in valley.

Combination ditch is next up stream, built in '90's. Irrigates river bottom on south side. Cannot give acreage. Same crops raised as on other ranches mentioned. Its diversion works similar to other ditches mentioned.

144 The Spencer ditches next. Constructed about 1885. Two cover about seven or eight hundred acres. River bottom on south side. Diversion works similar to others mentioned. Not acquainted above Spencer place, but know other ranchmen
145 irrigate there.

The Laramie flows through mountainous country from where Wheatland Tunnel diverts water and there are no farms for a considerable distance along that portion of the stream. Ranches along Laramie River Valley east of the Laramie mountains and to Fort Laramie are similar and used for feeding grounds for livestock in the winter.

146 Prior to construction of Development Company's reservoir we had our principal flow in Laramie river in June, commencing latter part of May, and running into July. In irrigating meadows we spread water or otherwise we would ruin our meadows. In my own case I changed water every twenty-four hours. We usually carried strong head in ditches when available. Could
147 get the water over meadows faster. When we were carrying these large heads of water greater portion of it running over meadows returned to the stream. The best native hay is not produced by keeping water circulating freely and as clearly continuously as possible across the meadows. Do not think any of the ranchmen up and down the valley changed their water often enough. Do not know how many cubic feet per second my ditch carries.

Cross-examination by Mr. Fred Farrar:

Water is turned off before the hay is cut. We generally irrigate native hay about three times each year, commencing first
148 of May. My meadows have generally taken a week or ten days to irrigated. Second irrigation as soon as the water

was needed, which might be in a week or ten days or in two weeks. Third irrigation a little later. Each irrigation is distinct. I irrigated my alfalfa about twice to a cutting, commencing about May first, giving one good wetting in May and another in June.

Have cut oats two different years that went fifty bushels per acre. Had no other experience.

Have no measuring weir at head of my ditch but have headgate. Other ditches mentioned have no weirs that I know of. Water
149 is not measured. We take whatever we want. No restriction is put on us. I do not know capacity of my ditch, or that of any other mentioned.

Know company which projected this Wheatland enterprise but not connected with it. These ditches mentioned do not form part of Wheatland enterprise. They are small ditches averaging
150 a mile or two in length, practically parallel to the stream and carrying no great distance. Irrigation of my native hay lasted about ten days. About two or three weeks between irrigations, during which time water was shut back into river. Cannot say whether that custom prevails up and down valley with reference to ditches mentioned. Other ranchmen irrigated their meadows similarly. Some have their ditches so arranged that the water flows through them when it is not used and back into stream, making constant diversion without any use of water.

Do not know of any regulation by Wyoming authorities of distribution of water among ditches mentioned. Each ditch owner allowed to take all the water he wanted. My neighbors and
151 I have lived in harmony under that system. The general irrigation season on ranches mentioned commences about May. All told we use water about thirty days during irrigation season. We need it longer than thirty consecutive days and use it at periods all through summer.

My place at Uva about 5,000 feet in altitude. Cannot give character of soil under these river bottom lands. Never been large acreage of oats raised on ranches. They raise oats for their own consumption.

152 Cross-examination by Mr. Delph E. Carpenter:

Only small ranchmen, with exception of Tolland Company, located along Laramie valley from the mountains to Fort Laramie and through tracts mentioned. Have considerable area of country there. Ranch buildings probably every four or five miles. Domestic water for ranches acquired mostly from wells, supplied with water just beneath surface of land. Irrigate my alfalfa about same time that people irrigate alfalfa on the flats at Wheatland. Under Wheatland canal farmers irrigate alfalfa first time about latter part of
153 May. On Wheatland flats chief business is farming. Up and down valley, near Uva, principal business is stock raising. Farming secondary matter.

154 J. A. ELLIOTT, a witness in behalf of Complainant.

Direct examination by Mr. John D. Clark:

I have been a civil engineer (irrigation) about six years Graduated at Cornell College, Iowa, in 1908. Have been Engineer and Superintendent for Wyoming Development Company since June, 1912. For a year and a half prior to that was engineer for that Company and from the fall of 1909 assistant engineer. Have known their irrigation system intimately since I first went there. Have superintended the running of the water and made measurements.

155 And supervised guaging stations on the river. Familiar with the amount of water in Laramie River and our tunnel and reservoir, and the amount drawn into supply canals and the use of the water. I had charge of the work of enlarging the tunnel. We began in the fall of 1910 and finished in the spring of 1911. The tunnel sides showed the high water line prior to the enlargement. That line was 18 inches to two feet from the top from a point 600 feet from the inlet, to the outlet.

156 That showed the capacity of the tunnel was limited by its intake. The enlargement commenced 200 feet below the portal. From there to the outlet we took out from two-tenths to two feet of the bottom of the tunnel with an average width of about eight feet. I don't think this work increased the capacity of the tunnel. If it did the increase was not over ten per cent. I estimate the capacity of the tunnel at 800 second feet. I do not know the capacity of the race-way.

157 From the outlet of No. 2 reservoir to the diversion dam is about 20 miles of river bottom. The tunnel is three-fifths of a mile long. From the tunnel to Blue Grass creek is about 1500 feet. From this point to the Sybille into which Blue Grass flows is fourteen miles. From that point to the head of Ditch No. 1, half a mile. From there to the head of Canal No. 3, six miles. From there to Canal No. 2, five miles.

The lands about the head of Ditch No. 1 constitute a low valley. The banks of the Sybille there are very low and sandy loam. No. 1 ditch follows the foothills. The flats irrigated by that canal are fifteen miles from the head-gate.

158 No 1 Canal is 35 miles long, flowing along the southern edge of the Wheatland flats, going within a mile and a half of Wheatland.

Canal No. 2 is 22 miles long and flows over the western and northern portions of the tract and through the town of Wheatland.

The Bordeaux ditch is taken out of Canal No. 1 about 22 miles from its head-gate.

159 No. 1 Canal has a capacity of 425 second feet. With a small amount of repair work it would carry 100 feet more. It has not been cleaned out for five or six years. In places it is filled from a foot to fifteen inches. Canal No. 2 is in the same condition. It has a capacity of 225 second feet. If repaired it would carry 75 feet more. The custom has been to run only what water was required.

160 We begin irrigating each year from the 4th of May to the latter part of May. Our last distribution is September 15. The ditches are run constantly from the beginning until August 15th after which the flow gradually decreases, except it is increased three or four days for beets.

Until August 15th it averages 550 to 575 second feet, although it has been as high as 650 for both canals.

If the supply is sufficient users receive their water constantly, and each does his own rotating between different parts of his land.

161 In three years since I have been there, 1910, 1911 and 1913, it has been necessary for the Company to apportion the water or rotate it among the users. 1909 and 1912 were the o years since I have been there that that was not necessary. The Reservoir No. 2 covers 6690 acres. I do not have the contour lines. The dam is 40 feet high across the river, and there are five feet of a free board. The reservoir has not been filled to high water line since I have been there. This year was the highest.

162 This year we had seven feet free board, leaving two feet to high water line and 33 feet of water at the dam. Last year it was three to four feet below high water line. Since 1909 we have stored in the reservoir all the water that came down the Laramie River. During that period water has never been wasted down the river. During that period it has been our practice to divert at the tunnel all the water in the river with the exception of the winter time when we were doing work on the tunnel or diversion dam below or one of the canals. The water went past the diversion dam this year when we had a cloudburst between the reservoir and the tunnel. The water went entirely over the works at the tunnel, taking out about 30 feet of fill next to the head-gates.

163 The water going past when we were repairing came from small springs and streams between the reservoir and tunnel, the added flow from these being about 25 second feet.

164 In case of floods from local rains in the Sybille and vicinity which we have frequently in summer we run our ditches to capacity, not always intentionally. With that exception we never carry more water in our ditches than is used upon the land. We have never had any way of wasting out of the lower end of either of our canals.

165 We have two sand gates, one at the head of Canal No. 2 and another about 1500 feet down the canal. At these sand gates we aim to run from three to four second feet of water. Sometimes these gates become clogged with sand. We then open them up and perhaps twice as much water is run for a day or two until the sand is cut out. Then we almost close the gates. The water through these gates runs into the Sybille.

Such use of sand gates is necessary and usual. With this exception no water is in the Sybille below head-gate No. 2, except in case of heavy rains which are only temporary. The greatest flood flow in the Sybille at headgate of No. 1 is in the latter part of April and the fore part of May, and is over when we start our irrigation.

166 At times this flood is about 2,000 second feet. This is from cloud-burst and would last from two to six hours and

gradually decreases. In some springs the creeks come up to about half that amount and run for about a week. This spring we had no high water in the Sybille to speak of. After the spring flow the average run-off would be 6 or 7 second feet. In the winter the average run-off is 25 or 30 second feet. Reservoir No. 1 has a capacity of about 7,000 acre feet. It is filled by No. 3 canal which is about 12 miles long.

167 It is twelve feet wide on the bottom and designed to carry water three feet in depth. Capacity is 90 to 100 second feet. Banks slope one to one. Grade is 1.8 feet to the mile. Think we have five or six freshets each season on the Sybille. There is no way by which we can take advantage of this water during the few hours it runs. It is generally an injury rather than a benefit to the system. Except Reservoir No. 1 we have no way of storing water from the Sybille.

168 The total acreage irrigated in the Wheatland tract is 33,544 acres, in the Bordeaux tract, 1,004 acres. The Bordeaux tract covers 10,000 acres. The irrigation is by the settlers. 1,300 acres of the Bordeaux tract have been entered. It is a Carey Act project.

169 Lands in the Bordeaux tract were irrigated in 1909. I don't know what was done before that. The Sybille ditch was started after I went there. The main ditch is completed. It is 16 miles long. Laterals and siphons and the diversion at the head-gate are to be built. The main ditch is 18 feet wide on the bottom and designed to carry water four feet deep. Grade 2.6 feet to the mile. Capacity 300 second feet. 30,000 acres in the project. It is a Carey Act project.

170 The total water used by us in 1912 was about 100,000 acre feet of which 3,060 was used by the Bordeaux tract. We had that year about 40,000 acre feet left in Reservoir No. 2 at the close of the season. At the close of 1911 there was no water in the reservoir so that the amount stored in Reservoir No. 2 from the close of irrigation, 1911, to close of irrigation, 1912, was about 140,000 acre feet. This did not include all the water in the river just above the reservoir between these two dates that had not been permitted to flow down the river.

171 This year less water will be used because there is not so much water. Think the amount used in 1911 was not over 40,000 acre feet. Less than 100,000 acre feet was used in 1910. 1912 was an exceptionally wet year. There was a strong flow in all the streams the entire season. The present year is drier than the average. There are cases of farmers using water wastefully but the greater per cent of the farmers on the Wheatland lands use their water very economically. We had a few gaugings of the reservoir last summer and took gaugings three times a week this summer at the bridge six miles above the reservoir.

172 There are no additions to the stream between that bridge and the reservoir. During the winter months the average flow in the river would be about 90 second feet. The water begins to rise along in May. The crest of the high water is from the 10th

to the 20th of June. It reaches the low water stage the forepart of July. The average flow after that for this summer is about 50 second feet.

173 There is always a flow in the river at Uva. The North Laramie and the Dry Laramie are tributaries there. The Sybille enters the Laramie about ten miles above Uva. The Laramie at Uva has some flow from seepage from the Wheatland lands. There is some flow at Uva when all is taken at the Wyoming Development Company's tunnel. There is always some water in the North Laramie. There is a gauging station at McGill maintained by the state, and measurements by R. I. Meeker.

174 They were measurements independent of mine.

175 & 176 Cross-examination by Mr. Fred Farrar:

The average flow of the Sybille after the flood season is from six to seven cubic feet per second. The height of the high water on the Laramie river at the gauging station at the Iron Bridge was about the middle of June. It returned to the lowest stage in July. In 1913 it increased after that time. Of course last year was no criterion to go by. Last year, 1912, there was a constant flow during the whole season.

The bore of the tunnel diverting water from the Laramie River for the Wheatland enterprise, at the present time has an area of 72 feet. The grade from the intake of the tunnel to the outlet is 33 feet. For the entire distance, which is 2,985 feet. The bore was made by hand and machinery. In the fall of 1910 and the spring of 1911 the floor of the tunnel was deepened and an enlargement made. There is no cement or concrete lining in it at any place. The width varies and the height varies. This does not change the 72 feet area. I do not think that the cross-

177 section falls below 72 square feet. The grade of the tunnel is not uniform. Water stands at the lower end just at the outlet, about 34 feet from the lowest tunnel end. A pool of perhaps two feet in depth and 25 or 30 feet in length and the width of the tunnel is left there at that point. The new ditch from the

178 river to the tunnel was made in 1907. The dimensions and grade of the old ditch leading from the river to the tunnel are: the width on high water line is 37 feet; width three feet below high water line 33 feet; width on the bottom 22 feet; depth of water 5 feet; grade 0.57. Some 300 feet from the headgate the fall by actual level is 1.1 feet in this distance. A grade of 10 feet by the mile is shown by taking levels for 800 feet. The wasteway is 1,500 feet long. The present raceway was constructed in 1907. The

179 present raceway is a part of the old raceway. The diversion dam was moved down the stream from the head of the old raceway. At the present headgate in the new raceway the width is 25 feet. From there it converges until it reaches the mouth of the tunnel. At the tunnel it is the size of the tunnel, about nine and one-half feet on the bottom and about 11 feet wide, about 5 feet above the bottom of the tunnel. The high water line I think is

about 14 feet. From the headgate to the tunnel there is a grade of .5 feet. 250 feet below the headgate there is a point that is .5 feet higher than the headgate. Then from there down to the mouth of the tunnel there is a fall of one foot. The fall of .5 feet is from the headgate to the tunnel. The distance from the headgate to the tunnel is 450 feet.

180 The floor of the tunnel was lowered from a point about 135 feet inside the mouth of the tunnel, the lower end. This enlargement at the upper end I think was in 1907. The second enlargement I speak of was made in the fall of 1910 and the spring of 1911. Commencing at a point 135 feet from the upper portal the floor of the tunnel was lowered according to the dimensions I have just testified to. It was attempted to be lowered to the grade line shown on my profile. There may be variation of .2 of a foot above and in some instances a foot below the grade line.

181 There is a reverse grade for the first 200 feet. During the last two years there have been five or 6 freshets occasioned by cloud-bursts on the Sybille and Blue Grass. During those periods our ditches were bringing water from the Laramie river. They were filled from that stream. The water in excess of the remaining carrying capacity of the ditches went down the Sybille and into the Laramie river. Most of the flood water

182 was lost to our system. In 1913 we had high water on the Laramie for a period of about three hours owing to a cloud-burst between the tunnel and the reservoir. It covered only a small drainage area. This flood extended over to a small degree into the headwaters of the Blue Grass and the Sybille which are south of the river. The water was appreciably increased in these two streams at the same time. When this high water occurred in the river it went over our dam. We kept the gates to the reser-

183 voirs shut down at that time for a period of six to seven days. This high water on the Laramie river washed *our* part of our raceways. It took about 35 feet of the rock fill next to the headgate out. The dam we have in there is usually called a rock and crib dam. The water flowed over the dam for a period of probably two or three hours. I could not say the depth, perhaps two feet to two and a half feet across, the wasteway. The dam is about 12½ feet high. It is about 100 feet long on the bottom for that portion traversed by the flow of the river. The wasteway and the dam are the same thing. The wasteway is a rock filled crib, then the fills on either side I suppose would be considered as a dam too, and we ordinarily speak of the wasteway as the dam and the balance of it as the fills. The central portion of the dam as

184 to its length is where we have these rock cribs. The fill on the north end of this rock and crib dam or wasteway is made of dirt. The fill on the south end which connects onto the wasteway is loose rock. From the end of the fill on the north side of the headgate is 300 feet. Then from the headgate into the tunnel is probably 150 feet of filled material. The fill from the headgate to the tunnel for distance of 150 feet is part of the raceway. That

is what we call the raceway. We have a system of head-
185 gates. These headgates which I mention are 450 feet from the tunnel at the upper end of the raceway. To describe the dam I will say that starting at the north end there is about 100 feet of an earth fill. That joins on to the rock crib spillway, which is about 100 feet wide. Joining onto this there are sluice boards or a wasteway which is 14 feet wide. From this point to the headgate, which is about 100 feet, is a rock fill. This joins onto the old raceway at this point. There is nothing between in the way of an outlet from the headgate to the mouth of the tunnel, along the raceway. The dirt fill is about 18 inches above the crest of the spillway. The spillway is about 12½ feet above the bottom of the sluice boards or wasteway and the rock fill from there on is about 3½ feet above the crest of the spillway. The sluiceway is where the sluice boards are in, 14 feet wide. The wasteway is 100 feet. The sluiceway is on the bottom of the channel in the rock crib dam. By wasteway I refer to the top of the rock crib dam itself.

The profile which I have does not show the line of the tunnel prior to 1907. The upper line of the profile is the top or
187 roof. It is a fact that the 4 feet of increased depth was made in the floor of the tunnel immediately inside the upper portal. From the roof to the floor at the upper portal after the work of enlargement was done there would be a difference of 4 feet.

The flow of water in the winter months between the reservoir No. 2 and the tunnel is diverted through the tunnel and used in No. 3 ditch which flows into reservoir No. 1. None of this water is allowed to pass the tunnel, unless we are doing some construc-
189 tion work on the ditches. At the iron bridge just above the reservoir there is a gauge with a chain which is let down from the top of the bridge, which gives the gauge height, and by reading this gauge height and taking actual gaugings with a meter at various times a rating table is formed, and the actual discharge is computed in this manner. The same method was pursued at the gauging station at McGill, between reservoir No. 2 and the tunnel. There is an automatic register there at the iron bridge above the reservoir belonging to the Laramie Water Company. The company that owns Lake Hattie and some other reservoirs and operates near Laramie. Mr. Meeker had charge of the automatic register at the iron bridge. At present there is an automatic register at the McGill station. It also belongs to the Laramie Water Company. That gauge has been there this season, 1913. Mr. Meeker kept the
190 gaugings there last season. We have very few gaugings at that point. I have some gaugings taken there last season, 1912. There were none taken prior to that. On what we call McGill station, they were taken about once a week to ten days, the balance to determine the discharge were taken at what we call Phelps bridge on the Sybille. I also gauged the Sybille at Phelps
191 bridge. I took measurements there last year, 1912. To a certain extent during 1913. I have a gauge bar there. It has to be read. I have no automatic. The gauge was read from one to three times a week. If there is any change in the delivery gauge

at the reservoir the reading would be taken, the reading was taken after the change. I think that was true in each case.

The measurement of the capacity of the ditches was entirely computed by gauging. There have been gauge rods in the ditches.
192 On No. 1 canal there is a gauge rod at the head; also at a point about 12 miles down the canal after about 4 second feet have been diverted from the canal. The gauge at the diversion of No. 1 canal is located on section 30, township 23, range 68. On No. 3 canal there is a gauge at the headgate and also one at the same gate which is about 1,500 feet down the canal. On No. 2 canal the gauge is just below the sand gate. On the sand-gate structure about 1,500 feet below the head of the canal. These rods were placed in there last year, 1913. There were none before that. I do not know of any former gaugings being made on the ditches before I went there. None were made after I went there and before these were installed. Our records are for the years 1912 and 1913.

Neither the board of control, the state engineer, the division engineer or the water superintendent or any other water official have ever compelled us to release water from either No. 2 or No. 1 reservoirs. They have in no way interfered with either the storing or the diversion of water in our system. I have a record of the
194 lands in the Wheatland district including the original tract and the Bordeaux tract that have been actually cultivated and irrigated from year to year. We have a map showing irrigated lands in 1910 and -11.

195 Defendants' exhibit 2, prepared by engineer C. C. Washington, purports to show the lands in the original Wheatland tract, the Bordeaux tract and the Sybille or Cooney Hill tract and in the shaded portions lands actually cultivated and irrigated in the year 1911. I have checked this map with our records as to the irrigated lands. The map is substantially correct. There were errors made both ways and I would say that the errors would practically offset each other, with the exception of the town of Wheatland, which is an irrigated tract. That is, within the corporate limits of the town. That is not a farming district. 1911 is the first year upon which I computed records of the irrigated lands. I could not say whether some of the lands irrigated in the original Wheatland tract are lands which formed a part of the project of the Wyoming Development Company in the first instance. There are lands in that area which were not parts of that system but which are now irrigated.

Defendant's exhibit 2 correctly details these lands irrigated in
196 the Bordeaux tract. Canals Nos. 1 and 2 of this sy-tem do not have any wasteway. Ordinarily any surplus of water in our canals increases the head of water in the canals, and of course increases the delivery through each of the various canals and laterals along the line of the canal. We do not have any wasteway for any of the individual laterals. In the case of laterals it is entirely regulated by diversion boxes, and if there is surplus water in the lateral each user under that lateral gets his proportion of the excess.

There is no definite system of turning the water back to the
197 stream. The water from the canals is measured out to consumers. Measuring weirs are used, although there are some

laterals where measuring weirs have not yet been installed. Perhaps 20 per cent of the smaller laterals. These weirs were installed in 1911 and -12. Prior to that time there was no system of measurement on these laterals. Several farmers draw through the same lateral. The farmers divide the water by division boxes. The company holds them down to a specific amount of water. The water is measured at the head of the lateral only. Sybille creek is used as a wasteway for surplus water at the head of canals Nos. 1 and 2. The crops raised in the Wheatland district in 1911 were not up to standard of yield.

Prior to becoming associated with the Wyoming Development Company as assistant engineer I lived in Cheyenne. I came to Wyoming during the fall of 1908. My work was not confined to Cheyenne and vicinity, it consisted of work on various pro-
199 jects over the state. I was in the state about a year before I became associated with the Wyoming Development Company as assistant engineer.

The farmers under this system do not take all the water they are entitled to all the time during the irrigation season. The height of the ground water is gradually rising. Drainage has not yet become necessary. Seepage has not affected the entire area to any
200 great extent. It is rising right along. There is a part of the tract where there is no water-table visible at all, but on the lower lands in the neighborhood of 7 feet. By the lower lands I mean that the land is rolling, such as around the vicinity of Wheatland and on the outskirts of the colony and further out on what we know as the bench the water plane is higher. At Wheatland the water plane is 456 feet, owing to the fact that there is no surplus water. The lower land that I have mentioned, where the
201 water-table is about 7 feet below the surface, is to the north of Wheatland, probably 4 miles, extending practically over the entire colony east and west from there to the Laramie river. Possibly six hundred acres are included in this district where the water comes within 10 or 12 feet of the surface. The water-table of the tract varies.

Cross-examination by Mr. Delph E. Carpenter:

As soon as irrigation on a tract is completed, the farmers order their water out. It has been done with nearly all of the farmers during the last two years. The average farmer has been drawing water from 80 to 85 per cent of the irrigation season. That would be during the continuous run up to August 15th. The men with the lands in these lower valleys do not demand it that much of the time. Their demands are diminishing from year to year. Demands are not noticeably diminishing on the higher or bench lands. The first orders to shut back water come ordinarily about the latter part of June. The time that it is shut back depends entirely on the help the farmer has; if he has a man he can spare for irrigation it is turned back on in a few days onto the part that has been harvested and it is wet again. At that time, however, the demand for irriga-

tion is not so imperative as to require the immediate return of the water to the land after the hay is off of it.

203 The hay harvest varies in duration. The harvest of the first cutting extends over a period of about three weeks. During this time the water would be shut back about 15 per cent of the time. Whether we diminish our head from the reservoir depends entirely on the length of time that they figure they want the water out. If it is only a small amount that is out it is run into No. 1 reservoir and can be distributed later. When the water is ordered on again by the farmers they irrigate their alfalfa for the second cutting. It is harvested from the latter part of July to the middle of August. Ordinarily if the farmers have not watered their grain at the time of the first cutting the water is then used on the grain or beets or some other crop during the time of the second cutting. After the 15th of August the demand for

204 water is greatly diminished. We close out the last small run about September 15th. With the exception of the third cutting of alfalfa irrigation is laid by. There are a part of the farmers who want water for the third cutting. About one-half of the farmers cut a third cutting of alfalfa. By rotation of water I mean that if the indications are that there will be a shortage of water we run it in what we call sections. The farmers are allowed to use the water as they see fit and the water drains off and flows back into the Chugwater and Sybille and other creeks.

205 I have ordered several farmers there to quit wasting water. There is hardly a day during the irrigation season that this is not done, that is, if you call wasting letting it get away from them. There is a sand creek over near the west edge of the area that has a constant flow since irrigation took place in the Wheatland district. Above the canal No. 1 Sand Creek is very dry, although the west bank of Sand Creek is not. That comes out of the foothills. The water flowing down Sand Creek and into Sybille all the time is not considered seepage water. There is a constant flow of water from the Sybille into the Laramie, that is occasioned

206 by the seepage from the Wheatland tract and also at the mouth of Chugwater occasioned by the same source. There is a general depression through the Wheatland area from near the town and off in a southwesterly direction that carries in the bottom of the depression a seepage ditch where water is flowing at various days. I do not think the water in the channel is occasioned in large measure by waste flow from the farms above and along its course. I think it is natural seepage, but it depends a great deal on the weather when it comes up. The seepage flow has increased to a certain extent since I have been there. That leads me to believe that the general water plane under this area is becoming higher.

207 In 1912 I delivered about 100,000 feet of water to our water consumers on the original and the Bordeaux tracts. In 1912 we obtained practically no benefit at all from the several floods that occurred down the Sybille. The time at which we begin to draw water out of No. 1 reservoir, varies in a period of years.

Reservoir No. 1 is used practically for a distributing reservoir. In case we have an additional supply coming from reservoir No. 2 it is necessary for delivery into the canals to run it into No. 1 reservoir. If we have not sufficient water to make the delivery it is taken into No. 1 reservoir to supply that canal, and the shortage is made up out of No. 1 reservoir for No. 2 canal. It will impound water about 40 feet deep. If we were to draw more of the water in No. 1 reservoir out early in the year we would not be in a better position to conserve the Sybille water during the summer months. We use the small normal flow of the Sybille as it is.

208 During such times the water in Sybille lasts only a few hours and we can carry all the water out No. 2 ditch will then take away. In the case of heavy rains the flood gradually diminishes and sometimes continues in diminishing quantity over two or three days.

We began to draw from the stored water in No. 2 reservoir May 4, 1913. In 1912 we started May 25th. These are the years that I have had charge of the distribution of the water. The demand for water is much less at the beginning of the irrigation period than along about the 10th or middle of June. We carry the greatest amount of water for distribution to farmers during the latter part of June. The demand starts in May and gradually increases up to about the middle of June. We are carrying our maximum head until the latter part of July ordinarily. It gradually diminishes up to the 15th of August. After August 15th we make a couple of runs for beets between that and September 15th. At those

209 times the farmers also irrigate their trees and whatever else they have to irrigate at that period.

Something over 700 acres of sugar beets were raised in the Wheatland district in the year 1913. There have been as high as 2000 acres in one year. The first year they raised sugar beets there, either in 1910 or '11 they raised that acreage. About 400 to 500 acres of beets were raised in 1912.

The floods on the Laramie usually begin from the 10th to the 20th of June. The river was gradually rising in 1911 from the 20th of May and ran up to 20th of June and in 1912 began to rise about the 26th of May and reached its height about the 19th of June. The peak of the flood was about the 12th of June. The method used in taking the observations relative to the flow

210 in the ditches has depended on the amount of water that we had in the canals. Sometimes it is measured by wading about a mile below the head of No. 1 canal. If it is too deep for wading at this point the entire flow is gauged at Phelps bridge and the amount of water going down the Sybille which is going past our headgate on No. 1 canal is also gauged and substracted from the first gauging. We make the gaugings on the Sybille about a half a mile below where No. 1 ditch takes out. I then assume that the difference between the two figures is what is going into ditch No. 1. No. 2 canal is measured at a bridge below the sand gate about 500 feet. At the head of the first lateral, several miles down the canal, we waded. We measured just above the head of the lateral. The

current comes around a curve and is not uniform. It is sufficiently uniform so that we could get a correct grading.

211 The new canal from our Wheatland canal No. 1, which supplies the Bordeaux tract, is Wheatland Industrial Company's canal No. 1. The canal which diverts water from the Blue Grass and carried it over to the Sybille tract is the Wheatland Industrial Company canal No. 2. In those canals a tunnel was constructed through intervening ridges. The tunnel on the industrial canal No. 2 is 900 feet long and is complete. It was completed in 1911 or '12. During 1913 we have run on an average about

212 18 cubic feet of water per second to the Bordeaux tract. No water has as yet been run to the Sybille tract. The capacity of Industrial canal No. 1 is 150 second feet. That of Industrial canal No. 2 is about 300 second feet.

212 Redirect examination by Mr. John D. Clark:

The net distribution of water to the Wheatland lands in 1912 was from 2.6 to 2.7 acre feet per acre. This was determined by the actual deliveries at the heads of the laterals.

Last year the seepage and evaporation on No. 1 canal amounted to about 16%. On No. 2 I have forgotten but it was not so much. I haven't checked the figures for this year.

213 The nearest large irrigation project to the Wheatland project is the Interstate, near Torrington, Wyoming, about 45 miles from Wheatland. That belongs to the United States Reclamation Service. That is a trifle lower than the Wheatland. Soil about the same. In 1912 the distribution there was 2.55 acre feet per acre, in 1911 4 feet per acre.

Recross-examination by Mr. Delph E. Carpenter:

213 The land under the Interstate project is sandy loam. I never went over the Interstate land in detail in Nebraska, but I have in Wyoming. My familiarity with the Interstate project is limited, for at least two or three years. The figures I have given are by those in control of the project. I obtained them from

214 Mr. Andrew Weiss, the supervising engineer. He has not been co-operating with me in this suit. The figures are also put out by the Water Users' Association of the Platte Valley. I would not call the country which the Interstate travels for some 50 miles before water is really applied in large quantities unusually sandy or gravelly.

I should judge that the canal No. 1 of the Wyoming Development Company is from 250 to 300 feet higher than the station at Wheatland. It is 4,738 feet.

Recross-examination by Mr. Fred Farrar:

215 This Interstate canal receives water from the Pathfinder dam. It is a part of that general reclamation project. The laws of the State of Wyoming fixed the maximum amount which

may be decreed to any given area of land. The maximum that may be decreed is one cubic foot per second of time for 70 acres of land. Under the Wyoming law the water is appurtenant to the land on which it is decreed. It must be used without waste, that is the maximum amount allowed. If a less amount will suffice they are only entitled to that amount.

217 RALPH I. MEEKER, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

Reside at Laramie. Am a civil and hydraulic engineer. Have had 13 years' experience,—6 on irrigation engineering, 5 on hydrographic engineering and 2 on mining, with the U. S. Geological Survey, the Reclamation Service, Central Colorado Power Company and with Mr. Doble, Consulting Engineer of Denver. My work embraced stream gauging in Colorado and all the adjoining states for 11 years. Have been employed in hydrographic investigations for the Laramie Water Company on the Laramie river in Wyoming and Colorado continuously since May, 1912.

218 Have established stations on the Laramie River for the measurement of its flow at the Pioneer Dam, at Lookout, and at McGill. Other stations have been established through co-operation with the State Engineer of Wyoming.

The Pioneer dam is about 4 miles below Woods Landing, and at the head of the Laramie River irrigated area in Wyoming and about 13 miles from the Colorado state line. Fox Creek, Woods Creek and Bear Creek flow into the Laramie between the Colorado line and this gauging station. The Pioneer Dam is the diversion point for the Pioneer Canal, and the Lake Hattie Reservoir.

219 The Lake Hattie Reservoir takes its water from Pioneer Canal about 4 miles from the head-gate. That portion of the canal is called the Pioneer Enlargement. The Pioneer Dam is a concrete overflow structure 89 feet long, the crest is about 3 feet above the bed of the stream. The entire flow of the Laramie except as diverted in ditches above passes over the dam which thus constitutes a weir over which the entire flow of the stream is measured. The Lookout gauging is at the steel bridge 33 miles north of Laramie and 1½ miles above the high water line of the Wheatland Reservoir, and about 85 miles from Pioneer Dam. There are no diversion ditches between Lookout and Wheatland Reservoir No. 2. The principal irrigation on the Laramie except through the Wheatland system and the ditches below takes place between these two stations.

220 The third station is at McGill, 1 mile below the dam for Wheatland Reservoir No. 2.

The equipment at Lookout consists of a steel bridge from which all measurements are taken except in low water when sometimes wading measurements are taken, and a chain gauge and a Bristol Automatic Water Stage Register. The McGill station has a steel cable 189 feet long, a vertical staff gauge and a Bristol Automatic Water Stage Register. There is also an Automatic Water Stage Register and a staff gauge at Pioneer Dam. By means of these I

have measured and recorded the flow of the Laramie covering 1912 and to August 22, 1913, the present time, and tabulated the flow. Table introduced Exhibit B.

(Copy of Complainant's Exhibit B.)

Laramie River Run-off.

Run-off, 1912.	Distribution.	Acre-ft
Laramie River at Pioneer Dam near Woods, Wyo.	Pioneer Canal.....	17,703
Run-off Jan. 1 to Dec. 31, 207,000 acre-ft.	Lake Hattie Res.....	69,855
	All other ditches between Pioneer Dam and Two Rivers.....	29,892
NOTE.—Jan., Feb. & March run-off estimated as 8,300 Acre-ft.	Wheatland Res. and Intermediate ditches below Two Rivers.....	89,550
		207,000

Run-off, 1913.	Distribution.	
Laramie at Pioneer Dam near Woods, Wyo.	Pioneer Canal	10,983
Run-off Jan. 1 to Aug. 31, 95,682 Acre-ft.	Lake Hattie Res.....	28,470
	All other ditches between Pioneer Dam and Two Rivers.....	18,167
NOTE.—Run-off for period of Aug. 21 to 31 estimated as 748 acre-feet.	Wheatland Res. & intermediate ditches below Two Rivers.....	38,062
		95,682

Monthly Discharge of Laramie River at Pioneer Dam, Near Woods, Wyoming, in Acre-feet.

	1912.	1913.	Mean.
January	....	2,650	2,650
February	....	2,355	2,355
March	....	3,296	3,296
April	5,534	12,674	9,104
May	40,643	38,307	39,475
June	91,874	26,598	59,236
July	34,863	6,764	20,814
August	7,809	3,038	5,424
September	4,641	....	4,641
October	6,456	....	6,456
November	4,403	....	4,403
December	2,644	....	2,644
Total.....	198,867	95,682	160,498

NOTE.—August 18 to 31, 1913, run-off estimated.

These records secured by the Laramie Water Company.

R. I. MEEKER,
Hydrographer.

Cross-examination by Mr. Fred Farrar:

221 Pioneer station is on the crest of the Pioneer dam. This estimate does not show water which is taken out immediately above the dam. This estimates the total volume at the dam, and includes the water diverted by the Pioneer canal enlargement. Tabulation offered is a summation of the water diverted by the Pioneer canal enlargement and volume of water passing over the Pioneer dam. This is the total record of the gauging stations at Pioneer dam and at Pioneer enlargement. The Bristol register at the Pioneer dam is run for ten day periods. The charts are taken off every ten days. All station charts are for ten day periods. I have ten day records, from which this is compiled, with the exception of the Pioneer enlargement, which is not equipped with a register, but with a chain gauge and the readings are secured twice daily by the ditch tender.

By Mr. Farrar: On behalf of the defendants, and each of them, we object to the introduction of this exhibit "B" on the ground that it is not the original record and is a mere conclusion of the witness; and for the reason that it does not show the readings from which these conclusions were made. We object also to the introduction of this exhibit until the original record has been taken by the witness and first introduced. In order to supplement this objection at this time, I request that the original records be produced for our examination.

222 Direct examination by Mr. N. E. Corthell (cont'd):

My original records are at the office of the Laramie Water Company. 17,703 acre feet of water was distributed to Pioneer Canal and 69,855 acre feet to Lake Hattie Reservoir in 1912 which did not pass over Pioneer Dam. The total flow of the stream in 1912, January 1-December 31, including that which passed over the dam and that which was diverted by Pioneer Enlargement was 207,000 acre feet. The 29,892 acre feet in the table is the amount of water lost in the river between the Pioneer Dam and the Two Rivers gauging station.

223 The 89,550 acre feet in the table is the volume of water at Lookout and does not include the water contributed by the Little Laramie. It includes the amount diverted by ditches between Two Rivers station and the Wyoming Development Company's reservoir. The table for 1913 is made up in the same way as the first table.

The total run-off of the Laramie including tributaries above Pioneer dam in 1912 was 207,000 acre feet. For 1913, up to August 31, was 95,682 feet.

No measurements were made in January, February and March, 1912.

224 The estimated run-off for those three months is based on the winter records secured in 1913. For the other nine months of 1912 the measurements were 198,867 feet. The figures in

the first and second columns of the third table are actual measurements. We kept a record of the total inflow into Wheatland reservoir No. 2 in 1912. From May 27 to December 31, 1912,
225 119,766 acre feet. On May 27th, 1912, there were approximately 29,000 acre feet in that reservoir; on September 16, 22,000 acre feet. That is practically the period during which water was drawn from that reservoir in 1912.

The outflow from that reservoir May 25 to December 31, 1912, was 95,653 acre feet.

On April 29th, 1913, the Reservoir No. 2 had about 76,000 acre feet of water. They began to draw water from it May 3, 1913. The amount in the reservoir August 18, 1913, was 15,000 acre feet.
226 May 1 to Aug. 17, 1913 the inflow was 90,053 acre feet.
Jan. 1 to Aug. 18, 1913, 63,463 acre feet.

Ex. C introduced. A sketch Map of Gauging Stations.
Ex. D introduced. Hydrograph of Flow in the Laramie.

The solid zig-zag line on Ex. D represents the flow of 1912, and the broken line the flow of 1913, and the dotted line the resulting mean by months.
227 The figures on the left denote the monthly flow in 1,000 acre feet.

The records of the witness here tendered to counsel for examination.

The Witness: I desire to correct my testimony by including Johnson Creek and Beaver Creek among the tributaries of the Laramie between the Colorado State line and Pioneer Dam.
228 The flow of 90,053 — in the Laramie between the Wheatland Reservoir and their tunnel, given by me, was the flow from Jan. 1 to Aug. 17, 1913. The flow Jan. 1 to May 2 was seepage from the reservoir and leakage through the gates. The headgates were closed. May 3 to Aug. 17 the total included outflow from the reservoir plus the seepage.

228 Cross-examination by Mr. Delph E. Carpenter:

The seepage and leakage at the gates showed an average flow of two cubic feet per second during January and February; three cubic feet per second in March, and four cubic feet per second in April. The Wyoming Development Company began to draw water from the reservoir May third. They drew water up to the 17th in varying quantities as shown by my measurements. Defendants' exhibit No. 4 is a tabulation of the daily flow during 1912 as shown by my records, including the "remarks." It is checked and signed by me.

By Mr. Farrar: Let the record show that exhibit No. 4 is produced by Ralph I. Meeker, a witness on behalf of plaintiff, on his cross-examination by the defendants.

229 Gaugings were made approximately ten days to two weeks apart at the Lookout station. From these I established a

rating curve for this station. These data were worked up by the shifting channel method, using the Bolster Method, using a standard rating table, and corrections being made between the discharge measurement and this curve for the daily discharges. The shifting channel method of computing the daily discharge was used at this station for the reason that a bed of silt and sand is deposited usually in the winter and scours out during high water stages, giving a changing cross-section. I made several measurements at Two Rivers, Wyoming, in 1912, but did not maintain a station there. The station was maintained by the State of Wyoming and the U. S. Geological Survey. When making trips which would take me across bridges in that vicinity I made discharge measurements to check the work of the state and the U. S. G. S.

230 There was a station maintained by the State of Wyoming and the Geological Survey on the Little Laramie river during the season of 1912, near the Two Rivers station. I made readings and checked that stream and the measurements made by the other parties. I began to take my measurements at the iron bridge immediately above the Wheatland reservoir on May 27, 1912. From May 27, to December 31, 1912, there was an aggregate of 119,766 acre feet flowed into the reservoir. In the meantime a chain gauge was installed and gauge readings were taken morning and evening by several observers, at different times.

231 A weight standard chain gauge of the U. S. Geological Survey consisted of a weight weighing about eight pounds with a chain and pulley and a staff gauge nailed horizontally on the bridge, the observations being taken from station ninety on the measuring section. By the use of this apparaaus my gaugers at Lookout station took their readings during the summer of 1912. I compiled a table. (Plaintiff's exhibit No. 4.) The Two Rivers station is located approximately one-third of a mile above the confluence of the two streams. The flow indicated at Two Rivers would be the flow of the Big Laramie alone and would not include that of the Little Laramie. It would be necessary to add the flow in both

232 streams in order to obtain the total flow of both of Little Laramie and the Big Laramie at the confluence. I did not prepare a table for the Little Laramie river station. I have taken the data of the state engineer's office. That data is published in the biennial report of the State Engineer of Wyoming for 1911-12, pages 92 and 87. On June 15, 1912, the elevation of the water surface in Wheatland reservoir No. 2 was 23.7 above the outlet floor. That was taken from surveys. On that trip I found a two by eight gauge on the outlet pier which had just been installed. An elevation of 23.7 feet above the outlet floor equals 3.70 feet on

233 the staff gauge. The gauge on the outlet pier does not reach to the floor zero of the outlet. It only reaches for 14 feet. It is an arbitrary gauge put on there for high water readings. The difference between the actual depth found by me from surveys and the reading on the rod is 20 feet. The figures on the gauge rod at the reservoir in 1912 read from zero to 14, from the bottom up. The rod was submerged 3.70 feet when I made the survey. It was dis-

placed laterally this spring, and there is a difference of about two-tenths of a foot between the readings of this year and last year. To illustrate, had the rod in 1912 been as in 1913, the reading I have shown when I found the depth stated would have been 3.5 feet. Other than this difference, the same rod is now and has been in place during the year 1913, the rod is displaced laterally, being anchored at the same place, being moved out and up a little vertically. The rod is not vertical today. In order to make these readings correspond you would add two-tenths of a foot to the 1913 reading to give the corresponding reading of 1912 for the same depth. To make my 1912 reading correspond with the gauge as it is in 1913 I would subtract two-tenths of a foot from the readings of 1912. The gauge rod has been raised two-tenths of a foot.

The maximum depth of water in the Wheatland No. 2 reservoir in the year 1913 was May 11th, 27.05 feet. That was the highest reading I secured. My readings were taken ten days apart.

235 The water in Wheatland reservoir No. 2 was 3.35 feet deeper in 1913 than in 1912. At the time of finding this maximum depth in 1913 I ascertained the height of free-board between the then high water line and the top of the fill at the outlet gate to be 6½ feet. The top of dam is 33 feet plus or minus above the flow of the outlet tube. The dead water in 1913 reached to approximately one mile below Lookout station at the iron bridge. May 11, 1913, the maximum depth of water in the cross-section in the Laramie river at the steel bridge above the Wheatland reservoir, was 1.5 feet at station 60. I continued to keep a record of the

236 flow of water at Lookout station after December 31, 1912. I have a table showing the daily flow of the water at this station for 1913. I am keeping up my observations. The table shows the daily flow for 1913 including August 17.

(Plaintiff's exhibit 5.)

By Mr. Farrar: Let the record show that the exhibit 5 was produced by the witness on cross-examination.

I maintained a gauging station at McGill's ranch. The station was established May 27, 1912. I have a table prepared from such observations showing the daily discharges.

(Witness produces Plaintiff's exhibit 6.)

I maintained the McGill station for 1913 and have a table to August 17th.

(Witness produces table plaintiff's exhibit 7.)

I am continuing my measurements at this station.

The Laramie Water Company, co-operating with the U. S. Geological Survey, is maintaining a portion of the expenses of a station near the mouth of the Sybille Creek. The same on the Laramie. Staff gauges are maintained at both stations. In 1912 I

238 visited the stations and made a few discharge measurements. I did make measurements at Sybille in 1913. The U. S. Geological Survey and the State of Wyoming in co-operation pre-

pared a table showing the daily flow of the Laramie river near Wheatland and immediately above the mouth of Sybille Creek. That table is published in the biennial report of the state engineer of Wyoming for 1911-12, page 90. There was no table published showing the daily discharge of Sybille creek at its mouth. I have measurements showing discharges on the dates that I made measurements on the Sybille. I believe I gave them to the U. S. Geological Survey. In 1913 I made measurements on Sybille creek
239 at various points. I made no measurements on Sybille creek above the mouth of Blue Grass. I have not made any
240 measurements on the Laramie river or any tributaries below the mouth of Sybille. In 1912 and 1913 I made measurements below the Wheatland tunnel dam.

During 1913 I established a new gauge rod at Two Rivers station and employed an observer until co-operation was secured with the State of Wyoming, and also made discharge measurements at various times. I obtained co-operation the first of May. The state of Wyoming has also had its hydrographer busy at those stations. Between us we have furnished the information for the joint benefit
241 of our employers. The same is true of the Little Laramie station for the year 1913. I established a new gauge there and employed an observer until the state co-operated. These gauge rods are located for all practical purposes as in 1912; the gauge on the Big Laramie river being about 340 feet below the old measuring section at the bridge and on the Little Laramie river the gauge is about 300 feet above the wagon bridge where the old gauge is located. The juncture of the two rivers is about one-third of a mile down stream from the gauge station on the Big Laramie. About one-half mile from the gauging station on the Little Laramie. The gauge heights are obtained by observers evening and morning. I have turned over to the state engineer the results of my measurements during 1913. The heights are practically in up to date, but not all the discharge measurements.

242 In the table produced in my direct testimony as to run-off from Laramie river for 1912 I give run of water into the Wheatland reservoir at 89,550 acre feet. That should be corrected. That is the deduction of the Big Laramie at Two Rivers. This table deals with the Big Laramie only. It does not take into consideration the Little Laramie. In 1912 stations were maintained by the Laramie Water Company at Hattie Supply canal No. 2 dam and at Hattie Supply canal 24 feet below the headgates, also on the Bellamy canal at Wright's ranch 800 feet below the headgate. The gauge height observations on the Little Laramie were
243 secured in 1912 at the Dougherty bridge one-half a mile below the dam. In 1913 the records at this station have been secured at one dam. Several small ditches divert water from the river above the dam to Lake Hattie Supply canal No. 2 beside the Bellamy canal. The May and Porter ditches are above the dam. Mr. Wright has a small ditch or two used to irrigate meadow land on the river, with the exception of the Porter ditch which takes water which does not return. The Porter ditch is used for meadows

on a foreign drainage channel. They are taken through the divide, and there are no waters from that ditch after they are used for irrigation. They go to Lake Hattie. Not all ditches drain back into creek above dam. Farr ditch would have a small drainage back above the dam, but the major portion of the water would return below the dam. Also the Dougherty ditch returns some water below the dam. Both return water into the Little Laramie. During
244 1912 a staff gauge was maintained and observations taken morning and evening by James Dougherty at the Dougherty bridge. In the fall a Bristol automatic Water Gauge Register was placed at the dam, a staff gauge being there already. Since that time the records have been secured at the dam. The automatic at the dam registers the water passing over the crest of the dam and from leakage through the dam. During the winter months when ice conditions were bad the records were more or less unsatisfactory and the table of discharges was largely based on discharge measurements. The observations so taken would establish with reasonable approximation the flow of the stream during the ice conditions. At the station in Lake Hattie Supply canal No. 2, about 400 feet below the head of the ditch, a chain gauge was maintained. Observations were taken morning and evening. The automatic register at the Fillmore station ran all winter, but I gave very little weight
245 to the charts. I began to rely upon the measurements shown by the automatic a few days before April 1st. The records of 1912 in the Bellamy canal were based on my visits to that station and for a short time gauge readings by one of the workmen at No. 2 dam. In 1913 a staff gauge was installed at the Wright ranch and continuous observations secured since then morning and evening. During the winters of 1912 and 1913 I saw one to three second feet at times leaking through the gates of Bellamy canal. I am the custodian of the records obtained at these three stations during the year 1912 and thus far during 1913.

246 Cross-examination by Mr. Fred Farrar:

By the word "discharge" marked on defendants' exhibit No. 4, and No. 6, I mean discharge in second feet. The chart shows the daily mean discharge in cubic feet per second. The daily mean discharge was obtained from readings, one in the morning and one in the evening. I do not recall any readings introduced where there has been but one reading. Where one reading a day was
247 taken, the record shows the flow the instant in which it was read.

Further cross-examination by Mr. Delph E. Carpenter:

There are no records in 1913 for Hattie Supply Canal No. 2 in the Laramie river, no water being carried this year. The data on Sybille creek and the rating stations there will be given you. I will permit the engineer for the defendants to examine the charts from our automatic and such other matters as they desire. As to

plaintiff's exhibit B, there are two tables under the general
248 head of Laramie river run-off, and these tables assume a given run-off for 1912 and '13. In the upper or 1912 table the figures 89,550 acre feet designate water passing at the Two Rivers station down the Big Laramie and stored in the Wheatland reservoir in 1912, and does not include the discharge from the Little Laramie. The same is true as to the 1913 table and the figures 38,062 acre feet. The water from the Little Laramie river, which may have passed into the Wheatland reservoir in 1912 is not included within this sum of 89,550 acre feet. The same thing is true in 1913, 38,062 feet. Those two figures show the flow from the Big Laramie river. The acre feet indicated as going into
249 the Wheatland reservoir in the years 1912 and '13 on those tables is not the total amount that actually flowed down the river to that reservoir. I was only dealing with the amount of water passing through the Big Laramie river at the Pioneer dam.

In the memorandum map handed to counsel, there appears a rating station maintained by the Laramie Water Company on Douglas creek. That station was there in 1912 but not in 1913. Douglas creek is a tributary of the North Platte River. The station was maintained because the Laramie Water Company has under construction a supply canal for their irrigation system from Douglas creek, known as the Bell Supply Canal No. 2.

250 This ditch, in process of construction, under permit issued by the State Engineer of Wyoming, was commenced in 1912. That canal is for diverting the waters of Douglas creek, a tributary of the North Platte river from its watershed over into the watershed of the Little Laramie River, which is a tributary of the Big Laramie River. It is an inter-watershed diversion by an open canal very similar in its relation to the two streams to the Sky Line ditch of the Water Supply and Storage Company, which diverts water from the Laramie river into the water shed of the Cache la Poudre. I have memoranda showing results of my ratings at that station in 1912. I have table requested showing summary of elevations of water surface at various times in Wheatland
251 reservoir No. 2 during 1912 and '13, insofar as my observations went.

(Defendants' exhibit 8.)

The various volumes in acre feet noted in the third column of figures and just before the column entitled "Remarks" were derived from a capacity curve of the Wheatland reservoir, prepared from the contour map filed in the state engineer's office of Wyoming.

On my memorandum map, there is indicated a station maintained by the Laramie Water Company at Lake Hattie reservoir outlet which has a gauge rod showing the elevation of the water surface of the reservoir. In 1912 there was no water drawn from the reservoir.

July 13, 1913, the first water was run from Lake Hattie reservoir down the outlet canal. With the exception of closing down for a day or two, the water has been running continuously since. Gauge

rods have been established in the north and south canals
252 below where the outlet from Lake Hattie reservoir divides into two parts and discharge measurements have been made by means of gauge readings. A gauging station is at the outlet of the reservoir this year. Since July 13, water has been running more continuously from the outlet canal than down the north canal. There have been several small breaks and repairs necessary to the north canal that have necessitated the cutting of the water therefrom at various times for a day or two. The water run to the north canal has been largely used by irrigators. I have crossed the canal on the road to Two Rivers, but not since there was water in it, and the lowest gauges I have made on it were on the Ridge road bridge, approximately two miles west of Laramie. I have the records
253 of Lake Hattie reservoir at the gauge rod station for 1912 and 1913. It shows the depth of water in the reservoir at the various times noted above the outlet. The outlet baffle on the lower side of the dam is taken as the zero point, the lowest point at which water can be withdrawn from the reservoir. The baffle wall extends directly across upper end of the canal and is some little higher than the bottom of the outlet tube. Its purpose is to kill the velocity of the outflow from the reservoir. I believe it is about three and one-half feet above the bottom of the outlet tube. My table showing amount of water in Lake Hattie reservoir during 1912 and '13 showed the depth in feet above the baffle wall.
254 The records have been obtained by me or under my directions. The records which will be furnished will be complete. I have also maintained stations on the Laramie river at Woods Landing, near the mouth of Fox creek, a tributary of the Laramie river, immediately below Woods Landing, and at the Pioneer dam, at the head of the Pioneer ditch, including a station in the Pioneer canal itself. The station indicated by my plat as being maintained by me below the one maintained at the head of the Pioneer canal is the old Pioneer canal at Weir No. 1. It is approximately 1000 feet below the bifurcation structure in Lake Hattie supply canal No. 1. Lake Hattie Reservoir is supplied from the Big Laramie
255 through the Pioneer canal enlargement and Lake Hattie Supply canal No. 1, and from Little Laramie river by Lake Hattie supply canal No. 2. The reservoir is between the two streams. Hattie Supply canal No. 1 leaves the old Pioneer canal, as enlarged, at the bifurcation structure. The old Pioneer canal was enlarged from the headgate to Sodergreen Lake. At that point bifurcation works were constructed and installed. This also serves as outlet works for the Sodergreen Lake, a small reservoir on the Pioneer canal. From the bifurcation gate the Pioneer canal runs northeasterly and the Lake Hattie Supply canal No. 1 goes northwesterly. It is about six miles from the bifurcation structure to Lake Hattie reservoir. The old Pioneer canal was not enlarged below the
256 bifurcation structure. I have a station on the old Pioneer canal below the bifurcation structure. It was maintained for 1912 and '13. It indicates the volume of water used by the Pioneer canal, with one exception, being above all laterals. There

is the Bloom lateral which takes out of the old Pioneer canal prism above the Sodergreen Lake. I have complete tables which show the water which flowed in the Pioneer canal during 1912. Similar records for 1913 are only partially completed.

257 Water is run in October.

The gauging station on Fox creek is located at the county road bridge to Woods Landing. I did not install the gauge at that station, using the one that was there in 1912. During 1912 I made discharge measurements and employed an observer to read that gauge during the month of June. The record was discontinued on July 2 for the reason that the flow had fallen to two second feet at that time. No gauge readings were secured in 1913 other than those made by myself and in that vicinity. The gauge rod at the Fox creek bridge was installed by Professor L. G. Carpenter. Graduations were made with brass headed tacks. I have the memoranda showing the discharge of Fox creek as obtained by me at that point during 1912 for June. Subsequently I only had miscellaneous readings on the gauge. The two Berg ditches, one of which

258 takes out a few hundred feet above, and the other some distance above the mouth of the Fox creek cañon, divert water on Fox creek. They are small private ditches. The lower Berg ditch can draw water from either the Laramie river or Fox creek. The record which I obtained at the Fox creek station shows water flowing there which would be that in excess of the diversion by the Berg ditches.

May 29, 1912, a staff gauge had already been established at the Pioneer dam, the zero point being at the crest of the Pioneer dam. Gauge readings were then being secured by Angus Matheson,

259 ditch tender for the Pioneer canal enlargement. Later in 1912 a Bristol Automatic Water Gauge Register was installed at this station. I began getting the data at this time. During 1912 an observer was also employed, Asa Brooks, during June and July, to read the old U. S. G. S. gauge at Woods Landing bridge as an auxiliary station. During 1912 it was necessary to make discharge measurements at high water stages from the Woods Landing ditch because the entire flow of the river was confined at that station. Further on in the year when the water receded measurements were made. The gauge reading was continued daily at the Pioneer headgate by Mr. Matheson up to the time I established the automatic gauge at that point. During the high water stage of 1912 the river overflowed the meadows on both sides below Wood's Landing and above the Pioneer dam and it was not possible to secure discharge measurements between those points or immediately below the Pioneer dam. At the time I commenced hydrographic work there was no gauge in the Pioneer enlargement. A gauge was established at that point by myself 1.7 miles below the headgate. Shortly after June

260 1, 1912, May 29, a temporary gauge was installed in the Pioneer canal, approximately 1800 feet below the headgate. The gauge at the Johnson bridge is a chain gauge. Daily readings were kept by Angus Matheson on these Pioneer gauges. They have been continued, W. H. McComber reading the gauge in 1913. Dur-

ing 1913 the gauge height observations have been secured by the Bristol Automatic water stage register at the Pioneer dam. During my observations in 1912 I ascertained the daily discharge of the Laramie river at the Pioneer dam. I have a table showing such discharge.

(Defendants' Exhibit No. 9.)

This is a copy of the table showing the daily discharge of the Laramie river at the Pioneer dam, including the water passing over the dam and that going into the canal for 1912. During my observations at Woods Landing I compiled a record showing the daily discharge of the river at that point. I hand you a copy of the table, being Exhibit No. 10.

This shows measurements for June and July at Woods Landing, Wyoming. It is complete for 1912. I compiled a table showing the daily mean discharges of the Pioneer canal for 1912, during the observations at Johnson's bridge. The total daily mean discharge of the Laramie river for 1912 at the Pioneer dam was derived by adding the flow passing over the dam and the amount of water diverted by the Pioneer canal enlargement The volume of water passing over the dam during June and July was derived from discharge measurements made during high stages at Woods Landing bridge, with gauge height readings at the Pioneer dam and Woods Landing bridge, both before and after the discharge measurements. Deductions were made for diversions by ditches between the two points and additions for inflow between the two points. In some
262 cases discharge measurements were made of the flow in each of the ditches diverting water between the bridge and the Pioneer canal. In other cases the elevations of the water surfaces in the ditches was determined from a reference point and later when sufficient measurements had been made to construct the discharge curve the volume of water was determined. With reference to two or three of the smaller ditches no specific discharge measurements were made, their volume being estimated from cross-section area and velocities. During latter half of July and succeeding months the discharge over the Pioneer dam was determined by measurement by wading immediately below the dam. During June and July I took into consideration the inflow from Fox creek. The amount shown on exhibit 9 as the mean water flow at the Pioneer dam for both the canal and that passing down the river during each day during those two months, would be the amount at Woods Landing for that day increased by the amount flowing in from Fox creek for that day and from the sum of these two a deduction of the amount of diversions between the Woods Landing Bridge and the Pioneer
263 dam. The mean daily discharge of the Laramie River at the Pioneer dam for 1912 are based on morning and evening readings at the Pioneer dam and in the Pioneer canal enlargement and at Woods Landing station on the Laramie river for 1913 also. The mean discharge would be the average ascertained by adding the two readings of the day and dividing by two. The readings were taken about 7 and 6 to 7 P. M. In the event the gauge

reader is absent he marks absent on the record. No reading being inserted. I think there were no "absence" on the 1912 record. We do not very often expect a certain percentage of notations of "absent" by the gauge readers. Gauge readers are instructed that if they are unable to secure the reading at a regular time to enter in the record the hour at which they did secure it.

264 Gauge heights were not kept, measurements being made only on days when measurements were made at Woods Landing bridge on the Laramie river. In arriving at the amount of flow at the dam I did not estimate those ditches as constant as of the last date of measurement until the next subsequent measurement was taken. Those factors did not enter into the problem. I did not make measurements at Woods Landing or on those ditches daily. I would say that the discharge curve at the river rating station is based on the measurements made at various times, and it was not essential in determining the flow from the Pioneer dam, that daily records be kept of the volumes of water diverted by ditches between the Pioneer Dam and the Woods Landing gauging station, for the reason that the daily mean discharges at the Pioneer dam are based on gauge readings at that point.

It is a fact that the flow rises and falls with a diurnal fluctuation.

I used a small Price current meter in ascertaining the amount of flow at the rating station during June and July 1912 at Woods Landing. With one or two exceptions, I used the vertical intergration method. I have found that method the most satis-

266 factory for all conditions. Speaking of the exceptions, I have in mind when I did not use that method at Woods Landing station, I recall one measurement at high water when the velocity was so great that it was impractical to control the meter below the surface and it was necessary to take surface velocities and apply a coefficient. That occurred on June 5th, 1912. I took the velocity of the current of the water at the surface of the stream clear across and then used the coefficient of ninety per cent to ascertain the current velocity. The meter was held approximately one foot below the surface during high stages. That point is considered virtually the point of maximum capacity of the stream at the point of taking the measurement. At perhaps two or three stations during other measurements velocities were so great that only surface velocities could be secured and in which coefficients were used. I refer to stations in the cross-section at the measuring point at Wood's Landing. The Price meter is an electric meter. It records revolu-

267 tions. It is difficult to keep count of the revolutions of such a meter when the velocity is in excess of 8 feet per second. On June 5, 1912, the average velocity was 6.16 feet per second. There were some velocities considerably in excess of that. In these electric meters the revolutions are indicated through the ear piece. There is a sort of a small telephone that communicates to the ear each revolution of the wheel of the meter. Record is made by counting and referring to a stop watch. The observer holds a stop watch as the meter turns and counts the number of revolutions indicated and keeps track of the number of such revolutions during

the interval of time involved. The little telephone is not entirely satisfactory when the velocities are very high. The velocities are noted by a little "click," made by the making and breaking
268 of an electric current. At high velocities the making and breaking becomes less precise than at low. The distinctness is also to a degree regulated by the strength and condition of the dry batteries that furnish the current. At extreme high velocities these factors enter into the making of a rating and afford difficulty. At low velocity, the interval between the clicks in the little telephone are much longer and much easier to record. The ability of the observer to concentrate his mind in keeping count enters into the ability to get an accurate record. The meter is not absolutely mechanical or automatic, but it involves the ability of the mind to receive the message as indicated by the telephone and to keep track of that message.

I used this surface method in two or three instances other than the ratings taken at Wood's Landing when I have been making observations in that vicinity. The only other station where I may have used the surface velocity measurement was on Little Laramie river at Dougherty bridge. The measurements there were accompanied by the same high velocity conditions. Outside of these places I have generally used the integration method. I used the two point method at Lookout and McGill stations for checking against the vertical integration method.

Cross-examination by Mr. Fred Farrar:

I testified as to the flow at Wood's Landing on one occasion by taking a surface measurement and in this I used a coefficient of ninety. I did not arbitrarily adopt that coefficient. That
270 was based on taking the vertical integration method at several points near the stream bank and determining what percentage the velocity so derived was of the surface velocity. I was not able to use my meter in the vertical integration method entirely across the stream at that time. At the point of rapid flow in the stream I could only take a surface measurement. By comparing the measurement, that is, the vertical integration method, which I took near the edge, the coefficient I adopted was taken as the proper one. There might be a variance of the true velocity at the point of cross-section flow of the stream, the one where I was not able to measure except upon the surface, and where the greatest velocity was at the surface. The coefficient of ninety would not give the correct result. Assuming these conditions, the result of my measurements would be less than the total amount of water in the stream.

271 The surface velocity in a stream is greatest immediately below the surface, within a foot, and a coefficient may be 92, or it may be 87 or 86, in some cases as low as 84. In some cases the coefficient might be in excess of 90, but never reaching a hundred. My coefficient of 90 was the best application of hydraulic methods to those conditions. All the high water measurements where conditions are not the very best are at times approximate, it depends upon conditions, they are looked upon as having a certain

amount of latitude. I most decidedly consider that the results of my method where I used the surface measurement and the coefficient of 90 are as accurate as where I am able to measure the velocity of stream from the surface to the bottom with my meter. I meant to say that high water measurements are not as accurate as low water measurements. A variation of ten to twelve per cent could
272 be expected at Wood's Landing on the Laramie river at extreme high water there. The total volume of water, as shown by my surface measurement with the coefficient of 90, might be as great as six per cent less than the volume of water which I might have determined had I been able to use the other method of measuring.

Cross-examination by Mr. Delph E. Carpenter:

The charts taken from the automatic register show the diurnal fluctuations of the river during 1913. I have prepared a table for 1913 including August 20th for the Laramie river station at Pioneer dam, showing the flow over the dam below the Pioneer canal in which table I have estimated the flow for temporary purposes from August 20th and including August 31st. Exhibit No. 11 is a copy. I have also prepared a table showing the amount of water passing down the stream from the Pioneer dam during 1913 between January 1 and August 17 inclusive. In that table I have made an estimate of the probable flow from August 17 to September 1. I hand you herewith a copy of that table.

(Table is marked Exhibit 12.) In the last column the figures under the heading "Aug." and after the figures "18" on the left hand margin there, appearing in parentheses. They are designated by a capital E and the line of parentheses. I have also prepared a table showing the discharges for the Pioneer canal at Johnston bridge during 1913. That table is complete to August 22. I hand you herewith a copy, Exhibit 13.
274 Exhibit 12 is a copy of that table.

Referring to plaintiff's exhibit B I estimated the runoff for January, February and March as 8300 acre feet for 1912 from the winter records for 1913 for the same period. It appears in the notes on exhibit B. I did not give any consideration to the records of previous years obtained by the United States Geological Survey at the Wood's Landing Station, to ascertain how their records compared with my 1913 runoff records for the same period, for the reason that they are unreliable. They are unreliable because of distortion by ice. I took them for the year 1913 only, because these records are based on keeping the ice from the dam, so we have most excellent records for the winter runoff and also because the winter of 1912 was an extremely cold one, and the run off for that period would probably fall in those figures, both winters being cold. Referring to exhibit B, the lower table, entitled "Monthly discharge of the Laramie River at Pioneer dam near Wood's Landing, Wyoming, in acre feet," I would state that those figures represent the volume of water passing over the dam to users below. It also in-

cludes the water diverted by the Pioneer canal. The word "mean" with its column of figures beneath it simply indicates the mean flow for 1912 and '13 or the portions thereof indicated as ascer-
275 tained by my figures. That does not purport to give the mean flow for a considerable number of years, but only for these two years. This table was prepared to cover records that I have secured and does not include other records. The records noted are on table appearing at page 94 of the biennial report of the State Engineer of Wyoming for the years of 1911-12, entitled "Daily discharge in second feet of Little Laramie river near Fillmore for 1912," was not obtained at the same rating station that I used in obtaining my records. That station is located approximately two miles and a half above the station at Lake Hattie Supply No. 2 dam, and referring to page 93 of this same report there is a notation of the 1911 records at the bridge at May's ranch, above all large diversions. There are diversions occurring between the bridge at May's ranch and the bridge at Dougherty's ranch. The Bellamy canal is the chief one, Farr or Dry Creek ditch is also of considerable importance and there are several minor ditches.

Cross-examination by Mr. Fred Farrar:

There are some diversions occurring on the Little Laramie above the station obtained by the state engineer at May's ranch, but I am not familiar with them.

At Wheatland reservoir No. 2, after the- commenced drawing from the water stored in the reservoir, there is both inflow and outflow of water simultaneously. My tables, as shown in exhibit 8, whic are produced this morning, giving the volume of acre feet do not indicate the total number of acre feet stored in the reservoir
276 during any one season, but merely the depth of the reservoir on the days indicated. These do not represent the total storage for the season. For illustration, under the date of May 11, 1913, my table shows the volume in acre feet of 78,000; at that time water was being withdrawn from the reservoir and was also coming into the reservoir from the river. The same would be true of any other date at which water might be withdrawn from the storage in the reservoir, and on some of these dates during the winter there was no positive inflow, the headgate was closed. There might be a small amount of seepage.

Redirect examination by Mr. John D. Clark:

I kept no gauging station on Fox Creek in 1913. It was omitted because of the small inflow.

Recross-examination by Mr. Delph E. Carpenter:

Yes, sir, there was a very small amount of inflow that year.

277 JOSEPH A. WINKLER, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

I am a ranchman, living on Sec. 20, T. 12, R. 74, right on the Colorado line: in Albany County since 1886 and with some interruptions since 1880. Ranching all that time.

I know the Riverside Ranch in Albany County, Wyoming, including the King Ranch, the Caldwell and Gardiner Ranch, as well as the Riverside. I know the ditches irrigating that property. Was one of the original incorporators of the Riverside Live Stock Company in 1886, and its Secretary from 1886 until 1907.

278 The Riverside Ranch was my home. It was sold in 1907.

I know Riverside Ditches No. 1 and No 2, also King Ditch, also the Caldwell and Gardiner Ditch, sometimes called the Caldwell Ditch. They irrigate that property.

Riverside No. 1 and the King Ditch were there in 1880. Riverside No. 2 was made in 1884 by enlarging Grann Ditch which was made in 1882 or 1883.

The Caldwell and Gardiner Ditch was constructed prior to 1886, and was there when I went there.

279 The King Ranch was separate until 1903-4, and the Caldwell and Gardiner until the early '90's. The land irrigated from these four ditches was about 13,500 acres. Irrigated principally for hay, also for pasture. We handled about 500 horses, 3,500 to 4,000 cattle and from 3,500 to 6,000 sheep. The business was begun by Balch and Bacon in 1878, and was gradually enlarged until it contained 34,000 acres.

280 These four ditches take their water supply from the Big Laramie, and irrigate lands back to the bluffs on both sides, largely covering a tract 12 to 14 miles long and averaging from two to four miles wide.

We began to irrigate about the first week in May, as soon as the ice went out and continued until the water would freeze. Sometimes it would be the first week in October and sometimes the first week in November.

281 The result of the application of the water was a large increase in the production of both hay and pasture. It was not originally meadow land. The greater part was second bench lands. There is bottom land then next above that first bench and next above that second bench. Besides cutting hay we irrigated for pasture. We pastured our cattle on the meadow land in winter and fed them hay there. Put in our beef cattle shortly after haying about September 15 to October 1, and the stock cattle later, in October. Kept them there until the grass came in the spring, May 1 to May 20, according to the spring.

282 The cattle were off of the meadow from May until the middle of September. There was a similarity as to methods of handling meadows all along the river. I ranched 4 years in Idaho and other places in Wyoming. Have been over the Riverside Ranch since 1907. Was over it last Sunday. I don't think they are getting as much water as they did two or three years ago,—

don't have the results, don't have the hay there they usually have.

283 Water has been spread very nearly over all the land we used to irrigate. I don't think they had water this year in North Lateral No. 2.

The ditches don't seem cleaned out as well as when we were there. King Ditch has been enlarged to twice, maybe three times, its original size and extended down to Sand Creek to use Hutton's Lake as a big reservoir. No water has run into Hutton's Lake yet through this canal. They began this work in 1911.

284 Completed it last year, except a flume. They may have begun in 1910. I have been acquainted with Pioneer Canal since 1880 and knew of irrigation through that canal by the Riverside Company from 1886 to 1892 or 1893.

The land irrigated lies between the Big and Little Laramie Rivers and North of the old Riverside north boundary. David McCollough and Charles Osterman are some of the settlers on that land. It was unfenced. We irrigated it for sheep. We

285 irrigated about 15 sections of it. We irrigated entirely for pasture. Leased the railroad land from Wyoming Central Land & Improvement Company. Settlers came in and took up the government sections and commenced to buy land from this Company.

Cross-examination by Mr. Fred Farrar:

285 Have been acquainted with Riverside ranch since 1880. Company was incorporated in 1886 since which I lived there. My headquarters for winter of 1880-81 was Laramie and from 1881 until 1886 Cheyenne. When I first knew Riverside ranch it comprised probably three sections, irrigated from Riverside No. 1 and the King ditch. These were sections 30, tp. 14, R. 75, we rented a portion of section 36, twp. 14 S. R. 76 W. I am speaking about 1880 now. The other lands used I don't think they owned then. Section 1 was irrigated, probably 7/8 of it.

286 From Riverside No. 1 ditch they irrigated sections 30 and 1 and they went through part of sections 36 and 35. Section 1, township 13, range 76, I think. They own that section now but they did not in 1880. They bought a large tract of railroad land in 1884. I do not believe they leased it in 1880. But they irrigated it and used it for pasture. I will try to indicate the lands added to this ranch from time to time. I can give you the number of bottom sections. I could, with a map, tell you just what sections they bought, but on the bottom they bought the east half of section 3, township 13, range 76. There was something over 34,000 acres of deeded land. The company sold out in 1907. I will give the bottom lands, starting with those in township 13, range 76. The east half of section 3, tp. 13 R. 76, 160 acres; and all section

287 1. That would indicate that all of the bottom lands that would be in township 13, range 76. None of these lands were owned by the Riverside in 1880. They were acquired at different times between 1884 and 1904. These particular lands I

have mentioned were in the first contract I have mentioned that we took in 1884. These lands were irrigated from the King ditch. The east one-half of section 3 is owned by the company, but the south one-half of the east one-half is hilly rocky country that cannot be irrigated. Only about 25 acres in the east half of section 3 can be irrigated. That was irrigated first from the King ditch in 1880. It is still irrigated. Between the ditch and the river it is good hay land. When I was living there and after, this was acquired, hay was cut from it. Section 2 between the King ditch and the river was irrigated. Some of the north side was irrigated from Riverside No. 1 and everything north of the river is irrigated from Riverside No. 1 and No. 2. Originally about 25 acres irrigated. They are using that land between the ditch and the river for pasture now, but I think they cut hay there two years ago. I could see where they raised a crop of stuff that they cut there two years. I think it was oats and some hay. Section 1, same township and range, practically all irrigated that could be. The extension of the original King ditch went through the north half of the section. They afterwards dug a branch that went out to section 6. It went through section 6 in the north half and into section 5, and at the present time it is extended further than that, and goes through section 4 and to Sand Creek. In 1886 I filed on the north half of section 6 and bought an interest in this ditch and took out a ditch to prove up with.

289 Probably seven-eighths of section 1 was irrigated when I left the Riverside. These three sections comprise all the bottom land on the ranch in township 13, range 36. This bottom land on section 1 was irrigated. Along the south edge there was some alkali and greasewood and we had a ditch through it and some grass growing.

Tp. 13, R. 75 W. sec. 6. I own the north half. I proved up on that and sold it to the Riverside. In 1889 I filed on it in 1888. It was irrigated in 1886 from a lateral out of King ditch. I bought a quarter interest. In 1886 and 1889 we irrigated practically all of the north half. That is bottom land. Section 5 was a part of the King ranch and when it was bought by the Riverside then they acquired the title to that, I think, in 1904. It is irrigated from the King ditch. I have known it since 1880. That was first

290 irrigated, to any large extent, by seepage from my ditch that ran down there from the King ditch from 1886 to 1889. The water seeps there and irrigates quite a bit of the north half of it. A little more than the north half is bottom land. Section 4 was filed on about 1904. That section has never been acquired by the Riverside Ranch Company, but has by the present owner. They proved up on it and raised crops on it. They had an extension of the King ditch about 1904. At the time they bought the King ditch the ditch was extended down to it. The Riverside includes no other land in that township and range. That is all the bottom land they own. They owned a lot of range land that went south and west.

Township 14, R. 75, they owned all of sections 31, 32, 33 and 28,

the south half of 21, all of 29, 39 and 19. That is all in township
14, range 75. In 1880 the original ranch buildings were
291 on the southeast one-fourth of sec. 36, Tp. 14 N., R. 75 W.
They leased that section and some time in the early '90's they bought forty acres from the schoolboard that the buildings were on and leased the balance of the section. Sec. 30, Tp. 14 N. R. 75 W. was part of the original tract. It is on the north side of the river. In 1880 that was about all they owned. In 1884 they bought this railroad land, from the Wyoming Central Land and Improvement Company. They got it from the U. P. road. I am not able to state the acres under irrigation in 1880, there are about 14,000. There were more than 9,108 acres irrigated in 1910. The Riverside proposition takes in these ranches, the Caldwell and Gardiner and section 29, the Le Roy section and the King ranch.
292 No increase of land under irrigation since 1910. Most of the bottom land is a good sandy loam and has a slight gravelly wash and when water is put on it a good sod grows and the gravel disappears. These sections referred to are all principally bottom, devoted principally to hay and pasture. The bottom land was the land at about the same altitude as the river, close to the river. Then at a short distance from the river comes a slight bench and this big flat that we used to call the upper and lower flat, that is on top of this bench. That is the bench upon which they cut hay. Since this new company has taken it I think they have put some new crops in in the way of oats, alfalfa, peas, etc., perhaps a large part of the section. That sort of business has been initiated within the past few years. In the early days we irrigated the pasture. That
was part of the bottom land, section 1. We did not cut
293 hay there because we had to have a place for our work and saddle horses and bulls. Section 1 would probably have cut 100 tons, or something like that. Some of the other pasture lands—the Culver place,—was a good deal better hay land. Some years we would pasture that and some years we would cut hay there. We cut as much as a section and a half, perhaps, in 1880. That was enlarged as they acquired more land.

After we got the King place and the Le Roy place we would cut about 17 or 18 hundred tons from our irrigated land, about 14,000
acres. D. C. Bacon was president and manager of the River-
294 side Livestock Company and I was secretary. A. C. Jones was the treasurer. Its headquarters were Laramie, Wyoming.

When we began irrigation we took the first two ditches that were taken out, the King ditch and the Riverside No. 1, and we gradually extended our irrigation by laterals and other ditches like Riverside No. 2, until we could practically cover all the land irrigable. There were some sloughs close to the river that used to be irrigated from overflows. The water was distributed from the ditches by use of laterals and headgates and finally even out onto the little plow furrows from the laterals. We used all the water we could. Water was applied very freely. We did not let our ditch loose and allow it to run because we had to change it on account of shortage of water.

We commenced to cut hay the last of July or the first of August
When we began cutting hay we let the water run through
295 the main ditches and closed the laterals. It ran into the river. Even when irrigating the water was coming back into the river. There would be some seepage from the hay land. On the south side of the river we irrigated land at the narrowest place, 10 or 15 acres, and the widest place, a mile. On the north side it goes back more than two miles in places. Both of the sloughs are below this flat that we called the upper and lower flats. It would be right close to the river and usually running along in the same course as the river. The natural drainage was from these ditches towards the river. The soil in the first bench, a light sandy loam, gets heavy after enough water. There is a light gravel on top that after we irrigate sinks out of sight and forms a very heavy soil,
but it is what we call a light sandy loam. At places on the
296 bench there is practically no good soil at all. All the gravel sinks out of sight after you irrigate. We had to plow the good soil for our ditches. We turned up some gravel, but principally good soil. We turned the gravel over, the gravel was on top the good soil. Section 26 had round boulders on it and they all disappeared as soon as we got the water on it and sunk. The boulders seem to sink down into this good soil on the flats. If given plenty of water, these boulders ten inches in diameter would dis-
appear within three years. These boulders are there today
297 as they were originally.

On the bottom lands the soil is a little heavier than the soil on the first bench on account of having been washed in there and it is a little different soil,—it is a heavier, blacker soil. There is a certain proportion of sand with it principally leaf loam and dark soil. We dug a deep ditch, two or three feet deep, in river bottom soil in several places. In cutting through the bottom land there seems to be a good deep loam, varying in depth. Some gravel but not much. I don't believe the gravel predominated in the sub-
soil. I was manager of the ranch for a good many years.
298 Mr. Bacon was general manager and I was working under him as secretary and working with the Live Stock Company. I do not believe I am mistaken as to the number of acres irrigated. I went over every foot of it with this surveyor, Mr. Buck, who made these maps. (Witness refers to maps in his hand.) With all my experience covering a number of years I am unable to state what the sub-soil on this bottom land is.

There were wooden headgates, raised with a wheel in Riverside No. 1 and No. 2, the King Ditch and the Caldwell and Gardiner ditch. They had dams built of rock, brush and soil. That was true of all four of them. The dams would wash out once in a while and we would have trouble with high water. A small proportion of
the bottom land overflowed in *the* eighty-nine and early nine-
299 ties, but so much other water was taken out before the enlargement of the Pioneer and before a good many other ditches were taken out subsequently. The Riverside sold these lands in 1907, I think. They sold to Mr. Ross, Mr. Ross to Mr. Haley

and Mr. Haley to the present owner. The present owner acquired it in 1908. I was on the land a short time ago this season. The last time previous was July, 1912. I bought some sheep there in the spring. I was there several times in 1910 and 1911. I have seen these lands practically every year for the last few years. The last two years I have noticed a deterioration in the method of farming. In July, 1912, I noticed that the ditches were not being cleaned. I also noticed it last Sunday and Saturday. Some of the laterals are being neglected. The quantity of hay cut is very much less than it used to be. All ditches and laterals originally there are still there. I think one Ware, I forget the party's name who was before him, farmed the land the last two years. The Northwestern had another man there. He was farming to show what the land would produce. They sold some land to colonists.

On the ranch are: the home ranch, the iKng ranch, the Le Roy ranch, which is section 29, and some buildings on the Caldwell. Outside of the buildings on the home ranch, they are not what you would call complete sets of buildings, except the home ranch and the King ranch. The King ranch has a house, bunk house and a barn, and the home ranch has a good many buildings. Two different families *are* living on the home place on section 36 in 1913, and some people on the King place, section 32. There is one family on 32 and the Drum family on 31. Four families are now living on the Riverside ranch. The area of this ranch is about 34,000 or 35,000 acres, but in the past two years there has been a great deal of this land that has been sold to speculators. During the time that I was connected with the company the people that lived on the ranch were, the Riverside people, Mr. Bacon and myself in the house and the housekeeper and various men in the bunk house, according to the season, from 10 to 26, and the foreman had his wife and family. That would be the home ranch. That was from 1886 until 1907. The number varied. At one time there were quite a lot of people living in the big house. On the balance of the ranch there would be the family at the King ranch, a man, his wife and four children, and then an old man lived on section 29 before we acquired it. He was a bachelor and had one man, sometimes two or three haying with him. Some people lived on the Caldwell and Gardiner, on section 2, Twp. 13, R. 76, a man named
302 Mulhern. We bought him out. That is all of the families that lived on the entire ranch. No crops are grown upon the Riverside ranch except hay. When I was there as foreman we did raise some oats, some field peas and potatoes. In 1902, the year after Mr. Bacon died, we began raising crops there other than hay. On the King place they had been raising right along, garden stuff and potatoes, but it was raised by Mr. King and not by the Riverside. King would put in three or four acres of field peas. In 1902, on the Riverside, we put in field peas on section 25 and potatoes on section 2, Tp. 13, R. 76. Section 25 was in Tp. 14, R. 76. We cut the field peas for hay. We had about ten acres. We had about three acres of potatoes. I think the first oats, about ten
303 acres, were put in on section 2 in 1902 or '03. That same acreage was continued for three years of oats, field peas and

potatoes. Peas were raised solely for our own use. After that the place had been sold to other parties. In 1907 or 1908 this company broke a desert land claim on Sec. 4, Tp. 13, R. 75. In 1913 there was no crop on the Riverside outside of natural hay. There were oats put in last year by people who bought this ranch. On Sec. 30 these oats are growing today and on Section 31 quite an extensive piece of oats, but I don't think the company put them in. I think on Section 31 there would be about 40 acres of oats and on section 30 about 25 or 30 acres. This ranch at all times has
304 been devoted almost entirely to livestock. It has not been a farm.

I will give the irrigated land in this tract. The highest township on which the ranch commences is Tp. 14, R. 76. In that Sec. 34 is practically all irrigated from Riverside No. 2. Sec. 27, 160 acres, Riverside No. 2. The south four forties. Sec. 26, three-fourths of the section, all lying under the bluff, Riverside No. 2, all of Sec. 35 north of the river, practically all the whole section; Riverside No. 2; a part of the southeast quarter was irrigated from Riverside No. 1. Sec. 24, Tp. 14, R. 76, about 300 acres in the south half; irrigated from Riverside No. 2, everything below the bluffs there. Practically all Sec. 25 from No. 1 and No. 2; No. 1 principally. No. 2 joins No. 1 in Sec. 25. Part of the east half and part of the southeast quarter of Section 25, 14-76 is under No. 1. All of 36 across the river, on the north side of the river about 160 acres. That is irrigated from Riverside No. 1.

305 There is in 36 on the south side about 40 acres. That lies in the southeast quarter of 36 and is irrigated from the Highwater ditch. I have given all the irrigated land in that township. In township 13, range 76, there is about 15 acres in section 3. About 160 acres in section 2, lying between the King ditch and the river. On the north side of the river in section 6 there is about 90 acres irrigated by the Riverside No. 1. Section 1 is practically all irrigated.

306 In Tp. 14, range 75 there is about half of section 19 irrigated from Riverside No. 2. All of section 30, lying north of the river, Riverside No. 2 and No. 1. Riverside No. 1 and No. 2 come together right close to the township line and then there is water from both ditches, but is carried out from a lateral on 19 and then between section 20 and section 29 to the corner of section 29. Practically all of 20 north of the river is irrigated. Practically all section 31 is irrigated. All of 29 that is north of the river up to the line of 20. The ditch follows the line between 20 and 29, about half of the section, 320 acres. That is irrigated from the combined Riverside No. 1 and No. 2. The other half of section 29 south of the river used to be irrigated by natural overflow and highwater ditches. Now it is irrigated from the King ditch. There is a half section there. All section 32 is irrigated from the King ditch and the Caldwell and Gardiner ditches come through that section and irrigate a small part of 32. 32 is practically all irrigated. There is little over half of section 21 that is irrigated from the combined waters of No. 1 and No. 2, which meet in that section

and go into the river. The north and west half of 31 is irrigated. About ¾ of Section 28 is irrigated, and from the Caldwell and Gardiner and the Hogue and Haley ditches. Section 33 is irrigated from the King ditch which empties into a lake in that section. Section 15, about 100 acres, irrigated from the Caldwell and Gardiner ditch. A small part is in the southwest quarter and the balance follows the river, on the south side of the river, about the center of the section, going towards the northeast quarter. Section 22 about one-half of that section is irrigated and from the Caldwell and Gardiner ditch. It would be the northwest part between the ditch and the river. The Hogue and Haley ditch goes through that section and irrigates some land in the southeast quarter. In section 27 there is about 160 acres in the northwest quarter irrigated from a branch of the Caldwell and Gardiner ditch. In section 23 the Hogue and Haley ditch irrigates about 160 acres. In section 14 the northwest quarter lying south of the river is irrigated, 160 acres, and 10 acres across the river, irrigated from overflow from the Fisher's ditch. The land south of the river is irrigated from
the Caldwell and Gardiner ditch. In section 11 there is
308 about 180 acres irrigated, parts of the east four forties and
across the river it is irrigated from the overflow of the river. Altogether probably 100 acres. Section 13 the northwest quarter is irrigated from overflow and seepage from the ditches above the Bush ditch and some overflow from the Caldwell and Gardiner ditch, there is about 50 acres. Section 35, I don't know whether you are interested in it, it is not irrigated from the Big Laramie river. It is irrigated from Sand Creek. We cut hay there. It is along Sand Creek and it would be in the east half. I included it in my estimate of 14,000 acres. Very nearly half of that section was irrigated. We owned section 25 but it was not irrigated, it was used for pasture and was pretty rough. We never put any hay on it or tried to. In Twp. 13, R. 76 N. the north half of section 6, from the King ditch. The north half of section 5, 160 acres irrigated from the King ditch. I don't know that I can tell you the amount of section 4 that was irrigated, because it was taken up and an extension of the King ditch put on it after I left. It was patented
after 1908 and it was irrigated from an extension of the
309 King ditch and they raised crops on it after 1908. It was
a part of my 14,000 acre estimate. They irrigated three fourths of it. That constitutes all of the Riverside ranch so far as I know. I have given you the maximum amount of land irrigated. After the death of Mr. Bacon, Mr. and Mrs. Emmons bought the Bacon stock. There are a few cases on the irrigated lands on the Riverside ranch where it is necessary to let the water stand in order to get water on the high places. But not to a large extent. There
is seepage that forms in these sloughs. There are sloughs
310 that fill up, I think, from seepage. The land which has been
seeped has increased. We have been troubled very little with seepage water, most of it goes back to the river through the sloughs and does not cover an area. Take it as a whole, a large part of the water turned onto the land by the ditches goes back to

the river. There is very little alkali on the ranch with the exception of the southeast side. On these greasewood flats there is some alkali, but we don't irrigate them, and very little of what is included in that irrigated land. There is a little alkali on sections 1 and 6 and a very little on the north half of section 6. There is some in the south forties of 1. The water goes on it and makes some feed. The grass seems to grow some.

Cross-examination by Mr. Delph E. Carpenter:

A crop of oats was out on that portion of Section 4, Twp. 13 N., R. 75 W., which I have mentioned as being under the ditch. As far as I know, I don't know of any hay being cut there outside of these oats and alfalfa that was started there. It was never irri-
311 gated until after 1908 or '09. That did not go to make a part of the original ranch that I managed. It was taken up in 1906 or '07. Mrs. Emmons took up half a section. Mr. Hishey the other half. They took an extension of the ditch to put on it as as soon as they filed on it, but my memory fails me as to what year it was. No hay was cut off the north part of section 5 that I described as being irrigated. It is a rough piece of land, was irrigated for hay, and makes good feed. North half of section 6 would vary. We usually put up three or four good sized stacks, averaging about 20 tons to the stack and some years about three or four. In running this extension of the King ditch to prove up on section 6, we took our laterals and put water on every forty of that north half, so we could irrigate both north and south. We followed the highest ground we could and got water on every forty of that north half of 6. It was practically all irrigated. It was irrigated in 1887, '8 and '9. I took it up in 1886 and proved up in 1889. Be-
312 tween '86 and '89 it was all irrigated. We could not irrigate in one season the whole business, but we did before we got through. I do not know how near to the surface the water plane is on sections 24, 25, '6, and '7 in Tp. 14 N. R. 76 W. I know that it took a great deal of water to irrigate it on the start and after that it took less. Those sections along the bluff I think have been pretty fairly irrigated, but I don't know how deep you would have to go to strike water. When the ditches are running the water is right there, but in the winter I don't know how deep you would have to go, I never tried. All of these lands that I have described as being irrigated, with the exception of that over on Sand Creek, section 5, Tp. 14, R. 75, all the rest of them lie right down in the floor of the valley of the Laramie river. None of them lie on what we
313 call the second bench. All through these lands that I have described as irrigated, there are evidences of old waterways of high water in the river long before men came to the country. What we call the sloughs were right along close to the river itself, what you might call where the river has changed its course, but not out on these flats, you don't see anything of that kind there. The depressions are not to any extent on these flats. They are pretty smooth with regard to slops toward the river and very few depres-

sions of any extent, nothing that will hold water. There might have been a river cut through these flats thousands of years ago, but they are very smooth and flat outside of close to the present channel of the river. Even in our meadow lands, in some of them that I speak of the soil is thinner than in others. The nearer you get to the river the deeper the soil that has been washed in there. It is better soil and a good deal deeper and the further out you go the lighter it becomes and contains more sand and is a little different quality of soil than this close to the river. Back toward the toe of the bluffs the soil is thinner and more gravel and sand in it. Near to the river it is quite flat. Outside of its being out up
314 close to the river by these little sloughs it is level.

On the second bottoms there naturally grows a little short buffalo grass and cactus and in some places before we irrigated there was very little grass even. There were no natural hay meadows. Even where we have irrigated the meadows do not run in one uniform body all down the valley. In a place of this size they vary a great deal. To one standing on a bluff and looking down at them, they would appear spotted. Where the grass is growing in the meadow there is a darker green and a lighter green where the pasture lands lie. In these places where our meadow grass grows the production varies quite materially. Some places you might cut as high as two or more tons to the acre, whereas in some other places you might have to cut over four acres to get one ton. After the first two years of irrigation a growth of blue stem comes and by increasing the water supply that blue stem will change into wire grass and make very good sod and what we consider a good quality of hay.
315 I wouldn't say what production we obtain from any particular spot, but it wouldn't average a ton to the acre on all the land we cut. Year in and year out, it would average 1600 tons and we would cut 3200 to 3500 acres. The rest of it wouldn't pay to cut for hay.

We would pasture on an average of at the outside about 4000 head on this 13,500 acres from October to May. That included the feeding of all our hay. We used to feed steers for beef and then stock cattle. We had the place cut into these different meadows and pastures, practically ten different fields. If the stock cattle needed hay we put them in and feed them and turn them down on the Caldwell. Towards the last we used to sell the calves. We ran these cattle out on the high railroad lands to the south of this ranch in the summer time. We brought them into the ranch and they consumed the pasture and the hay during the winter. The sheep would get some of that hay in storms, the cattle wouldn't get it all; and the mares and colts would get some. Our cattle did not run short of feed just before we turned them out on the range in the spring in some seasons, because we did not put them all in this field. A lot of
316 the young cattle would stay out in the big pasture. The big pasture was then largely Government land, every alternate section. A good part of our stock would run in the big pasture or less all winter and keep in good order.

We had two bunches of sheep. We ran one bunch south and the other north of the ranch before that country was settled up. In good winters some of the young cattle would never be fed, but would run out all winter. They would stay in this big pasture and down in the Caldwell, some in both places. We usually fed all of our hay right on the property, although every spring more or less was left over. We never sold any unless a neighbor might get short and buy a hundred tons or so. If we had any hay left over we would keep it.

317 Cross-examination (cont'd).

Mr. Fred Farrar:

The hay meadows are river bottom lands and what we call the first bench. The first bench is practically river bottom as compared with the general country. That is true of the Laramie river. The upper country produced an entirely different natural vegetation.

317 Redirect examination by Mr. N. E. Corthell:

The second bench in its natural state produces very little, and that is different vegetation from that on the lower lands.

318 There was a yearly increase in productiveness since we started irrigation. At first there was an overflow each spring which would naturally irrigate a good deal of land. From the early '80's up to the early '90's a good many ditches were taken out above us, and from then on we ceased to have the overflow. Our ditches were all low water ditches and we had plenty of water. Occasionally there would be a year when not so much water came down and we would be short of water. I assisted Mr. Buck in making a survey in 1901 or 1902, to ascertain the acreage of irrigated land.

319 My estimate is made from the knowledge gained at that time. The Hogue and Haley Ditch is taken out on Sec. 29, Tp. 14, R. 75. It irrigates part of the Caldwell property and the Hogue Ranch. It was built in 1893 or 1894. The Denver-Laramie Realty Company, purchasers of the Riverside Ranch, have sold a good deal of the land in tracts of from 40 to 160 acres. Sand

320 Creek on the maps is a tributary of the Laramie. I have known it since 1880. It flows into Hutton Lake. Very little of its water finds its way to the River except in high water. Don't think any of it has reached the River in the past ten years.

Recross-examination by Mr. Fred Farrar:

320 The water from Sand Creek would naturally go into Hutton Lake if not diverted. Hutton Lake is now used as a storage reservoir. I suppose the water of Sand Creek will be used for irrigation if they finish their system there.

Recross-examination by Mr. Delph E. Carpenter:

This new system will use this Sand Creek water through the Hogue ditch. Mr. Hogue had an old water right that took all of Sand Creek

for his meadow, lying north and west of Hutton Lake. The water ran into the lake after it had passed over his meadows. The
321 lake would hold it all, and they are contemplating now building this lake up in order to hold this water from the King ditch that they intend to put through there into that reservoir. Mr. Hogue's ditch from Sand Creek runs into a little stream called Antelope and through the channel of the Antelope it goes into Hutton lake. The water of Sand Creek did not naturally go into Hutton lake. After that water had gone into Hutton lake it stayed there. Do not know whether or not it evaporated, the lakes have not overflowed. I am not sufficiently acquainted to know whether any ditch is taken out of it at this time. I haven't been there for a number of years. Five years ago there had been no ditches taken out of it. The water in the lakes which are very deep either evaporated or stayed there. Antelope creek drains into the lake. The people who now own the Riverside ranch have built an extension of the
322 King ditch to irrigate the lands near the Hogue ranch. Also lands east of there. They started that enterprise about 1909 or 1910, I am not sure which, it might have been 1910. The enlargement is of very recent development. They about doubled the old King ditch.

During the years I was on the Riverside ranch the water was never measured out to me in the various ditches by the authorities of Wyoming.

323 CHARLES BENSON, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

Am 49. Reside on Sec. 3, T. 13, R. 76. Am a ranchman. Have lived in the vicinity since 1886.

Was employed as foreman of Riverside Ranch from 1893 to 1911. Know the King and the Caldwell and Gardiner ranches. They are part of the Riverside.

324 Knew the properties before I went there. Know the system of ditches and irrigation there, and also the Hogue and Haley Ditch. The latter irrigates the Hogue Ranch and part of the Riverside. Since I have known it the Riverside has produced some little grain, but mostly hay, and quite a good deal was irrigated for pasture. 13,500 acres and some acres in the ranch were irrigated.

325 It was irrigated before I came there in 1893. We cut 1600 to 1700 tons of hay. I had charge of that. Cut over about 3200 acres. The rest of the land was used for pasture and some little farmed. The ranch was used to run 3500 to 4000 head of cattle, about 5400 head of sheep and about 500 horses. We fed them there in the winter, and in the summer had them out on the range.

326 You can get a good many times more feed off of the irrigated portion than off of unirrigated land. This hay and grain would not grow there without irrigation. I have known the land the last two years. It has not been irrigated as well as previous to that time. There was a shortage of water this summer, and usually

a shortage in previous years during the latter part of the irrigation season. The ditches on this ranch while I was there were kept cleaned out and in good condition to run water. We run them to capacity when we could get the water.

327 The ditches have been neglected somewhat the last two years. There were extensions made when I was there in 1897 or 1898, no enlargements. A new ditch in the N. E. ¼ Sec. 29 was taken out in 1903, and a new lateral from the King Ditch that waters the S. ½ of S. E. ¼ of Sec. 29. This new work was in the Le Roy Ranch.

328 That was added to Riverside in 1898. The land was irrigated by flood waters before whenever they could get a flow, but not by ditches. That was Mr. Le Roy's method of irrigating. There is not the water in the river there used to be years ago. That is what made the change of method necessary.

I know the recent extensions in the King Ditch. It was enlarged and a branch has been taken off running southeast through Sections 1, 6, 5, 4, 34, 35, 26, 25 and 30.

329 It empties into Hutton Lake which has been made a reservoir. This ditch is intended to fill it. The extension was made in 1910 and 1911. It still lacks a flume across Sand Creek. I own the W. ½ of Sec. 3, T. 13, R. 76 and the S. ½ of S. W. ¼ of Sec. 34, T. 14, R. 76.

330 That is on the river above the Riverside property. The land above me is used for hay and some grain, practically the same. 240 acres of my ranch has been irrigated ever since 1884. Most of the land adjoining the river above me has been irrigated. Mr. Olson has been raising oats on Sec. 33-14-76 for a number of years. He has 80 acres of oats there this year. All of this irrigation is with water from the Laramie. The method of irrigating

331 used and the crops raised on the Riverside are similar to those generally in the Laramie Valley.

CHARLES BENSON.

Cross-examination by Mr. Fred Farrar:

331 I first saw Riverside ranch in 1888. I was ranching on the Little Laramie river and had been in this country about two years. I came from Dakota. I have lived in this country since 1886. I have lived on my present ranch about two years and since I ceased to be employed by the Riverside company. I bought part of my ranch from Conrad Hammond and the remainder from the Denver-Laramie Realty Company. The latter was part of the Riverside Ranch originally. It was irrigated for hay land when I bought it and there was then quite a lot of hay on it. It was all irrigated. The best of it was cut for hay from year to year. I have improved it some. I don't cut all the section. There is some willow land and young cottonwood trees on part of it. I cut half a ton of hay to the acre. I cut over 74 to 75 acres and I get about 35 tons. All of this tract is under irrigation. A portion of the lands I own, the southwest quarter of section 3 is upland. It cannot be irrigated un-

less a person puts in wheels or something of that sort. It cannot be irrigated from the river very handy. It is up on the hills to the south of the river. In section 3 I have 160 acres under irrigation.
On the south half of the southwest quarter of section 34 all
333 of the land is under irrigation. There is some little brush land next to the river and trees that would probably take in 4 to 6 acres. There are practically 200 acres under irrigation. I cut hay on all of this 240 acres. I have 160 acres under irrigation on section 3. I cut hay on that with exception of 9 acres that I irrigate. I have 9 acres of oats. I cut hay on about 75 acres in section 3. I have farmed there just two years. Other than hay and oats I have raised potatoes for my own use, about two acres of potatoes every year since I have been there and some garden stuff in land along the river that is not hay land. In 1912 I obtained
334 450 bushels of oats, about 58 bushels to the acre, off of this land. I do not have any crop on section 34 this year. My ditch is on between sections 3 and 34. The Con Hammond North Ditch. My buildings are on the south side of the river,
336 my land on the north side and watered by the Con Hammond ditch. The land on the south side is watered by the Con Hammond south ditch. I should judge about 60 acres are watered to hay by the latter ditch. I cut about 22 tons on this 60 acres.

As to the Riverside ranch, during the time that I worked there I should judge there were about 11,000 acres irrigated to pasture. That was not land from which hay was cut, it was too short and better to leave it stand for feed for cattle. During the latter part of the season the water was short many years. I mean the latter part of the irrigating season, when we irrigate for hay land, that is the latter part of June and first part of July. We were very short this year, we didn't have any water and the Riverside people didn't have any at that time. There was no water in the river in 1913 except a very small seepage from the ditches higher up. That was not true in 1912, we had plenty of water then by tightening up
337 the dams. We were not short of water in 1888. During the rest of the time I was on the Riverside ranch we nearly always had sufficient water for irrigation. There were times that we were a little short and we had to tighten up the dam to keep the water from going through in a good many years. This shortage of water has been true from time to time since I came to work on the ranch. I could not say that there has been a general enlargement of irrigating lands on the river immediately above the Riverside ranch since I went to work there. No enlargement of these ditches on the river, or extension of any of them above the Riverside that I know of.

There has been an enlargement of the Pioneer canal. I thought you referred to the ditches on the river, yes, the Pioneer canal has been extended. The Sodergreen, taking water from the river above me, has been constructed, and the extension and enlargement of the Pioneer canal. Also the Pioneer enlargement leading to Lake Hattie. That was built in 1910, I believe, if my memory is correct. Lake Hattie reservoir has been built in the last few years and water stored in it. They first began storing water in 1912, this year, 1913, and

last year. I could not say whether they have water in it now. I have not been up there for some time. They have had water this summer there during the flood season. I do not know whether or not they had water during the summer. I was not up there, but I know they had plenty of water in the flood water time.

When I went to Riverside ranch in 1888 they did not use dams to divert water in some of the ditches. They went down at the bottom of the river and didn't have to use dams, but the channel sunk down and they had to build dams later. I built some myself. In 1888 the King ditch and Riverside Ditch No. 2 had a little dam. It had to be built up. The King ditch did not have any dam. It never did have a dam except the temporary one at times. By
339 a temporary dam I mean a dam built out of cottonwood logs, brush and manure. The Caldwell and Gardiner ditch has had a permanent dam for a good many years and it washed down of late years. It had a permanent dam when I was there. The Riverside Ditch No. 1 did not have a dam when I went there. Not even a temporary dam. There is a permanent dam now put in in 1894 or '5. The ditch was changed and taken out higher up. It used to be lower down and didn't have a dam and didn't have water enough. Before it was changed it did not have a dam at the mouth to my knowledge. Riverside ditch No. 2 had a little bit of a dam and part of it washed down. It is not a permanent dam now. It was washed out and there is no dam there now. It washed out the last two years. It has not been replaced.

340 Hans Olson owns section 33, Tp. 14, N. R. 76 W. He raises oats in the southwest quarter of section 33. Mrs. Olson owns the section excepting the west four forties. About 80 acres of what she owns is devoted to oats this year. They have been raising oats there for the last 6 or 7 years to my knowledge, 80 acres is the most they have raised and previous to this time they have had in a less area.

I do not know when irrigation of the Riverside ranch began. It was before I came there to work. I do not know when the irrigation of my land began.

I raise cattle. So do most of the people up and down the river. Some people have sheep. I am 23 miles from Laramie.
341 22 miles to the nearest station.

I feed the hay I cut to my stock. I turn the cattle during the summer into the Medicine Bow forest reserve. I usually turn out about the 10th to the 20th of May. They generally come in themselves along the latter part of September and first part of October. This reserve lies south and west of my ranch.

The Riverside ranch is about 20 miles from Laramie. The Riverside ranch is immediately below my ranch. My hay land lies mostly north, close to the river. It is partly bottom land and on the first bench. This first bench is not clearly defined, it is merely the first rise from the bottom. It is essentially in the valley of the river. The second bench is where the high prairie land is. There is not necessarily a distinction in the character of vegetation on these benches. It is about the same vegetation. Most any of the second bench will make meadow land if you have enough water on it.

They cut hay on it which will average up with the bottom land, about one-half ton to the acre. The natural growth on the second bench is blue stem and some buffalo grass. Not much sage brush on second bench. No greasewood on the north side of the river. It would probably be a good deal different a good many miles north, a different character of grass and soil and so on.

The altitude of my place is about 7300 feet. That of Laramie is 7,164 feet.

When I was on the Riverside ranch we had laterals for the irrigation of the meadow land. We used to turn the water
344 on the meadows May 10th. We applied the water freely, but we used to change it, we didn't have enough water to supply all over the land at one time. When we did apply the water we flooded the meadows. I would say we flooded them for two weeks and dried them for two weeks. There naturally would be some seepage from the first bench down on the bottom lands and from the bottom lands down to the river. There would be some water going into the river continuously during the time we applied the water on the land. When we applied these waters on these lands there was a considerable return to the river within a very short time. Water returns to the river from land irrigated within a mile. Further out I do not know that it would. We did not have
345 any trouble with seepage while I was working there. There is some seepage. There were 200 miles of ditches and laterals on the Riverside ranch. That included the small laterals leading from the main ditches and the main laterals. The Laramie valley above the Riverside ranch is mostly devoted to stock raising, sheep. The hay meadows are of the same character as on the Riverside. They have, on a general average, hay meadows and irrigated pasture land. The laterals on the Riverside ranch, a good many of them, would be 4 feet wide and a foot deep. The smaller laterals were made with a scraper with a handle on and a man behind follows it up. If it was a very small lateral we would throw the dirt to one side. If it was a two foot lateral on the bottom they would take and throw it out on each side. A still smaller lateral they made by plowing and using this hoe scraper and putting the bank at the low side of the laterals. The smaller laterals would be about two furrows wide. If there would be only one furrow we wouldn't bother with the scraper.

346 Cross-examination by Mr. Delph E. Carpenter:

The ranches that were purchased and went to make up the Riverside ranch were the King ranch, the Caldwell, the Mulhern and the Le Roy. When I began work on the Riverside ranch in 1883 the following sections went to make up the Riverside ranch;
347 Sections 26, 27, 34, 35 and 36 in Tp. 14 N., R. 76 W. Section 25, Tp. 14 N., R. 76 W. The south half of section 24, same township and range was leased. In Twp. 13, R. 76 W., they had the east one-half of section 3; the north one-half of section 2. That was not fenced. Section 1; north one-half section 6, Tp. 13, R. 75 W., sections 31, 30 and 19, Tp. 14, 75 W. That com-

prises the Riverside holdings at that time. Caldwell was leased by Riverside Company but not owned. Le Roy section was leased then and bought within a year. Le Roy section was 29, Tp. 14
348 N., R. 75 W. Le Roy owned section 35 on Sand Creek, bought at same time. Shortly after I came to work there, in 1894 or '5. Mr. Bacon bought that. The Le Roy land was part of Union Pacific Railroad Company's grant. The Caldwell place in 1893 comprised the south half section 21; section 28; section 27; section 22; section 15; section 11, N. W. ¼ section 14; section 23; section 13; Tp. 14 N., R. 75 W. This was leased in 1890 by the Riverside people and purchased in 1894 or '95. The Mulhern place comprised N. W. ¼ section 2, Tp. 13, N., R. 76 W. I believe it was purchased about 1894. They tore down and hauled the buildings away to the ranch about 1892. I can give the irrigated land and some of the range land of the King ranch in 1893.
349 Sec. 32, Tp. 14 N., R. 75 W., and the east forties of Sec. 31, same township and range. Sec. 33 belonged to the King ranch but was not irrigated. Sec. 3 and Sec. 5, Tp. 13 N., R. 75. That is as far as I know south of the King buildings. That was purchased about 1901 or '2. Prior thereto it was run by James King and son. They lived there on north half of sec. 32 close to and south of the line of 29 and 32, about the middle of the section where his buildings are. In 1893 we had nothing to do with the King ranch. I took charge of the Le Roy ranch for the Riverside people in 1894 or '95. Sec. 30, Tp. 14, R. 75 W. is owned by Oliver Mansfield. All irrigated except the four north forties by
350 the Mansfield ditch, a separate ditch taking water from the river. Has its own headgate.

I had charge of the distribution of water for the Riverside people during the time I was there. I began in 1893 and I quit when I left there two years ago. After the irrigation season of 1911 was over. Was foreman in charge generally of ranch. Lived at ranch buildings. In 1893 I irrigated in Tp. 14, R. 76, all sec. 34 to south branch of Riverside No. 2. South half of Sec. 27 and some little
351 land on north half Sec. 27, about 80 or 90 acres. South half of Northeast quarter Sec. 26 and south half of northwest fourth Sec. 26 and all Sec. 25. All from Riverside No. 2. There is a little land on the east side of 25 irrigated from Riverside No. 1. East half of southeast quarter and probably 30 acres of east half of northeast quarter of sec. 25 is irrigated by Riverside No. 1. The remainder by Riverside No. 2. The northwest quarter of Sec. 36 is irrigated by Riverside No. 2. Northwest quarter of northeast quarter is irrigated by Riverside No. 2, south branch. Some land irrigated by Riverside No. 1 in Sec. 36 on south side of river, about 60 acres in southwest quarter and about 60 in northeast fourth of Sec. 36 on north side of river. There are about three quarters of Sec. 36 irrigated, all except 40 acres on south side of river, by Riverside ditches 1 and 2 on north side and King ditch on
352 south side. 50 or 60 acres irrigated by King ditch. Riverside ranch people then had half interest in King ditch. In township 14, range 75 west 19 was irrigated except north half of

northwest quarter. It was irrigated out of Riverside No. 2. Sec. 30 from Riverside No. 1, and King ditch on south side of river. Sec. 31 is irrigated. The Caldwell ditch heads in that quarter. Sec. 32 is irrigated from King ditch, some parts of 29 from King ditch in southeast quarter, probably 65 acres. That is part of Le Roy place. Bottom lands on south side of river irrigated by overflow in Sec. 29, north side irrigated by ditches. Riverside No. 2 and No. 1, they joining in there. No. 2 ditch empties into No. 1 in Sec. 19. All land on north side of river in Sec. 29 was irrigated, about 360 acres. Some land in Sec. 33 irrigated by King ditch,
but it is not all meadow land, it is grazing land, there has
353 not been any hay cut. It is all irrigated pasture land except north half of northeast quarter and northeast quarter of northwest quarter. That portion irrigated was covered with water in recent years, not the northwest quarter of northeast quarter. Not to exceed 125 acres was above irrigation on Sec. 33. Mr. King irrigated from King ditch the balance every year for pasture. He used to keep his saddle horses and work horses in there. It is covered
more or less with greasewood. The Riverside Ranch Com-
354 pany did not purchase that until 1906 or '7. Mr. King had an old lateral to irrigated that land when I came to the place. The soil is a kind of gumbo, very sticky when it is wet. Most of the land where this greasewood grows is the same kind of sticky soil. All Sec. 32 is irrigated by the King ditch, all the land on the south side of river in Sec. 31. All of south half of south half of Sec. 32 is irrigated land, there is some greasewood on it and some sage brush. There is a good part of it that has been cleared
off, some greasewood on south part. This sticky gumbo land
355 is called Billings Clay. The south of south half of Sec. 32 is of same character. The Caldwell and Gardiner ditch irrigates the west half of Sec. 28, and all the rest of Sec. 28 except the bluff land on the southeasterly portion. It takes up the south half of southeast quarter. The north half is pretty well covered with water. It irrigates both ways, toward the river and away
from the river. The ditch is in rather high places. Some
356 hay was cut and there was some pasture land south of ditch. It was mostly pasture. Hay was cut in spots where the land was smooth. We would probably cut about 40 tons off that portion of Sec. 28 southeasterly from ditch and about 40 tons from that portion north and westerly from ditch, and between ditch and river. From the whole section about 80 tons. The land between Caldwell and Gardiner ditch and Laramie river, west and north clear to river, was pretty much all irrigated. The river has a great many trees along its course. There was hay cut right up to the trees. We
did not dodge in among the trees much, we left that stand.
357 South half Sec. 21 was irrigated from Le Roy ditch, that comes out of Sec. 29 and partly out of Riverside No. 2, they join at the corner of 20, 29, 21 and 28. That ditch was taken directly from the river into Sec. 21. Was built in 1903 or '4, odd times, and took a good many years to build, four or five years. Completed about that time. South half of 21 is not very low land. By

taking ditch out on Sec. 29 half a mile up river from the corner, we get water on first bench at corner of Sections 29, 20, 21 and 28. On south of Sec. 21 the bench slopes to east and south.
358 There is a ditch there that runs north and you can let the water out and it will run south and east. The ditch has very little fall along the fence, running on line between 20 and 21, runs from river north and when it gets to half mile line runs east along section and if it is let out of these two ditches, it will run east and south. About 200 acres south half of that section were irrigated on north side of river. Some hay cut there, about 35 tons. The rest is pasture. There is about a quarter section or a little less on south side of river in Sec. 21 irrigated by Caldwell and Gardiner ditch. It is pasture and hay land. We would cut about 10
359 tons in that corner. About all Sec. 22, except 60 or 70 acres in northwest quarter was irrigated. Part of it from Hogue and Haley ditch and part from Caldwell and Gardiner ditch and part from Bush and Holliday ditch. Last ditch runs in between the Hogue and Haley and Caldwell and Gardiner ditches. The Riverside Company did not own Hogue and Haley ditch. It was owned by Hogue and Haley. The Riverside ranch used to get lots of water out of the ditch. It overflowed a great deal along these banks, they were good strong banks and they generally used to carry plenty of water so we watered pretty much all that section. Not quite the whole southeast half was watered that way. The Bush and
360 Holliday ditch irrigated a good deal of land on east side of their ditch. The Riverside Ranch did not have any interest in Bush and Holliday ditch. They would make the ditch part of the way and lead it into a low place and use that for a part of ditch and then make another ditch and lead it into another low place and in that way the water ran both ways in the low places and irrigated some of the land in 22. All the land south and east of Bush and Holliday ditch was irrigated either by Bush and Holliday or Hogue and Haley ditch. That was all pasture land. I did not know that Samuel Blackwell held title to that section until 1900. A small part of 23 was irrigated by Riverside Company, about 60 acres in northwest quarter, irrigated from a lateral out of the Hogue
361 and Haley. There is a lateral out of the Hogue and Haley that waters the east half of 14. This land in 23 was irrigated from that lateral. I do not know whether Mr. Blackwell owned Sec. 23 or not. It was under control of Riverside Company as long as I worked there. It was not fenced separately and has always been in same field. That was pasture. Sec. 13 is irrigated partly from the Bush and Holliday and partly from the Hogue and Haley. The Riverside people had control of the section and I believe owned it. East 80 acres was pasture. East half of southeast quarter was hay land. I did not know that Mr. Samuel Blackwell owned
362 that section until 1900. Whatever irrigation took place in Sec. 13 was from ditches neither owned or controlled by the Riverside Company. We cut about 35 or 40 tons on that 80. It was good hay land. We cut 35 tons, one year with another. They used to get lots of water from the Hogue and Haley. There is a lateral

comes out of the Hogue and Haley and runs the east half of the section, through the corner of Secs. 18, 7 and 13 and 12 and onto Sec. 7, called the Hogue Land. That lateral has only been there the last three or four years. There was no irrigation on 13 prior to the construction of this lateral. There was some water from the Hogue and Haley ditch that slopped over. There was some irrigation and some seepage where this hay was cut, it is kind of a low place. There was practically 80 acres irrigated by seepage and overflow from the Hogue and Haley ditch prior to construction of the lateral. The lateral waters practically to the line on 13 and 18. It waters all this 80 I have spoken about, and then half of east 80 and northeast quarter,—east half of northeast quarter. It goes diagonally across the 80. Probably 35 or 40 acres. That has all been watered since the lateral was built. The lateral is rather deep at that place, you can't get the water out on this 80 I spoke
363 about. The northwest quarter of Sec. 14 has been watered since 1893. That was all in that section the Riverside Company owned. It was part of the Caldwell and Gardiner ranch. It was irrigated by Caldwell and Gardiner ditch. About 120 acres on south side of river. The other 40 acres is on north side. We would cut probably 35 or 40 tons of hay on that quarter section. That portion on north side of river gets its water from Fischer ditch. Nelson had a ditch and it gets some water from that. I don't know whether it is on record or not, but Mr. Nelson
364 has a little ditch on the north side of river. The Riverside Company did not own any part of Nelson water appropriation in Fischer ditch. Whatever irrigation there was on this quarter on north side of section was by waste and overflow or return waters from these two ditches which the Riverside Company did not own. We had no control over that overflow or waste. I did not know that Samuel Blackwell owned that quarter section until 1900. Some land in Sec. 15 was irrigated, about 340 acres on the south and east sides from Caldwell and Gardiner ditch. Some meadow land and some pasture. About 24 tons of hay were cut there. The north side of river was not irrigated. It got some water, I think, from overflow of Nelson ditch. I do not know of any ditch there of late years. We had no control over the waters in Nelson ditch. The river passes from southwest to northeast across section 15. Part of a quarter section on Sec. 11 south and east of the river was irrigated. It was owned by Riverside people. Partly pasture and partly meadow. Quite a little hay land on southwest quarter of section irrigated by Riverside people. North of the river it is a little low land and seeps in there and makes quite a little hay land. The Riverside people owned all 11. The little
365 meadow on north side of river was a natural meadow, but it did not require irrigation. All northwest quarter of 25 is irrigated from the Garden ditch out of Sand Creek. The ditch belonged to Denver-Laramie Realty Company. The land to Riverside. It was a partnership ditch, Hogue and Riverside people owned it. Riverside owned all Sec. 25. All except northwest quarter is pasture. In the southwest quarter there is under this Gardiner

ditch about 45 or 50 acres irrigated pasture land. They could have cut hay there but didn't. It was too far away from ranch. There is some land in Sec. 35. Sand Creek runs through Sec. 35 all west half of that section, barring about 20 acres. There is 20 acres in southwest corner that has no water on account of a bluff. All the rest of that west land has water on it. That was part of Riverside ranch during the time I managed it. There was some hay cut there and balance used for pasture. We cut about 30 tons or more.

367 There was a little more land in section 35 irrigated. I believe we have about covered all the land owned by the Riverside in that township. In township 13, range 75, the Riverside people owned north half of Sec. 6, irrigated from a lateral coming out of King ditch in Sec. 1, Tp. 13, R. 76 and running from Sec. 1 into 6. The ditch also extends through 5 and 4. There was some hay land on this north half of 6. The biggest part of it is pasture. Mostly Billings Clay or adobe. There was also some land irrigated in Sec. 5, about 15 acres of irrigated pasture land. There is a ditch over the land, but it has not been irrigated. Almost the entire 5 is Billings Clay or adobe covered with greasewood. The north half of 4 was irrigated by this same lateral. Was taken up as a

368 claim by Mrs. Emmons in 1903 or '4. Prior to that time it had not been irrigated. All the north half of this section has been irrigated from this lateral, if at all. That was greasewood, Billings Clay land, plowed up since and some grain raised on it. One lot of oats raised on there a year ago by other parties, about 150 acres in oats. I don't know what yield they got. Practically all Sec. 1 was irrigated by Riverside Company, except southeast quarter. There was some land in there not irrigated, and a little in southwest quarter, about 10 or 12 acres. There is a little bluff there. It was used for irrigated pasture. We didn't cut any hay there.

369 Right next to river it is a sandy loam and about a mile out it is adobe clay. A little over three-quarters of section is irrigated. Some high greasewood bluffs. In sections 1 and 2, Tp. 13, R. 76, this Billings Clay soil comes down quite near to river, much nearer than further east. It comes about half a mile from the river along there. This Billings Clay soil is not always indicated by greasewood growth. Some of that clay don't grow any*ht*ing—greasewood, sage brush or anything, just bare land. It makes good land if it is seeded down. Even then it gets very hard and breaks when wet and exposed to sun. There was some little land in sections 2 and 3 in that township that was irrigated. About 30 acres in Sec. 2 in northeast quarter on south side of river from King

370 ditch. It is sandy loam and gravel like. Irrigated for pasture. On south side of river about 25 or 30 acres and on north side in Sec. 2. It is irrigated by Riverside No. 2. In north half of Sec. 3 on south side of river about 13 acres watered from King ditch, that is, in the northeast quarter. That is pasture land. On north side of river in that section there are about 50 or 60 acres watered from Riverside No. 2.

These lands constitute all land in any way irrigated by Riverside Company, during my term as foreman. Out of all that land I

have described as irrigated I count over about 3,200 acres of hay land, and cut from 1600 to 1700 tons of hay. Such hay land would average then about half a ton to acre. One acre with
371 another would cut about the same. It is a fact that some of very favorable spots would go as much as a ton and then sometimes we would cut land that would go as low as a quarter of a ton, making an average on the whole of about half a ton. The garden truck I spoke of was raised on Sec. 32 *on* right by the King buildings. That was merely the garden for the ranch. The potato patch was just for ranch use. I stated I superintended the irrigation. We alternated in irrigation on hay land. Let the water run in one place about 2 weeks and then dry for succeeding 2 weeks. There was never enough water to cover all that land at one time. We would cover each spot irrigated four or five times each season.
372 The water that ran in one place for two weeks evaporated and the most part went into the soil and some evaporated and some seepage. I do not know whether it got as far as the sub-soil, but it watered the surface. I don't know whether it went down into that gravel, it went into the land. Most of our irrigation was done on the first bench. The further down the river you go the higher this bench becomes. Up above my place in Sec. 3 it would be about 4 feet up to the first bench and further down on the Riverside in Sec. 36 it would be about 8 feet to first bench from bottom land. From there down the river it would be a little lower again. It would probably be only about 5 or 6 feet in Sec. 30, the highest point there for several miles would be in Section 36-14-76. The river bottom land would be about three feet six inches higher than the river bed in this particular place we are speaking about. This whole Riverside ranch that I have described in the
373 Laramie river valley. I could not say whether or not the first bench was made by the action of water in depositing gravel and sand, which was later covered with soil. There is quite a big plat of that first bench, that the land is pretty level. I never did dig down and make wells in this first bench. We dug wells in Sec. 36 about 16 feet deep. We found sandy loam on top and some gravel, and some sand mixed. Then a kind of blue shale, very light shale. That was on south side of river. There was some water in this sand and gravel that we found between sandy loam on top and shale in bottom. I never did excavate on the first bench anywhere on Riverside north of the river. I do not have any idea what the formation is there. The water applied on the north side would act differently in different places. Places that had been irrigated more than others the water would go further. Where the land was more new and had not had so much irrigation, it would take more water and it would sink in more. After the land had been irrigated for several years it seemed to hold water quite well and wouldn't take quite so much water to go over it. That condition generally prevailed on Riverside lands irrigated north of
374 river. I have not noticed that in many places in the first bench north of river and especially over along north edge of our irrigated lands that the water plane is only a foot or so below

the surface, or in other words, that water stands very close to grass roots. I haven't noticed any water, except in irrigation season, seepage from ditches. When the ditches are shut off it is perfectly dry there. I never dug down there to see where the water plane was. Not a great deal of this water run over this irrigated land goes back into the river through sloughs and depressions. Some little runs through the sloughs during irrigation season. After irrigation season is over there is no water in fall or winter running through the sloughs. There is some little while we are applying it. The land on south side takes as much again water or more as those on north side of river. The sandy loam on south side takes more, that strip about a mile wide along river that I have described is very light sandy and gravelly loam. Billings Clay would not take so much; would take very little water. I never did dig down in that strip of sandy or gravelly loam between Billings clay land and the river which is from half a mile to a mile wide, to see what
375 the sub-soil formation was there. I dug several wells on section 36-14-76 at the ranch buildings. At that point the surface is not over 3 or 4 feet above bed of river. On two or three occasions the river overflowed and went through the yard of Riverside ranch buildings. I dug these wells in overflow district. In these wells we found some fine sand and some large gravel, the largest stones would be an inch and a half. Very much like the river wash not quite so coarse as some you see where the water washes bottom of river. On bottom of river the action of the water washes away the fine sand and gravel and leaves the coarse gravel exposed. What we found would be in river if water had not washed away the fine sand and gravel. It washes in parts of river and then
376 heaves up this fine sand and gravel in other parts and you find rough gravel on one side and sand bars on other, making what we call river bars. I do not know that this strip of land on south side between Billings Clay and river has appearance in a good many places of being large river bars covered with some silt. It is pretty much uniform soil so far as I have seen. There are very few sloughs on south side of river. About 2 or 3 sloughs and they are very close to river. There is a slough running northeast right close to buildings at ranch. There are some low places down in vicinity of Bush and Holliday and Haley and Hogue ditches. There is not any water in them except in irrigation seasons. But depressions, a good deal like those we have mentioned, appear more or less over that mile strip, so if at high water it should overflow this land to south it would drain back into river through those depressions. I could not say how this strip of land between Billings clay
377 and river was made. It is pretty much same character of soil from river out south and west for a mile or two, little more gravelly toward river. The nearer the river the more gravel. Over in Sand Creek district the soil is pretty much the same character as at Riverside, some clay and some sand.

During time I was forman we ran as high as 4,000 head cattle, 5400 head sheep and 500 head horses at this ranch. We had a very large pasture immediately south and west of river bottom

lands for some years and then we took the fence away and you might call it an open range. I do not know the circumstances that led to taking the fence down. It was taken down voluntarily. Other people were forced by the Government to take their fences down.

Every other section in there was title land. By title land
378 I mean deeded land that a person buying owns it and has a deed. This title land comprised all odd numbered sections. It was part of land given to Union Pacific Railway Company in its land grant, at the time it was built across continent. The title to it was derived from the railroad. All even numbered sections were Government sections except sections 16 and 36 which were school lands. We took down this fence which enclosed these railroad sections belonging to Riverside and also school and Government lands about 1900 or 1901. There is still some fence standing on south and east side of the pasture, but most of it is piled up in piles on odd numbered sections and some little standing there yet, not on any Government land, but on odd numbered sections. Prior to the time we tore fence down we had in this big pasture
379 16,000 or 17,000 acres. All was above irrigation. It lay south and west from ranch. The company owned about 8,000 acres, in 1893. There is some land outside the big pasture that we owned, but I wouldn't say how much, on what is called Red Mountain flats, so I might be mistaken as to acreage. I don't know just exactly how much they did have. I have control of about 31,000 acres both in big pasture and in valley part of ranch during my management, from 1893 to when the Denver-Laramie Realty Company bought in 1910. We did not have exclusive control of all land in our fence, other people could turn cattle in there if they felt so disposed, and there was other stock in there besides the company stock. We could not keep anyone from turning stock in there as long as we had Government land fenced. We had some stock on outside as well as in big pasture. We also ran horses and cattle on open range to south of big pasture and up into Red Mountain and Bull Mountain country. We ran all our stock out there during summer months, and until into September, when we would let them into big pasture. It would average from 10th to 20th of May when we turned stock out. All our stock would range and feed both in Valley and on mountains in vicinity of Red Mountain, Bull Mountain and Ring Mountain. We would gather them in September. In early years we had a roundup. In the last ten years we didn't. We would let them come to the gate and keep riding every day and what we found along the fence we would put into field through the big gates. We had a roundup in 1893, '94 and '95. From then on we just gathered them from the ranch. We would gather them and turn them into the big pasture and hold them on the big pasture and on valley lands from September until May. In probably September or October the first snow storm came and we would turn them in on bottom lands where we could take better care of them. They would drift to bottom fences and we would have to take them or they would break down the fence and come in themselves. Our stock would range clear over into

Colorado, from 12 to 14 miles from ranch during summer months on open range. Over on Sheep creek in Boulder Ridge country and McIntyre and on Jimmy creek, a tributary of Big Laramie. We had some ranches on Jimmy creek.

381 We owned the Otto Graham ranch. That is first ranch on creek from its headwaters down. It is in Colorado. It is at west part or mouth of Sand Creek Pass. We used that ranch to take our calves up there in winter time and feed them what hay was up there. We would generally take our weaning calves up there about middle of February. The Jimmy creek ranch would cut about 125 tons of hay. It would take care of about 275 to 300 calves from middle of February to about 10th or 15th of May.

382 We, in large measure, had control of this large range up to south of our pasture in those years. Some stock men turned their stock in, but not a very large number. Never enough to amount to much.

During summer months we ran two bands of sheep between Big and Little Laramie rivers a good deal, and also up around Ring Mountain south of ranch. Ring Mountain sheep camp was located in Sec. 28, Tp. 13 N., R. 76 W. That was our central sheep camp. We did not have traveling wagons and camps. We didn't use wagons. We had corrals and cabins. We also had another sheep camp or two between the Big and the Little Laramie Rivers. These are in the Big Hollow. The other camp at Osterman Lakes. They are south and over the bluff from the Big Hollow camp.

383 We used to run the sheep there in the summer and fall. In the winter we would take them further south toward the home ranch. Whether we would move them into the ranch depended on the weather and the feed. Sometimes we would move the sheep from the Big Hollow over to the Ring Mountain feeding grounds. We aimed to hold the sheep out on the open range as much as possible during the winter months. In order to provide for their care during storms, if we had them any distance from the ranch, we would take out baled hay and keep there in case of a storm. The ranges were open most of the winter. During 1893-4 and '5 we ran wethers. They came from Oregon. Wool only brought about 5 or 6 cents a pound. After that we ran ewes and raised lambs. That was during 1897 and '8 and from then

384 on until two years ago when we sold out. Wool was a first class price during that time. The wethers were shipped down to Silver Creek, Nebraska, almost every winter and fed corn and put onto the market from there. There was a man named Alex McQueen there and he fed them out on a percentage. We sold the old ewes each fall. Sometimes Fort Collins feeders would buy them. These sheep sold to him were taken there to be fed for the market. We figured on carrying over from 4300 to 4400 ewes each winter.

385 During these years we mostly ran white faced cattle. Each fall we would sell all the dry cows and all the steer calves that were big enough around October and November. All of the fat

stuff generally went to Omaha and some to St. Joe. A good many of the steer calves were sold to Governor Carey for several years. We aimed to sell out all our steer calves each fall. We aimed to hold over only our producing cows that were in good condition. We aimed to carry over each winter about 2400 cows. Along in the late fall or early winter, whenever they would come down and press against the fence on the north side of the pasture and south of valley land then we would let them through into the graz-
386 ing grounds there. We consumed all hay from year to year with these cattle. Sometimes we would have stacks left, generally some little surplus.

We ranged our young horses around Bull Mountain, Red Mountain and outside of the Big Pasture. The mares we generally kept in the big pasture. During the years I was in control we as a rule had about 140 mares. Our young horses ran on the open range in the Bull Mountain country until they were ready to break. We also had some 70 head of saddle and work horses that we ran in the big fields up until haying time. I mean the big pasture south of the irrigated land. We generally had about 300 head of young horses on the open range. The proportion of horses kept in and turned out would run about the same in the years 1893 to 1910 or '11. We shipped some horses every year to get rid of the surplus.

387 This open range country to the south of the ranch was a good range country. Other ranchmen turned out there but in the use of the range and the big pasture the Riverside company had the biggest proportion of it. The other ranchmen had small holdings as compared with the Riverside company. These
388 smaller holdings were mostly held around the little ranches of their owners. The big pasture to the south was left open during winter so that the stock ranged up in that region more or less during the winter. There is some quaking asp land along Bull Mountain, Jelm Mountain and Red Mountain, and the horses browsed the quaking asp more or less in the winter months. There was also a good deal of grass that we didn't cut, pasture land, among the brush, and along the river in the shelter. It was utilized in the winter by our cattle. The cattle will pick at the greasewood some when it is green, but generally it is not regarded as of much
389 use.

The largest field of oats we ever raised on the Riverside ranch was 137 acres in 1910 and '11. That was after the Denver-Laramie Realty Company bought it. They had an idea of converting this Riverside stock ranch into a colonization scheme. They did not get a large crop, about 2800 bushels. These oats were irrigated. They were raised on Section 24 and 25, Tp. 14 N. R. 76 W. I had charge of their raising. This Denver-Laramie Realty Company was an auxiliary company to the Denver, Laramie and Northwestern railroad company.

390 During the years prior to the Denver-Laramie Realty Company's promotion effort I did not raise any oats while I was foreman. We did not feed any grain prior to the ownership

of Denver-Laramie Realty Company. We had horses enough to change and never fed them any grain. We did not feed any grain in fattening our animals, excepting a few hundred lambs we used to buy corn for. It was shipped in from Nebraska. We did not raise any wheat or barley during the years I was foreman and prior to the Denver-Laramie Realty Company's efforts at promotion. In 1910 we did raise a little wheat and barley on Sec. 1, about 30 acres in wheat, barley and field peas.

391 While I was running the ranch for the Riverside people I did not pretend to cultivate except for our garden and potato patch. All the rest we used for hay. That is its most valuable crop. The greatest value is obtained from this ranch by the use that was made of it during my management of it from 1893 up until the Denver-Laramie Realty Company purchased it. It was at that time nothing but a stock ranch.

In 1893 and at present the Riverside canal No. 2 is about 8 feet wide on the bottom, will carry water 2 feet and one half in depth, has a fall of about 3 feet per mile and I do not know its carrying capacity. It diverts water from the Laramie river below Oscar Sodergreen's house, and above Charlie Sodergreen's house. It has the same headgates and diverting appliances it always had. It then had and now has at its head a crib dam, filled with rock. It has and had a headgate but no measuring weir. We didn't measure the

392 water.

In 1893 and now I should judge that the Riverside canal No. 1 is about the same size as No. 2, but the grades are somewhat less. It has a wooden crib dam filled up with rock and a headgate at the head of the ditch. It did not have any measuring weir and does not have. Both of these ditches are practically the same now as they were in 1893. They have been somewhat neglected. The Riverside No. 2, its south branch, combined in Sec. 25 with Riverside No. 1. The north branch of Riverside No. 2 combined with Riverside No. 1 in Sec. 19. In 1893 the King ditch was practically the same proportion as the Riverside ditches, about 8 feet on the bottom. They were all three about the same. About 2½ feet of water in depth. If there was any water in the river, they generally got enough without any dam.

393 The Caldwell and Gardiner ditch is about 6 feet on the bottom and has a headgate and a dam at the head. The dam is of pilings and logs crosswise against the piles and rocks against that. It was that way in 189—. Neither the King ditch nor the Caldwell and Gardiner ditch has any weirs.

These are the ditches that used to irrigate land of the Riverside company. We required such large ditches because there was considerable land to cover. In places we had to have large heads of water to properly flood our hay land. We could irrigate with a small head after we had irrigated a couple of weeks or so. The first irrigation usually occurred during the period of high water. We generally kept the ditches full. I had a gauge in the river and so when the water raised or lowered I regulated the headgate accordingly.

The water officials of Wyoming did not regulate our ditches
394 at any time, they have lately.

In the '90s quite a number of ditches diverted water from the river above the ranch. The ditches upstream from the Riverside ranch are the Fischer ditch and that of Mr. Oscar Sodergreen. The next is the Park. The next belongs to Popp and Pahlow. The Last Chance ditch is the Burgland ditch. The next above the Popp and Pahlow ditch is the Pioneer canal. Next above that, in 1893, was the Lund ditch and then there is the Gus Burg ditch. The next above the Burg is the Porter ditch. Next above that the Jim Polack, called the Charles Heidrick ditch. The next is
Frank Smith's. That is all the ditches I know of to the
395 Colorado line. The Burg ditch takes its water at Woods Landing. The Porter, Heidrick and Smith ditches are all above Woods Landing. All of them except the Burg are ditches irrigating small acreages of meadow along the bank of the stream. The first ditch irrigates quite a lot of land. It heads at Woods Landing, and another ditch taken out of Fox creek empties into the Burg ditch further down. Fox creek is a tributary of the Big Laramie river. The Burg ditch takes its water from both the Laramie river and Fox creek. No other ditches that I have named take their water from Fox creek.

Since 1893 the Sodergreen ditch built by Oscar Sodergreen has
been constructed, taking water from the Laramie river. It
396 heads below Fox Creek. There is the old Sodergreen ditch, between that and Riverside No. 2. This last Sodergreen ditch is the Sodergreen High Line. I believe the Pioneer canal was enlarged in 1910 and '11. I don't believe any water was carried through it into Lake Hattie until 1912. I don't know as it was finished in 1911. I didn't pay much attention to the Pioneer canal. I was not there when they were constructing the north end of the canal by washing out the ditch. I don't believe they were running water through the inlet to Lake Hattie except in flood times.

After the Denver-Laramie Realty Company had purchased the Riverside ranch they made a high line to the King ditch. None of
that work was done by the Riverside company. It was
397 started for the purpose of carrying water through to Hutton lakes, natural lakes fed partly by Sand Creek and partly by Antelope creek. Creighton Lake also had water in it. There are three lakes there. Sand Creek runs into Hutton Lake. Sand Creek runs into Creighton Lake and Antelope creek into Hutton lake. There is not much water coming from Sand Creek into the big Laramie river. It generally runs into that lake. Very little of it comes into the Big Laramie. Sometimes in high water it might fill that lake and run out again. A large part of the year there is no water
in Sand Creek. After the water has entered either Creigh-
398 ton or Hutton Lake it ceases to be of any value for irrigation. There is an intention of taking out ditches from these lakes but there has been no work done except putting the reservoir in. These two natural lakes were intended to be utilized as a part of the reservoir scheme started by the Denver-Laramie company in

connection with this King High Line ditch. They got the reservoir all built except the rip rapping. They have got the dykes built. They are large dykes. They have been finished. The outlets from the lakes have not been finished. The King High Line Ditch
399 has never yet been used to carry water to these lakes.

Cross-examination by Mr. Fred Farrar:

In my testimony when I mention hay I mean native grass cut and cured for feed. These lands included within the Riverside ranch was not cultivated, except where we raised some oats and possibly some other grain.

399 Redirect examination by Mr. N. E. Corthell:

About all of Sec. 35, T. 14, R. 76 has been irrigated ever since I knew the place.

400 Also S. ½ Sec. 24. All the land between Riverside Canal No. 2 and the river is irrigated. All the land between Riverside No. 1 and the river except about 35 acres in Sec. 36 is irrigated.

401 Beginning in Sec. 2, T. 13, R. 76, King Ditch distributes water to the north and to the south.

The Caldwell Ditch is flumed across the Hogue and Haley Ditch. No water taken into the Riverside ditches is wasted into the river except what little seepage there might be. It is all used up for irrigation.

402 Recross-examination by Mr. Delph E. Carpenter:

The Hogue and Haley headgate was originally on the north line of Sec. 28-14-75. In 1901 or '2 the owners extended the headgate up stream to a point in Sec. 29. At this time they cut through the Caldwell ditch and flumed the ditch across. A man by the name of Bush owned Sec. 12-14-75 in 1893. Irrigated by the Bush and Holliday ditch. Never purchased by the Riverside people.

403 OSCAR SODERGREEN, a witness in behalf of Complainant.

Direct examination by Mr. John D. Clark:

Have resided on the Laramie River about 23 miles southwest of Laramie City for about 35 years. Engaged in ranching and raising live stock. Live 8 or 10 miles due north from the Colorado line, and about half a mile above Riverside Ditch No. 2, and a mile and a half east from and below the headgate of Pioneer Canal.

404 For a number of years I was superintendent of Pioneer Canal. That canal is over 30 miles long. I think 3 years or so before I became superintendent the length of the canal was increased and its capacity enlarged. When I was superintendent Pioneer Canal was 16 feet wide on the bottom.

405 From the time I became superintendent until the Lake Hattie Project there was no change in the size of that ditch.

I was superintendent 10 or 12 years. I had no knowledge as to the acreage irrigated under the canal.

406 The farms under the canal are mostly from 160 to 320 acres. The farmers had cattle, chickens and pigs and farmed raising grain, hay, and vegetables of all kinds. Produce was raised for feed and for sale. I think farming predominated over hay raising. On the upper end of the river where I live we are more in the cattle business.

407 On my ranch I have irrigated a good many hundred acres and raise hay chiefly, for that business. I raise grain too nearly every year. I get about 30 bushels of oats per acre. Have never had a failure. Raise successful wheat crops.

408 Late frosts in spring and early frosts in the fall have not prevented success. Raise no corn except have raised sweet corn for 30 years. Never had a failure in that except last year. I live about 15 miles from the Colorado line if you follow the river 8 miles in a straight line. Between me and the state line are the ranches of N. K. Boswell, Frank Smith, Jim Pollack, Fred Hansen, Gus Berg, Jacob Lund and J. E. Johnson. I know the tributaries of the Laramie between me and the state line.

409 They are Johnson Creek, Beaver Creek and Fox Creek. Woods Creek don't amount to anything. Fox Creek don't amount to anything. One ditch takes all the water from it. There is a pretty good flow in Johnson and Beaver Creeks early, but before we begin to irrigate where I live the water is all gone out of Johnson and Beaver Creeks. We begin to irrigate about the first of May. I know the Murphy Ditch of A. M. Goode. It was constructed in 1877 or 1878.

410 It irrigates about 80 acres. I built the O. Sodergreen Ditch in 1878.

411 And extended it in 1884. Also have the Last Chance Ditch and the Fisher Ditch. From the three last named ditches I have irrigated 800 acres ever since 1884, taking the water from the Laramie. The O. N. Ditch of Mansfield takes water from the Laramie and was constructed in 1884 or 1885. It irrigates pretty near a section.

412 Con Hammond built the Hammond North and South Ditches about 1885-1886. It irrigates 160 acres, maybe more. Smith Ditches Nos. 1 and 2 are 8 or 9 miles above me. They were constructed in the '80's and irrigate 80 acres. Lund's North Line Ditch was constructed in the '80's and irrigates about half a section.

413 Burg's Ditch was constructed in the '80's and irrigates perhaps over 200 acres. My Central Ditch irrigates 50 acres.

414 Sodergreen Ditches 1 and 2 were constructed in the '80's and irrigate 300 or 400 acres. O. G. Ditch of H. Olson was built about 1887 and irrigates a section. Fisher Ditch was built in 1887.

415 I think he irrigates three or four sections from that. I irrigate 40 or 50 acres from Sodergreen South Ditch. It

was built in 1887. My brother's Island Ditch has been there ever since I can remember.

416 He irrigates 80 acres from that. Charles Heidrick's ditch is 7 miles up the Laramie from my place. It was built in the '80's and irrigates 160 acres.

Parker Ditch was constructed about 1896.

417 It irrigates 1,650 acres. The Last Chance Ditch was extended in the early '90's.

418 Popp & Pahlow made the extension and irrigates from it about 1,120 acres. I built Sodergreen High Line Ditch about 1910 and irrigate from it 4,000 to 5,000 acres.

419 I raise hay and some grain and some potatoes on these lands. I begin to irrigate about May 1st, and shut down for native hay about the middle of July, and for alfalfa later. The water begins rising about May 1 and is highest about June 10th, and ordinarily gets low the latter part of July. This year there was a shortage caused by light snow fall in the mountains. All these ditches take water from the river by means of loose rock dams and head-gates.

420 Sometimes dams wash out and you must watch head-gates.

My High Line Ditch was surveyed in 1907. At that time there was plenty of water in the river and a good many "last chances" after that to get a ditch.

Cross-examination by Mr. Delph E. Carpenter:

420 The first creek that empties into the Laramie river starting near the inter-state line is Johnson creek. I do not know
421 whether or not that stream rises in Colorado. It flows northeasterly, joining the Laramie river about a mile below the inter-state line. The next tributary to that stream is Beaver creek, possibly some of it rises in Colorado. I think some of it rises in Wyoming. It joins the river about two miles below inter-state line. Bear Gulch joins the river at Jelm. Two or three little stubs of creeks come in through canon below Bear Gulch. Porter and Wood creeks enter the river below this. The latter has little water except in the spring. It generally dries up in June. The next tributary is Fox creek, with a considerable drainage area.

422 Generally dry about last of June. If — rains heavy Wood and Fox creeks flow. I have know- Fox creek to flow a great many times after July 1st. Don't know as to Woods creek. Late in the fall sometimes Woods Creek will start. Fox Creek starts whenever the rains and snow begin to come. Johnson and Beaver creek both flow during the fall and winter months. Outside these creeks I have named there are a number of stub creeks coming down from the mountains and emptying into the Laramie at times when the snow is melting in the mountains. They discharge water the latter part of April and May.

Jelm mountain is about one mile from my ranch. Sheep
423 Mountain is about 3 or 4 miles. My buildings are on Sec. 32, Tp. 14 N., R. 76 W. The country tributary to the Lara-

mie above the points where the river runs between Sheep mountain and Jelm mountain is mountainous. It is so to the inter-state line, with the exception of the small river bottom. I am located at the upper extremity of the Laramie Plains. Immediately across my ranch the Laramie Plains end and the mountainous district begins.

Johnson and Beaver creeks are tributaries furnishing considerable water to the stream. The snows first begin to melt in the spring and the waters to flow. As the days become warmer the melting extends higher up the mountain sides. At the southwest portion of the Laramie Plains the ice goes out always in the month of
424 March, at our place, and the snow begins to melt about the first of April, and the drifts that are piled up during the winter around there. The drifts disappear along in May. The wind drifts the snow in my vicinity and pretty deep in the gulches. During this period these little creeks and unnamed tributaries are running. My ranch is about 7,350 feet in altitude. The grass on the meadows begins to grow in April. Growth very slow until in May. The days are warm but the nights are too cool for rapid growth. The grass increases until June. It is growing then about as fast as any time I guess. It ceases its growth about the middle of July. That is the time I stated we dry up our meadows preparatory to harvesting hay. I generally aim to begin cutting hay July 25th. We aim to finish in 30 days.

425 Our harvest continues for a period of about 30 days after July 25th. The same custom exists up and down the valley. When I speak of hay I usually refer to native hay.

I do not know when the frosts cease. We figure that we are safe to plant our garden by the middle of May. By the time the garden is up, after planting in the middle of May we will be comparatively safe from frost. During some years the frosts have occurred at my place every month. We haven't had frost this year but down near Laramie I understand they had a little, in July. My place is a little closer to the mountains. In September we sometimes have
426 a little frost. In October a white frost. The years vary in this. I have seen snows at my place September 13th and then again not until November, they vary. I saw one snow storm in my vicinity July 4. It rained in the valley but snowed on the mountains. It snowed in the mountains about 2,000 feet above where my land was. I have known snows to cover portions of the Laramie Plains in June. These snow storms have occurred on the Plains more frequently in the month of May than they have in June. In the Laramie Plains the thermometer varies quite suddenly in
427 the summer. The Laramie Plains is quite noted for its winds in the early part of the summer and the latter part of the spring. I don't know whether more windy than other portions of the country. Where I live the prevailing wind is from the southwest. I think it is much the same further east. It is windy in the summer and fall. The wind is so frequent during the winter that practically all the snow that falls drifts. As a rule it blows nearly every day during the winter.

428 The corn I plant in my garden on May 15th comes up in about two weeks. We aim to avoid the frosts in the last of May. The frost has nipped my garden and corn a little sometimes. I raised oats a number of years on my land. They ripen for harvest about this time. I am running a binder today, August 29th. This would hardly be our ordinary harvest time. On an average about the 10th of September would be our harvest of oats. The present season is a little earlier than the average. Maybe I got my grain planted earlier than some of the others. I planted my oats in April. We usually try to plant April. Under average
429 conditions we irrigate our oats three times while they are growing. I am raising white Swedish oats this year, and I have raised the black Russian. This year I have between 30 and 40 acres of oats. In previous years I have averaged from 10 to 60 acres. I always feed oats to my stock and one thing and another. I also entertain travelers at my ranch.

I have raised some barley. I had about 4 or 5 acres of
430 barley two years ago. It is called Bald barley: It ripened earlier than oats. We generally have barley cut long before we cut oats. I did not have a good yield in 1911. I got too much water on it and it didn't yield as good as previously. If you give it too much water it dies out. Two irrigations is all that I have ever given barley. I raise barley and use it for chicken feed. That is not the same variety of barley usually raised on the Laramie
431 Plains. They raise the other kind too. The other yields a larger crop than the Bald barley.

I have not grown wheat very extensively. We have been in the custom of harvesting our wheat about the 10th of September. Just about the same time as the oats. I might have threshed my wheat some years, but mostly I stack it for chicken feed. We irrigate wheat about the same as oats. I could not give my average production of wheat. We generally plant as early as possible in April. The growing period for both our wheat and oats extended over about the same period of time. That would be from April until September
432 10, as a rule.

We aim to raise the early Rose or Early Ohio. You must wait until a certain date before you can irrigate wheat. If it is a growing season and plenty of rain in the spring, it grows faster and your dates are different. We irrigated last when it begins to head, that is in latter part of July. We irrigated oats the last time about the same date. We plant potatoes about the middle of May. We aim to harvest just before the frost gets them. They are ready from August 29th until September first. I usually cultivate only enough potatoes for my own use. Have never kept track of
433 the production. I cannot say what my heaviest crop is. That is not a country for the cultivation of potatoes for market. We are too far from the market. I just raise enough grain for my own use on the ranch and vegetables. I raise sweet corn for roasting ears, planting about the middle of May and it is ready for the table about September first.

Other than the crops mentioned, I use my land for native hay.

We have about 40 acres of alfalfa. One year with another we cut two crops. We harvest our first cutting about July 5th. It is
434 then about in full blossom. It is then in the best condition for hay. I obtain as a whole about a ton to the acre for the first cutting. We harvest our second cutting between first and 15th of September. I obtained about a ton to the acre last year for the second cutting, I don't know what I will get this year. Last year was a little above normal for my second cutting. I have been raising alfalfa in this one patch for 15 years. During that period of time my average production for that patch per second cutting would be about a ton per acre. The figures I have given are approximate. I only give alfalfa one irrigation after the first cutting. That is on account of this particular land gets seepage from other irrigation. I give the alfalfa this irrigation right after the first cutting. I do not think I have ever failed to get a second cutting on account of the frost. I don't know that frost has ever hurt my second cutting any, it has been touched once or twice but never destroyed. A frost about August 25, 1910, hurt my second crop but didn't destroy it. Quite frequently the frosts hurt my second crop, but do not destroy it.

The major portion of the land I irrigate I use for hay and pasturage. I do not know what you would term the native hay, it is called native hay. There are several varieties of grass. I would obtain about half a ton to the acre of native hay from the land which I cut. The choicest spots on my ranch will possibly grow a ton and a half to the acre. On those spots it will grow heavier than the first cutting of alfalfa. We figure if it does not average half a
436 ton to the acre we let it go for stock to graze.

I own the northwest quarter of Sec. 32, Tp. 14, N., R. 76 W. I own sections 28 and 29, same township. That is the old homestead. The other lands are on the table under Sheep Mountain. There are about 320 acres of 29 that you might call meadow land which I use for pasture. It is under the Sodergreen ditch and the Jones and Norton ditch. A good portion of the north half of that section is above water. I am including practically all of the south half of Sec. 29 as land of the character I have described. Some of the north half comes under the Sodergreen High Line. I would guess that about 200 acres of Sec. 29, the south half, are used for meadow, the remainder supports my work horses and my milk cows and stuff I keep around the ranch in the summer. I generally keep in there about 15 head of cattle and 40 head of horses, during the summer. This portion of Sec. 29 is all I have for pasture.
437 These stock obtain their entire feed there. I do not feed my cattle hay in the summer. These cattle graze this land during May, June and July, and about August 1st I turn them back on the meadows where I have been cutting hay. I also have my garden and buildings on south half of 29. I irrigate about one-half of the northwest quarter of Sec. 32. The south, Central and Sodergreen ditches cut that. The Central ditch has its headgate across the river from the Sodergreen ditch and uses the same dam. It irrigates a sort of an island. The island goes from the northeast to the southeast end of this quarter. This Central ditch irri-

gates that island. The South ditch irrigates the land between
438 the bluff and the old channel. The headgate of that ditch is about a quarter of a mile above the other dam and below that of the Popp and Pahlow ditch. South ditch is about half a mile long. The land irrigated by the South canal is used for native hay and is about 60 acres. About 50 acres on the Island are irrigated by the Central ditch. I irrigate Sec. 28 except the north four forties which are on the edge of the high table lands. My alfalfa
439 is towards southeast corner of that section. These lands are all that I irrigate of my home ranch. It is irrigated from 3 or 4 ditches. At the same time my new Sodergreen High Line ditch covers it all. I do not irrigate from the Parker ditch. I use the Sodergreen, Fischer and Jones and Norton ditches. The Jones and Norton ditch is sometimes known as the Popp and Pahlow and also as the Last Chance. It is on record as the Last Chance. It was located as the Jones and Norton ditch and then built down as far as my place. Years afterwards it was completed and called the Last Chance ditch. They speak of it generally as the Popp and Pahlow ditch, because those are the men who own it. I irrigated from that ditch. I have a 250 acre interest in it. I have sufficient interest in the Fisher ditch for the irrigation of about 100 acres.
440 The Sodergreen ditch belongs to me. These are the three ditches from which I obtain water for this land. I cut about 400 tons of native hay on my home place and these lands, being parts of sections 28 and 29 and the northwest quarter of Sec. 32, on an average year. I have about 800 acres in that field that I irrigate.

I stated that Frank Smith irrigated some land on their gulch or in that vicinity. He only irrigated about 90 acres. It lies along the margin of the stream. The only irrigation between his place and the state line is on the Boswell ranch. Some of the ditches that irrigate that ranch are taken out in Colorado. The Bliler and Boswell ditch is taken out in Colorado. They may have other ditches that I don't know anything about. Some are taken out in Wyoming. I do not know whether Boswell has any ditches out of Johnson creek. A fellow living on Johnson creek named Ovid has some ditches out of Johnson creek. A ditch takes water from the Laramie at mouth of Beaver, belonging to Boswell and irrigating a small tract at the mouth of the cañon. From there the river runs through a narrow cañon to the Frank Smith property, near Jelm. Jim Pollack is located next down the river from Frank Smith. He is between Smiths and Woods Landing, in the Jelm bottom. He irrigates small patches along the river. I don't
442 think he has over a quarter of a section. The next man down the river is Hanson. He irrigates about 80 acres, close to the stream. Both Pollack and Hanson properties are on the floor of the cañon, the mountains below the Hanson place close in forming a narrow cañon down to Woods Landing. The latter is near the east line of Sec. 10, Tp. 13 N., R. 77 W. At that point the Burg ditch, owned by Gus Burg's estate, takes water from the

river. This ditch is about 4 miles long and irrigates about 200 acres on the river bottom, but he extended his ditch out on Sheep
mountain flats and I don't know how much he irrigates
443 with it. He also owns the Fox creek ditch. That also goes to Sheep mountain flats. It is taken out of Fox creek at a higher elevation than the Burg ditch. The 200 acres irrigated along the river bottom run along edge of stream. The next ditch below
the Burg is the Jacob Lund ditch. He has a small ditch
444 on each side of the river taken out from the same dam. He irrigated about 300 acres. The land on the south side was originally upland, but he made it into hay land. The north or west side was old natural river bottom. It was used for hay always. He raises hay with both ditches. He owns Murphy ditch. It comes out just below his meadow that his two ditches cover. This ditch is about half a mile long and irrigates about 80 acres. The land
lying between the ditch and river. The next canal is the
445 Pioneer canal. My Sodergreen High Line starts there too, just above the Pioneer. This is the third year I have been irrigating land by my high line canal. I commenced the survey of this ditch in November, 1907. I began the actual work of construction in February or March succeeding the survey. The canal is about 9 miles long and was taken out for irrigation. I have irrigated from that ditch since I began. I ran water through the irrigating seasons of 1911 and 1912. In 1912 I ran water until it
began to freeze. The same in 1911. The ditch was never
446 full of water. Towards the last the water got low in the river. I have been running water through the year 1913. I stopped running water July 1. I own sections 5, 7, the west half of 8, 17, 18, 19, the north half of 20, and the southwest quarter of 20, Tp. 14, R. 76; also the north half of 30 in the same township and range, the north half of 24, Tp. 14, R. 77. All but 40 acres in Sec. 13, but the ditch covers only about 100 acres in 13. The canal was taken out to irrigate the lands described. I don't know how
much has been irrigated, all that I could. These lands lie in
447 a regular natural slope, and it irrigates by just turning the water out of the ditch at intervals. It was raw prairie land. The greatest part is hay land now. I cut about 50 tons of hay last year, but this year it came in fox tail hay and I didn't cut it. I left it standing for feed. About 100 acres is cultivated. 50 acres in Sec. 30, 40 acres in Sec. 20, and 10 acres in Sec. 24. The 50 acres on Sec. 30 was in oats. It has not been planted this year, it
was in 1911. During the last two years I have used it for
448 pasture. It will best be adapted for that purpose until I irrigate it long enough, until it will produce native hay, which comes some little later. It takes from 3 to 5 years of continuous irrigation to get this 50 acres on Sec. 30 to native hay. The 40 acres on Sec. 20 which I had plowed, were planted in oats 3 years ago and also in 1912 and '13. The oat patch on Sec. 20 is now growing a pretty fair crop. I had a pretty fair crop in 1911. It went about 30 bushels. I didn't get quite as good a crop in 1912 as I did the first year. I am going to put that field in alfalfa next

year. Of the 10 acres on Sec. 24, I had some oats and potatoes. It is not in crop this year, except a small piece of potatoes. I am converting the rest of it into hay land.

The chief value of this land is for native hay. The soil is quite thin and that beneath this top soil is quite a pronounced strata of very coarse gravel and fine sand. It has been my practice to run water out of this ditch constantly so as to raise the water plane in the gravel, that is our system with that kind of land. I do not know how much more water it takes to irrigate land that way than it would with the ordinary flooding or running of water in furrows.

I simply turn the water out of the ditches up near the main
450 canal and along the foot of Sheep Mountain and it runs down to this gravel. By this method it raises the water plane so as to eventually wet the grass roots. I don't know how thick the strata of gravel is there. They cut through it cutting through the supply canal for the Pioneer Canal Company, the Lake Hattie Water Company, they cut through it in places. I should think that this Lake Hattie inlet will serve to drain off the water from my land and thereby lower the water plane. My land is above and below the Lake Hattie inlet. My High Line canal crosses the inlet to Lake Hattie. I cannot give the acreage irrigated from this canal in the three years that I have been operating it. I have irrigated about 100 acres in Sec. 30, Sec. 19, a little over half of 20, 160 acres in 24, Tp. 14, R. 76. Perhaps 100 acres in 13, Tp. 14, R. 77. Nearly all of 18. I have considerable seepage from that ditch of the Pioneer canal company in sections 5 and 7. I ran water in there too, but it was hard to tell how much my water would irrigate. There must be half of seven and nearly all of 5 that is irrigated by these two ways and I don't know how to divide it. I do not know how much I irrigated on Sec. 17. I just turned water out at different times and didn't pay much attention to that, because it had a good deal of seepage from this ditch, and I didn't dare to give it much. After the season closed last year I irrigated considerably there after the regular irrigation season closed. I irrigated late to help fill up this land below. I do not know of any other ditch owners using this same method. I do not think the owners of land to the east and north of mine and principally under the Pioneer canal toward Laramie city have had to irrigate in the same manner. I think their sub-soil is not so deep. They generally run

water right over the top of their land in furrows and ditches.
452 I would obtain no results if I irrigated my land in the same way they do theirs. The water would all disappear. We have to irrigate this particular land of which I am speaking so as to fill this land full of water first. If you do fill it up until the water comes to the surface, then it takes but little water, and it irrigates easier after that, but it takes a tremendous amount of water to fill this ground full from the bed rock up. There is not much of any alkali appearing so far as I see. The alkali has appeared in only one small spot. If alkali is going to appear it should have come up by this time. I dare say that you can dig down into this land now and find water within two feet of the surface, and maybe

within a foot. The ground is damp now and has not had any water on it since the first of July, but whether it will be that way in the spring I could not say. I do not know that there was
453 any objection made to my use of the canal in 1911, '12 and '13 by other ditch owners. The Pioneer Canal Company shut me off about July 1 this year.

That is the first time when the water officials interfered with the appropriators.

The irrigation of these lands has been materially aided by seepage from the Lake Hattie Inlet canal. I do not have any way of knowing how much water it will take to irrigate this land after I have the water plane filled to near the surface. It has taken considerable water to fill it. It looks like it was pretty well filled now. It
454 don't take near so much to get it started this year as it did the year before. I never made any examination of the land east of mine to ascertain how far east that formation of thin soil underlaid with heavy gravel extends. The only thing I can go by is where they excavated those ditches. Through Sec. 21 and part of Sec. 16 where the old Pioneer canal cuts through, *there* seems to be shallow in spots there and they cut through into the shale in making that ditch. They cut into what we call yellow shale. I don't think this same top soil underlain with gravelly sub-soil extends a number of miles from my place towards Laramie and beyond what is known as the Nelson Road House. It is a different character of soil from what my land is. The gravel stops before we approach the
455 Seven Mile Lake. I do not think it goes much east of the Popp Lane. The soil throughout the entire Laramie Plains region contains a considerable amount of gravel. There is a difference in this gravel. In some places there is coarser gravel than others, and there is more of it in some places than in others. Up at the foot of Sheep Mountain, where my land is, most of the gravel is egg shape, and then it runs up to boulders as large as that (indicating), about half as large as a man's head on the surface. Where I cut my ditch through the hill over into the flats we found boulders as deep down as ten feet. The soil at the surface was about two and a half feet thick. When I was speaking of this area not ex-
456 tending so far easterly, I meant the area having this very large gravel. There is not nearly as much of it and not the same kind of gravel as there is up on the Sheep mountain flats. I have seen the ditch break out and water stand and flood there for acres and have to fix the ditch and leave the water stand there, and it would stand there for a week, and for that reason I know there is no gravel underneath. In my country where I irrigate it won't stand fifteen minutes. Down there it will stand for weeks. In the vicinity of the Grable place, there are some alkali lakes standing with water in them the year round. I don't call that gravelly land. There is gravel showing in the plowed fields. You would see gravel right on the surface. The gravel has enough soil mixed with it to make it tight.

The next canal down stream from the Murphy ditch is the Pio-

neer canal, the largest canal taking water from the Laramie
457 river in the Laramie Plains region. It was commenced along in 1879. It was enlarged during the eighties. I was superintendent of that canal for a number of years. I started in May, 1887 or '8, and had charge for ten years or more. My duties were to keep a continual flow of water in the ditch and look after it in a general way. I would open the headgates for the consumers. In 1879, when they built the canal, it was about 30 miles long. It went a little northwest of Laramie. The enlargement went to the same place. I only delivered water to the consumers at their lateral headgates. I could not describe the lands irrigated. I could not say which lateral received the most water from the Pioneer canal during the years I had control. Most of the lateral headgates were located down below Laramie from what we call West Laramie, the most of them were down. I never had charge of that. I always turned that over to another man. I turned the water over to him at the Preigle ranch. It was in vicinity of Seven Mile Lakes in Sec. 16,
458 Tp. 15 N., R. 74 West. There were a good many users of
459 water between the headgate and the Seven Mile Lake. Starting at the upper end of the canal they used a little water at the Johnson ranch, close to the headgates, on the river bottom. The next place was near Sodergreen Lake, a ditch comes out there and irrigates some land. It crosses Last Chance and Parker ditches and irrigates some ranches on that bench. It irrigated the Tommy Hefron ranch. Mr. Matson has that ranch now. Bloom also irrigated under that lateral. A Russian, Harvenneck, lives there now. The
460 Stromberg place was also irrigated. The Bloom place was east of the Popp Lane. The Stromberg place was south and east from the Bloom place. I think those were the lands irrigated from that lateral. The next place down the canal is Sec. 16, Tp. 14, R. 76. Chris Gabrielson irrigated from that lateral. He lives on Sec. 10. He has been there 10 or 15 years. He used that
461 lateral entirely. The next lateral starts right close and runs due north and irrigates close over to the next township half section. Pretty nearly east of Lake Hattie. Two homesteads of 160 acres each irrigated from that lateral. That was built 10 or 15 years ago. I do not know how much of their land they irrigated. The next lateral was one for the irrigation of part of Sec. 11. All land in Sec. 11 lying north and west of the Pioneer canal was irrigated by Nate Johnson. I put a box in there when I had
462 charge of the canal. The next lateral was in Sec. 1, Tp. 14, R. 76 and used for the irrigation of Sec. 1. A portion of Sec. 1 does not require irrigation owing to seepage and a portion of it is high grazing land above the canal. The next lateral was on Sec. 6, there was the Vass and the Roberts ranch that irrigated
463 from that lateral. The location of the original Pioneer canal was abandoned on Sec. 6 and the line was run across Sec. 6 and into Sections 31, 32 and 33 in the township above. Benson lives now on the Roberts ranch and Mr. Vass still lives there. The next lateral was for Sec. 32. There were four settlers on that section.

I do not know how much land they irrigated. The next
464 lateral was at the Osterman ranch in Sec. 28, Tp. 15, R. 75.
The next lateral was at the Joe Wheat Ranch. He used to
465 irrigate about a half a section below the ditch. Possibly Sec.
26. Those are laterals out of which I distributed water.

The settlers secured water during my administration by paying the company fifty cents an acre per year. The Wyoming Central
Land and Improvement Company, or may be it was the
466 Pioneer Canal Company, they were the same company. I
delivered the consumers practically all water they wanted. We had plenty of water for all.

I do not think that any of lakes which appear on the map below the Pioneer canal are used for the storage of water for irrigation. The water is always there. Whatever gets out has to evaporate. Practically all of them have always had water in them. I suppose they obtained the water from rains. They were natural basins. Since the irrigation in that country they have filled naturally. None
of them are used for irrigation. We began running water in
467 the Pioneer canal about April 15, and kept it running
throughout the season. When I was superintendent the most water was used at lower end of the Pioneer.

This land under the Pioneer was settled in 1887 as now, only more of them now. Shortly after 1887 during the early nineties a number of families sold out to their neighbors. A good many of the holdings under the Pioneer are larger now than in earlier days. They have not so much bought out their neighbors as they have purchased railroad lands. I cannot give you the land under the Pioneer canal that was meadow. A man that had 160 acres if he could irrigate it, he would farm all he could of it and the rest he
would irrigate for native hay. Wheat and oats were culti-
468 vated under the canal generally for market. I understand
the Millbrook project owns a mill in Laramie and a 5,000 acre ranch. They haul their grain to the mill. The Millbrook
ranch, on the north side of the Little Laramie, is part of
469 the Bell ranch and distant 4 or 5 miles from the Hahns
Peak railroad. I think the mill is in operation now in Laramie. At one time Augsperger ran it. I cannot approximate the years the mill remained idle. There is land under the canal between the head of the canal and the Seven Mile Lakes that is unbroken prairie. A man cultivating native hay don't break his land, just irrigates it. The greater portion if the land between the ditch and Seven Mile lakes is cultivated. Some pieces are used for pasture.
It has gone into the hands of private owners. I include as
470 cultivated that irrigated to native hay as well as that actually
tilled. I have not gone over this land to determine how much is irrigated, I am judging from general observation, from a distance. I understand that Mr. F. C. Grable and Mr. J. S. Grable did buy a ranch or two. I guess they have sold some of it, but they haven't cut it up much. They may have sold some of it, but the settlers are not there. The Grable ranch receives its water from the Fischer ditch. The Fisher ranch didn't receive any water from the Pioneer.

These meadow lands were irrigated in the same manner as the meadow lands on the bottom.

471 Cross-examination by Mr. Fred Farrar:

I do not know how many acres were irrigated under the Pioneer canal when I became superintendent or how many are now. I cannot give you the population upon the various ranches irrigated from the Pioneer canal in 1886 or now. The canal was constructed before I took charge as superintendent. I was on the ground and helped to make the canal. I think they turned water in the enlargement in 1885. The first ditch that was constructed was built in 1879, I think. The original ditch was as long as the present ditch. They have a waste ditch at the lower end, in case of a rain or flood up the ditch they could turn it out. The original ditch, before enlargement,
was just a small ditch, 5 or 6 feet wide on bottom. I don't
472 remember how much water it originally carried or know its present capacity. General farm crops were irrigated under this canal in 1886. They had not then begun raising native hay but they raised oats and grain and vegetables the same as now. I have not been down at lower end of canal in years and cannot state how far beyond a point directly west of Laramie it runs. It may run approximately 10 miles and it may have been extended. I don't know.

The Laramie, Hahns Peak and Pacific railroad runs nearly west from Laramie. It does not follow the Laramie canal. My nearest railroad station is Laramie, 23 miles by wagon road. Laramie is the nearest railroad station on Union Pacific to all ranches on this canal up the river from Laramie. The Laramie, Hahns Peak and Pacific Railroad was built a few years ago. Laramie still the most practical point for people under that canal. Any wheat raised under the canal for sale at Laramie would be hauled from the ranches to the city by wagon. I don't think they raised very much wheat under the canal in 1886. They never have raised any great sight. They
raised more oats than anything else. The oats were raised
473 for commercial purposes and for feed on ranch. Hay cut on land under this canal compares in quantity about the same with the hay on bottom land. About the same variety of grasses. It is composed of wire grass and blue stem. Hay raised on ranches under canal was fed to stock of settlers and some of it came to town to supply livery barns and dairies. Hay on ranches not adjacent to Laramie was fed to stock. Nearly all ranchmen under this canal had a small dairy, raised a few horses, and made butter. I do not know that I have had any litigation with the Pioneer canal people. I am proving up my ditches. We always settled our difficulties without going into court, unless it was some years ago. Maybe there is something pending that I don't know anything about. When we want to prove up our ditches, everybody up and down the river filed a protest against the way the Pioneer people were trying to prove up their water rights and also the Wyoming Development
Company. I was a party to the litigation. I do not remem-
475 ber whether or not I testified. I could not say whether or not fewer people actually live under this canal today than a

number of years ago. I don't travel along that ditch, and there are lots of people along that ditch that I don't know. I do not know that ranches formerly owned by various persons have been consolidated, except the instance near the stockyards, purchased to have a ranch for cattle shipped in transit. It is possible that Talmadge and Buntin bought a few ranches and consolidated, but there are people living in all those houses. Whether they own or rent them I do not know.

I did not have a measuring weir at headgate of Pioneer canal when I was superintendent. Water was never measured out to me by state officials. I was allowed to take all I wanted without interference. This canal is not further than 4 or 5 miles from
476 river at any place. The line of canal is parallel with river for its full length. The general slope of country is toward river. Sometimes there is a little basin and it slopes toward the basin. The inlet to Lake Hattie reservoir leads out of Pioneer canal. The canal was enlarged from headgate to this point. I do not remember when the work was done, but they started at Sodergreen Lake. They then started two machines—one went down toward Lake Hattie, and the other went up Pioneer ditch, followed its old line except where they left a lake. They cut across land of mine until they struck the old ditch then followed it up. That work was done somewhere in 1911, by contractors. I believe the company was
477 the Laramie Water Company. This intake from Pioneer canal to Lake Hattie was excavated, but not to its full size all the way. They used the steam shovel, or drag line, to a point within a mile of Lake Hattie where they quit work with this machine and made a very small ditch with teams, plows and scrapers; and then turned the water in and let it sluice it out. The water through this portion cut a channel into the reservoir, which channel is now 25 or 30 feet deep in places and 25 or 30 feet wide. A little water was turned into the reservoir in 1911. Water ran into the lake during 1912 during the high water season, for about two months. The same is just about true of 1913, maybe not quite so long. I haven't seen the reservoir in 1913. I saw it in 1912. It was not filled. Water was carried over in the reservoir from 1912. No water was used out of it in 1912 for irrigation or any other purpose. During 1913 I have seen water in the ditches below here, but I haven't been to reservoir. I don't know how much water was held over at the end of 1912. The water in the reservoir finds its way back in part into Pioneer canal. I never did work for Mr. E. D. Titus.
479 I think the Laramie Water Company built Lake Hattie. Mr. Goldsborough is the head man in here doing the construction work. What position he holds I don't know. I met some of the other officers but I don't remember but one man's name, McDonald. He traded with me for right of way through my ranch for ditch. I was familiar with the companies out of which the Laramie Water Company was formed. The Laramie Water Company absorbed the Wyoming Central Land and Improvement Company. They were local men and lived in Laramie, pretty near all. It was an old company. I do not know of recent companies out of which

the Laramie Water Company was organized. The Laramie
480 Water Company absorbed the Pioneer company. I met Mr. F. C. Grable. He was operating in this valley. I do not recall the name of this company. I knew Colonel Bell. I think he and Mr. Grable were associated in one or two projects. The Laramie Water Company bought up the Pioneer ditch with its appropriations. I suppose these appropriations are now used to a certain extent in Lake Hattie. There is an enlarged system of ditches from Lake Hattie. I do not know capacity of Lake Hattie. It is a big body of water. If the water was not stored in Lake Hattie it would go down to Wheatland reservoir, the next reservoir. I do not know
481 whether or not the owners intend to put water in Lake Hattie during the winter months. They ran a little water last winter and it began seeping out onto my land under that ditch and I made them shut it down because it would freeze on top my land and spoil my pasture. They didn't run much last winter. I don't think they ran any water in winter of 1912. I required them to shut the water out of this ditch because it seeped through banks and went on my meadow and the cold water made it overflow and freeze on top of the grass, for winter feed.

They do not customarily use water in the river, only for stock watering. For domestic purposes only. No water is used in our valley for irrigation during winter. It never has during my residence in this district. Water is stored in Lake Hattie from Big Laramie river and some from Little Laramie river.

482 Cross-examination by Mr. Delph E. Carpenter:

Sodergreen Lake is located on Pioneer ditch, on Sec. 28 and 21, Tp. 14, R. 76. The water is run into the reservoir from river and then drawn out through the Pioneer canal, they have bifurcation works there. When the Lake Hattie people obtained control of Pioneer canal, they enlarged Pioneer canal from Sodergreen Lake up to the river. The inlet to Lake Hattie leaves the Pioneer canal at Sodergreen Lake. At the bifurcation works, one line of the ditch goes to Lake Hattie and the other is utilized as the old Pioneer canal.
Lake Hattie inlet runs northwesterly from the lake. The old
483 Pioneer canal runs northeasterly. The Sodergreen lake is still used as a regulation basin up to present time.

The old Pioneer canal was 16 feet on the bottom. The new ditch is 40 feet on the bottom from Sodergreen Lake to river, and is capable of carrying considerable more water in depth than was the *one* one. When I speak of a 16 foot bottom on the old canal I mean as enlarged in the eighties. Prior to the eighties is was smaller than a 16 foot bottom. I have never been to Little Laramie river to observe the inlet canal for diverting water from Little
Laramie river to Lake Hattie except where it crosses the
484 road. The inlet from Little Laramie river is of good size. They have run some water through there. This inlet is about 14 or 16 feet wide. If the Lake Hattie people did not divert the waters of Little Laramie river by this canal, and discharge

them into Lake Hattie they would empty into the Big Laramie river and go into Wheatland reservoir, both winter and summer.

The Lake Hattie people are constructing a ditch diverting water from Douglas creek across the divide and over into Little Laramie. Douglas creek is west from the headwaters of Little Laramie. It is a tributary of North Platte. When this ditch is completed it will bring the waters of Douglas creek over the intervening divide and discharge them into Little Laramie river. That water will then be diverted into Lake Hattie through the inlet ditch from Little Laramie river to the reservoir.

485 Cross-examination by Mr. Fred Farrar:

The headgate of the old Sodergreen ditch was built in 1878. I used the ditch that year for garden and a little of hay land. The ditch I had constructed in 1878 was about a quarter mile long. It was afterwards enlarged and changed too, but it was started from the river at the same place. That was in the spring of 1884. It is two miles long now.

I cannot estimate the amount of water stored in Lake Hattie during 1913. There is water there now. Water has been withdrawn from the reservoir. They turn some of it into the old Pioneer canal and are using it for irrigation. I do not know whether or not they are using all they turn out, or what they do with it. They were to do that to help those Wheatland people out. They were short of water. It was their plan this fall to draw water out of Lake Hattie and drop it into the river, to allow it to be intercepted by Wheatland reservoir, because of the scarcity of water at Wheatland. The Lake Hattie people stored more water than they needed this year.

486 The ditches which I have mentioned with the exception of Pioneer canal and Sodergreen High Line, are all relatively small. They are built on bottom lands along the river. Riverside No. 2 is a pretty large ditch. No ditches taking water in vicinity of my place divert water any great distance from the stream except Parker ditch and Last Chance ditch. They are taking a little further away.

487 Even with the Pioneer canal the greatest width of land between it and the stream does not exceed 4 to 5 miles. The others are all less. In some instances not more than 200 yards. I had occasion to observe the effect on the river, when water is taken out in these ditches and used on the bottom land close to the river. You can see seepage most all along the river down to the Riverside, coming back into the river in the wintertime because the ice don't freeze along the banks of the river and we call it seepage. It don't seem to raise the water in the river, but there is a little seepage there all the time. The river being the natural drainage of the country, it would naturally all drain toward the river.

I have noticed the character of soil on the bottom land along the river. The bottom of the river is gravel and sand. Close to the river most of that land is black loam mixed with sand and gravel.

Where the water overflows, it has deposited a sediment in this gravel and formed a soil that looks like black loam mixed with sand
488 and gravel. It is a porous soil. Under this black soil is gravel. There is a gravel sub-soil throughout the bottom next the river. The first bench is the next bench above the old original river bottom bench land. It is very nearly uniform up and down the river and is 3, 4, 5, or 6 feet above the river bottom. It is sand and gravel mixed with soil on top. The soil, both on the present river bottom and on this first bench is obviously sand and gravel made by the river wash. The depth of soil on top of sand and gravel varies. It averages two or three feet. There are places where there is no soil above the sand and gravel. It requires
489 less water to irrigate the river bottom than the first bench land as the irrigation progresses. A certain quantity of water will today irrigate more land in the irrigated section than it would formerly. Under the Pioneer canal there are meadows which are now irrigated entirely by seepage. There is one little strip under this canal that has always had seepage. It starts on Sec. 16, Tp. 14, R. 75 and continues through 10 and into No. 1. There may be a little seepage below that. Some small lakes and ponds within the area irrigated by the Pioneer canal and other ditches receive water from seepage, but most of these lakes always did have water before the Pioneer was built. The water has been increased in many of them since the irrigation. I do not know that
490 it has become necessary to drain any lands under these ditches. I saw water standing on the Grable land. I don't believe if the land was mine I would drain it. I don't think there was water enough to hurt the land. I wouldn't put so much water on it and don't think he would. The ditch broke and the water simply stood there. If he had used the land for native hay it would have been just what he wanted. If he had plowed and farmed it, it would be too much. It would kill his grain.

Cross-examination continued by Mr. Delph E. Carpenter:

I have an idea the water stands all the time less than 3 feet below the surface under land I have described as being seeped in Sec. 16 and Sections 10, 11 and 1. I have never examined it.
491 There appears to be a strip across these sections, about a mile wide, where the water stands less than 6 feet below the surface. The grass grows without irrigation. I don't know how far that moist strip extends below the Popp lane. I have an idea that some land under Pioneer canal on Sections 33, 34 and 25 in Tp. 15, R. 75 is seeped. I have not been there for many years. I am familiar with Seven Mile Lakes. They lie along the road southwest of Laramie in Sections 21, 20 and 29, Tp. 15, R. 74. I pass them in going to and from Laramie. I guess there are stretches from there almost to Laramie City in which the water is very close to the surface. That land has all been irrigated from the ditch. It appears moist during the year. The water does not appear to be

almost at the surface outside the irrigation season; There
492 is a white deposit along there, alkali or soda. The people call it soda. It is on a direct line from the soda lakes. Some land on south side of road coming in from Seven Mile Lakes to Laramie City appears to be affected with seepage. Whether it is direct irrigation or seepage I don't know. Ditches are there crossing the road and irrigating the land below. Under this Fischer canal and in the vicinity of the place now owned by Mr. Grable there is a stretch covering portions of Sections 16, 17, 9 and 10 in Tp. 14, R. 75 where the water stands pretty close to the surface, quite similar to that land northwest of Pioneer canal I first described. My opinion for the water standing so near the surface near the Fischer ditch is that it is only a short way to shale and it can't seep through and get away. The water has poured in from irrigation the past two years and the rains. The little lakes used to contain water before there were any ditches there. One lake is now dry and has been dry all summer. I haven't been over to the other lake this summer.

493 Cross-examination continued.

By Mr. Fred Farrar:

Part of my land is river bottom or first bench land. My land under my High Line ditch is higher. My ranch joins the Riverside on the east. My land compares about the same with the Riverside, on the same bottom. The methods of handling these ranches are about the same as to irrigation, harvesting, etc. They are practically the same land, except that I am immediately above the Riverside.

The Millbrook ranch is over on the other side of Little Laramie. The land is sand and gravel. There is very much difference between that land and my land. It is bench land.

I am generally acquainted with the place owned by Mr. Corthell west of Laramie City. I think the soil there is a little different from on mine. I do not believe the Riverside land on the same bottom is less valuable than mine generally. I do not know that there is very much difference between my land under the High Line and the Riverside place. When land can be irrigated it is pretty nearly all the same value. I don't think there is very much difference between my place and the Millbrook place. The Millbrook ranch, where cultivated, is in a greater state of cultivation than anything I have, and maybe worth more at present. I don't
494 know that there is much difference in value between my place and the Corthell place. Corthell's would be more valuable per acre. It is nearer Laramie. Aside from that I don't think there would be very much difference in value, eliminating improvements. The same would be true of the Riverside ranch. I don't know what is raised on the Millbrook farm. That was formerly the Bell farm. I am not acquainted with the Haley ranch,

I have been across it. I don't know *how* owns it. I don't
495 know the number of miles from Laramie, 10 or 15. In a northerly direction. I have always heard it is included within the Talmadge and Buntin project, but I do not know.

495 Redirect examination by Mr. John D. Clark:

When I came here in 1877 there were but 8 or 10 places between Laramie and my place, and there was very little irrigation. The bulk of the country was unfenced.
496 Now it is all settled and fenced. The settlements on the Laramie Plains are numerous. That came gradually. Two of my neighbors raise some apples but not extensively.

Recross-examination by Mr. Fred Farrar:

The other man raising apples was on my place, just where he planted the trees. Durant owns it now. I do not know how
497 many trees Mr. Lunt has, maybe 50 or 75. There are 6 or 8 trees on the Durant place. They are the regular apples. I think they are different varieties. They are a very good dark red apple. He had 4 or 5 barrels of them one time when he was picking them.

Recross-examination.

By Mr. Delph E. Carpenter:

I do not know whether there are more than 8 or 10 ranches occupied on the river bottom between Laramie City and my ranch. It is 30 years since I went down that river bottom to Laramie. I judge there would be twice that many or more.

There are lots of people I don't know their names living in there now. To start at the river and go down as far as I can from my place, then comes Durant, Olsen, Benson, Riverside, Fischer, Mansfield, and there is a big bunch of people I don't know who they are.

(End of Transcript vol. 1, Complainant.)

FRED RICKARD, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

499 I live on the Laramie, 14 miles southwest of Laramie on Sec. 12, T. 14, R. 75. Have lived there most of the time since 1898. I own the ranch, and the Bush and Holliday ditch. The ditch was in operation when I first went there—had been built some years before.
500 It irrigates 180 acres in Sec. 14, 90 to 100 acres in Sec. 13. 80 acres in Sec. 6 in the next township east. I irrigate 500 acres in Sec. 12.
501 Mr. Wymore irrigates 40 acres on Sec. 12. We grow hay principally, some grain.
502 We have stock—principally horses and cattle. Our water comes from the Laramie. I have been short of water several

years since I have been there. I did not have half enough this last season. The shortage was in the river. When there is lots of snow in the mountains we have plenty of water; but in some winters there is not much snow, then we are short of water. We were short of water in 1902, short in 1903, very short, this year we didn't have half enough. In other years we were a little short but it was not so bad. There have only been two years when we had plenty. In all the other years we were more or less short.

503 I also have an appropriation through the Hogue and Haley ditch and get some water through that, for 40 acres of my land.

FRED RICKARD.

504 Cross-examination by Mr. Delph E. Carpenter:

I own 160 acres in Sec. 14 and all Sec. 12 except 80 acres. That is all. Mr. Mason owns the west half of east half of Sec. 14. Mr. Wymore owns the southwest quarter. The Riverside ranch owns the remainder. It belonged to Caldwell and now the Denver-Laramie and Northwestern people own it. Sec. 13 belongs to the Caldwell field. That belongs to the Denver Laramie Realty Company. These lands are in Tp. 14, R. 75. I homestead 160 acres in 14 and I bought 400 acres of Mrs. Bush in 12, and then one of my boys homesteaded the other 160 acres. I took up the east half of east half of Sec. 14, in 1898. At that time I was a railroad engineer. I proved up the 160 acres in 1904. I bought a relinquishment of Joe Walters. He was in Texas and I think he is now. I went there to live in 1904. The Denver-Laramie Realty Company owns a portion of Sec. 6. There was 80 acres that Mrs. Bush sold to Hogue and the other 240 Hogue had previous to

506 that, I don't know how long. That was on bottom land. The rest of the section was on the hill and not very desirable land and I think it is Government land yet. On Sec. 14 of my 160 acres I irrigated the south 40 from the Hogue and Haley ditch. It runs through the south end. About the second 40 from the north end is irrigated by the Bush and Holliday ditch. I still irrigate that south 40 from the Bush and Holliday ditch. I had about 12 acres plowed on the 160 and the north 40 I used for pasturage. I used the rest of the 160, except the 80 acres irrigated, for pasture. In Sec. 13 are about 40 acres belonging to the Denver-Laramie Realty Company (formerly belonging to the Caldwell fields), with hay cut on same. Over half that section can be irrigated and is mostly all irrigated. It is pretty good hay land and is irrigated from Hogue and Haley ditch. The north 40 in the northwest corner is used to raise hay. I had to purchase a right of way through 13 to

507 put a branch in there. The old ditch was there already. I irrigate nearly 500 acres in 12, a little over, with Wyomore's 40. oYu can call that either a farming or a hay country.

508 I don't consider it extra good for farming, it is good hay land. I can buy my grain cheaper than I can raise it, and

I have done that. This year I didn't cut very much hay on my land. I have never cut very big crops on my place, because I have never had water enough to find out what it would produce. On the homestead, I always have plenty of water, and that has produced over a ton of hay to the acre. It did this year. Down on the other 400 acres we are generally short. We won't make this year an average of a quarter of a ton to the acre. It won't produce without water and we didn't have it, in the early months this year. When the river is high we have plenty of flood water, but ordinary years we don't. The water that flows in the river at Wood's Landing, is used before we can get a chance to use it. This year they took so much of it into Lake Hattie is one thing that made us short, that hurt us a good deal. Then Mr. Sodergreen has a brand new ditch running full this year. They hurt us fellows down there. They got the first whack at it and took it whether they were entitled to it or not. They do generally.

This year was the first time I ever made complaint to the water commissioner, but it didn't do any good. I guess they allowed the Lake Hattie people to keep right on taking the water too. I went up there after I made complaint and I saw the water was running as lively as ever. Sodergreen's High Line was running water too. They kept on leaving me dry. There was a little water which went down my way that we didn't get this year. If my gates had been down to the river bottom I could have got the water, but I wasn't prepared for such low water as we had this year. Between the general shortage of snow in the mountains and Lake Hattie inlet and Sodergreen's High Line ditch they drew the river down so low that I could not get any at all. I had a little water about a week. The water I got was from the Hogue and Haley principally. The

Bush and Holliday ditch was never intended as a high water
510 ditch. The gate never was put down as low as it ought to have been. The ditch was never constructed deep enough into the ground so that it would draw the water from the river during the time the water was low in the stream. Before this Denver-Laramie and Northwestern got hold of this ditch I used to get plenty of water, but they put that down so low it wouldn't run over through their ditch into mine, so where I used to get pretty fairly safe on water before, since they have got that I have had to look out for myself for water. They put that down into the river bed. They can run water the year around in the Hogue and Haley ditch. This ditch was extended and the headgate put up stream before the Denver-Laramie Realty Company bought it. Mr. Hogue extended it but he just run it down a big swale there and didn't build much of a ditch. Aftr the Denver-Laramie people got hold of it, they made

a good ditch of it. During the days that Hogue had it it
511 would overflow and my ditch would catch all the overflow. Then there was the Caldwell ditch, that used to be running, and there was a lot of overflow from that and we caught all that overflow from the King and the Caldwell ditch, and in years when there was plenty of water we had water anyway, whether we got any out of our gate or not, but we don't do so any more. There was

water going past our headgate in the river even this year that I could have diverted had my ditch been excavated low enough so as to drain the river at that point, but it was mighty little. There was another year that was worse than this one, 1903. That year there was no overflow from the Caldwell, King or Hogue and Haley ditches. I was short that year.

I do not have any dam in the river at the point of diversion. There used to be a dam there, but it is a pretty hard place to put a dam in, quicksand, washy. I would have to deepen my ditch about two feet or two and a half at the head to draw water from the river at a low stage. One year with another I have had high water during June so I could divert water even with my ditch as it has been. I would be able to divert water from 3 to 5 weeks during those high stages. The river channel is probably 40 to 50 feet wide at my headgate. There is only once in a very great while that the river gets out of the channel, two years since 1903. There are overflow waterways through the meadows on south side of river, but it is very seldom that they ever have any water now. When the water is up as much as the banks of the river will allow it is a tremendous amount of water. We don't get it any more. During high water the last few years the flow of the Laramie river has not been very steady. It has been quite changeable. Sometimes there will be as much again water as there is at others. I notice it pretty close, and this year particularly there were days when the water would vary pretty near half. That comes from big headgates up there, from the raising and lowering of those headgates higher up. I never com-
513 plained to the river commissioner before this summer, but I had reason to.

The river commissioner never has measured the water in my ditch. I have no measuring weir. We take what we want. We raise the headgate until it will fill the ditch. That is the only way we ever measure it or have it measured, and always have done so. From the Pioneer they have a system but this is on the river bed. There has been some little contention about that on Sand Creek, where they had to shut down to allow other people to get a little water not on the river. This Laramie Plains region is a good place for oats, wheat, rutabagas, turnips and stuff like that. Yes, any stuff that grows in cold climates.

514 The principal value of my ranch is for raising hay and feeding it to stock.

We consider $12 a good price for hay, baled. Delivered in Laramie. Hay runs from $6 to $8 in the stack. It hardly ever goes under $6 that is native wild hay. I do not raise alfalfa. I do not know its comparative value with wild hay. I have bought considerable of it in the winter but never when high. I run a little dairy and when pretty good and fairly low price buy to feed my dairy. I paid $6 and $7 a ton, in the stack. I had to haul it about 4 miles. I get the principal return from my place from dairy cows and I raise a few horses to sell. We are milking 14 cows now. I use part
515 of Sec. 12 for pasture in the summer. I have not sold or rented any pasture.

The going price for cattle pasture in my vicinity during the winter is about 40 cents per head per month. Horses are more. Winter pasture runs from 30 to 40 cents. That is the uniform price for all cattle, of grazing age. The going price for horses for winter pasture is about a dollar per month. A horse eats more and takes more pasture than for cattle, and horses are more injurious to pasture, they graze shorter than cattle.

516 Cross-examination by Mr. Fred Farrar:

I have never raised wheat on my place. I have never raised oats. I am 14 miles from Laramie, my nearest railroad point. The products from my ranch are limited to hay and butter. Turnips, rutabagas and so on are raised to a certain extent in the valley, commercially. They are not shipped out of here, just to Laramie for local use. We sell all we raise right here. There is no market garden in this valley for exportation. There is not a great deal of wheat. They can raise fine wheat. I saw some fine wheat the other day on Mr. Harley Grable's place. The old John A. Fischer place. Just about ready to cut. He has some fine oats too. That is on Sec. 17-14-75. There was probably 15 or 20 acres of wheat.

517 There isn't much wheat raised. There are more oats raised than any other grain. We don't raise much hay on the plains, just the river bottom. Over the plains hay and oats are the principal crops. My land is all river bottom land and not as favorable for grain as the plains. It is different soil. I could raise oats there. I have not done it on account of the late irrigation. I find it cheaper to buy my oats than to raise them. I buy of people on the ditch. Of my neighbor. I bought my oats this last summer from Harley Grable. He is under the John A. Fischer ditch. I bought these oats threshed.

518 I was short of water this May. I think they were then putting water into Lake Hattie. They were putting water in Lake Hattie in June when I was up there. My complaint to the water commissioner didn't help me any.

I bought oats in previous years from Charlie Osterman and Johnny Barth. I bought 12 or 13 tons threshed of Johnny Barth one time, raised on the Hogue farm. I fed them to horses, 35 or 40. I generally keep from 10 to 12 work teams. In the winter I pasture my horses on Sec. 12 and in summer on the north

519 side of Sec. 12. There must be 100 acres, over on the side of the hill and the river runs through. It is not meadow land and we use that for pasture. I own that land. This last year I had half a section 2 also. I didn't pay anything for it. It belonged to my mother and I done some fencing and fixed it up for her and had the use of the land. Final proof is made but she has not got her patent yet. It is a homestead of 160 acres. She had half a section but relinquished it on account of water. In other years I pastured my horses on railroad Sec. 1. It is fenced. I owned it. I sold it but had the use of that two years after. I ran my horses there

520 except my work horses. I had 10 or 12 horses and part of the time 35 or 36 cattle in this pasture, I could not say how

long. I buy and sell cattle and some of the time I didn't have any cattle, only my milk cows. I did not have these cattle in there during all the season, I would run them on the meadow after the hay was cut. I would put them in this pasture about the middle of May. I kept them there until July. I had pretty nearly enough stock in there to consume all the grass. This is the first year I have ever run my cattle in that pasture. I had lots of outside pasture there in other years. We used to have Sec. 2, a Government section we used to pasture. It was fenced. Then there was half a
521 section in another field that Hogue called the hog pasture. I think it is a part of Sec. 6, Government land. There has never been any water on this land in Sec. 2 which my mother took up as a homestead. It could be irrigated from the Pioneer or Fisher ditch or from the river. Just grazing is all I consider land in this section good for, the way the water business is now. I have 560 acres. One of my boys has 160 acres in homestead in Sec. 12. I consider my 560 acres worth $25 an acre. That includes land, improvements and water rights. I would sell. I listed it with brokers at $35 an acre two years ago. I would not take $20 an acre for it. My assessment is about $6 an acre. That don't really fix the value that I would put on it. A man would have to give me what I thought it was worth. About two years ago I was offered $15 an acre for that place and refused it. I would feel the same today. Land has gone higher during the last two years. Land has sold as high as $50 or $60 an acre on Riverside ranch. I couldn't give the description of the land that was sold. There is a lot they claimed to have sold at that price. I suppose the Denver-Laramie Realty Company sold the land I mentioned. As I understand, the biggest part of the Riverside Ranch has been sold by the Denver-Laramie Realty Company. To my certain knowledge there is only one family to whom the land was sold that is living there. I have a letter from a couple that claim they bought land there and wanted me to look after it for them. I could not give you their names and addresses because I never answered their letters. I don't know what lands they bought.

524 Between 1898 and 1904 I made my home on the ranch. I worked on the road part of the time and was out there sometimes as high as three months at a time. I was an engineer on the Union Pacific. Part of the time I was working extra. I was down in Kansas once for three months. I lived at Medicine Bow for five years, then I liver right in Laramie until 1898. I was on the railroad until 1904.

ANGUS SUTHERLAND, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

524 I have lived in Albany County over thirty years. I know the country along the Big Laramine from Laramie up the stream.

525 I worked for ranchmen along the river and for the last fifteen years have owned a piece of land, the Southwest

quarter of Section 32, Township 15, Range 74, on the river. We cut hay on about 40 acres. The hay was made from overflow from the river. Had a dam that backed the water up and did not have to use ditches. The average yield would be about 20 tons.

526 If the water were taken from the river it would not produce any hay. It could be irrigated from a ditch.

E. D. TITUS, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

527 Am 57 years of age; have resided in Albany County, Wyoming, over 25 years. Prior to that had spent some years in Albany County. Engaged in ranching on the Big Laramie River from three to eight miles from Laramie for about 23 years. Superintended the Pioneer Canal 14 or 15 years. In my ranch business had experience in irrigation of ranch lands. I know Frederick Rickard's ranch. Also Bush and Holliday Ditch and the lands irrigated by that ditch. About 700 acres are irrigated in Sections 14, 12 and 13, T. 14, R. 75.

528 Section 7 had irrigation from that ditch. Mr. Hogue irrigated the land in Sections 13, 6 and 7. The Denver-Laramie Realty Company now own it. Bush and Holliday ditch was built in the 90's. The Caldwell and Gardiner Ditch irrigated that land before the Bush ditch was built. That was true ever since I have know it, which has been 25 years. I know the Sutherland tract of land in Sec. 32, T. 15, R. 74. The river runs through it.

529 Part of that land is irrigated by overflow. 50 or 60 acres. He has always cut hay there. The irrigation is artificial. A dam is put in the river and raises the water so that the water does not have to get high in the river but flows over the land. The dam belongs to the Heart Ranch. The first dam was put in 23 years ago. I built the present dam six or seven years ago. In Section 11, T. 14, R. 75 there are lands irrigated in the same manner, but without a dam. Hay is put up there. Other lands down the river in Section 12, T. 15, R. 74, are in the same condition.

530 Quite a good many tracts along the river are in the same condition. They produce the best and biggest grass, more per acre, than the other irrigated lands. That irrigation is largely seepage and overflow. Were the water withdrawn from the river they would not produce grass. In dry years they produce only about a fourth as much as in normal years. I have known the Heart ranch for 37 or 38 years. Worked on it at one time and lived in the vicinity.

531 In the spring and summer of '77 and '78 I worked there and the lower part of the Heart ranch was irrigated through a ditch called the Bilderback ditch, or at that time may be called the Hutton ditch. Bilderback enlarged it. It irrigated land in Section 28, south of the river, practically all of Section 33, most of 34, nearly all of 27, about half of 26, 160 acres in 35, nearly all of 23 that is south of the river and a portion of 22, all in Town-

ship 15, Range 74. The lands mentioned are a part of the Heart ranch. Four or five years ago the Realty Credit Company and Mr. Buntin became connected with the property.

532 The Wyoming Central Land & Improvement Company owned it at one time. Haley had it at one time. Charles Hutton first had it in shape. The Laramie Plains Land & Cattle Company owned it at one time. All of the lower lands next the river in Sections 28, 33, 27 and 14 were irrigated by overflow, that is by throwing dams into the old river beds of manure and dirt it raised the water and spread it out from one old river-bed to another. In that way practically all the land was irrigated that is now irrigated. They irrigate now through ditches because they could not get the waters out in any other way. This was largely caused by the drawing off of water by the Sky Line ditch from the head waters of the Big Laramie.

533 Also some seasons we have been short of snowfall. In the irrigation now the water is carried out in one large main ditch. It spreads the water on Section 33 and it flows down through and over 34. The Bilderback ditch was extended and connected with this larger ditch. That ditch is sometimes called the Richards ditch and sometimes the Dowling ditch. The present system was completed about seven years ago, maybe longer. I built the dam myself.

534 It is a crib and rock dam and raises the water about two feet, which turns the water into the ditch at any stage of the flow. The dam is on Section 32, T. 15, R. 74. The land slopes east and a trifle to the south away from the river. The fall is six or seven feet to the mile eastward and about three feet to the mile southward. That ditch also irrigates land in Sections 26 and 13, same Township and Range, and in Section 7, Range 73; also practically all of Section 33, all but about 80 acres of 34, all but about 20 acres of 27, 160 acres in 35, maybe 200 acres; the Northwest quarter of 26, 100 acres in the Northeast quarter of 26, 140 acres in the Southwest quarter of 26, and 25 in the Southeast quarter.

535 The river runs through Section 23 from the Southwest corner to the Northeast. All of that lying South of the river except 80 acres has been irrigated for a good many years. That North of the River is irrigated from the Pioneer Canal and from the old Penitentiary Ditch, sometimes called the Walcott ditch. That makes 3100 or 3200 acres. They were bottom lands on the North side of the river on the Heart ranch. When I first knew the ranch the low lands lying close to the river in Sections 28 and 32 were irrigated by overflow, and also in Sections 22, 23 and 27. The Walcott ditch covered 23 and 14, the bigger portion of 23 north of the river and about 240 acres in 14. There were also small pieces in 32. There is probably 350 acres not including 23 and 14. In Sections 23 and 14, 200 to 300, maybe 400 acres, is covered by the Walcott ditch, making in all 600 to 750 acres on the north side of the river irrigated from natural overflow and

seepage or by the Walcott ditch. Walcott ditch was there when I first knew the property.

536 The land under the ditch is low land and used to be overflowed every year. That was true when I first knew the property. In the ranch when I first knew it there was 3100 to 3200 acres irrigated on the south side of the river and 550 to 600 acres irrigated on the north side of the river. They have been irrigated since that time. Since then a flume was built in 32 taking water from the extension of the Bilderback ditch joined with the Dowling ditch. It crosses the river and they propose to cover this same low bottom land with a ditch clear down through those lands on that side of the river, to make up for the irrigation those lands formerly got from the high water that they don't get now. All the lands will be watered from one dam and head-gate.

537 These changes have been made necessary by the taking out of other ditches. When I first came there were no large ditches. The original Pioneer was started when I was first in the country and completed and distributed water over the lands that the present Pioneer covers as far as its capacity would carry. I came back here in '88. Understand the present Pioneer was completed in '85. It was completed when I returned and was distributing water to all the lands lying under it. That tends to draw on the high water, and then the King ditch, the Fischer ditch, the Riverside No. 1 and No. 2, the Sodergreen ditch, in fact all of these ditches take out more or less water, and the Hogue and Haley and the Bush ditches, they all take a little water, and it makes a big lot of water when you get it together. Those diversions are all above the Heart land and lower the river, requiring the change from a system of natural overflow to a system of dams and ditches on the Heart ranch. The upper lands on the Heart ranch have always been hay lands with the exception of a small tract in 27. There is some plowed up there and grain raised on it and a portion of it seeded in alfalfa. With that

538 exception it is hay. On account of lack of water the hay crops have not been as good in late years, excepting last year. In the earlier years the lower end of the Heart ranch produced from 1400 to 1800 tons of hay. The lands of the Denver Laramie Realty Company embrace Sections 18, 19, 7, 8, 17, 20 and 5. Practically all of it is irrigated. It is in the same range and extends clear up Sand Creek. These lands were originally covered by the overflow, that is the very low land. Fifteen years ago Hogue built the Hogue and Haley ditch and before that of the waste water from the Caldwell and Gardiner ditch carried on down to this land.

539 At a rough guess there are more than 2000 acres irrigated, nearer 3000 acres than 2000. It has been under irrigation ever since I have known it, first by overflow, later by the Hogue and Haley and the Caldwell and Gardiner ditches. All of these lands in the Heart and Denver-Laramie Realty Company ranches are irrigated from the Laramie River; 2000 to 3000 acres of the Denver-Laramie Realty Company land and 3650 to 3850 of the Heart ranch proper.

Cross-examination by Mr. Fred Farrar:

Practically all lands that formerly overflowed are now under ditch. The eastern portion of the Heart ranch now belongs to Buntin and Talmadge. The upper portion to the Denver-Laramie Realty Company. The Buntin and Talmadge people acquired title
540 about four years ago. I leased part of it myself for the last 7 or 8 years. I don't think that transfer had any connection with the Talmadge Company project down the river. This land up here was owned by the Wyoming Central Land and Improvement Company and the land down the river was sold to them by Ora Haley. I think they bought the Heart ranch a couple of years after they bought that land down there. Some of the Heart ranch has been irrigated in later years, but was not. The Pioneer, when built, practically covered the land on north side of river. The Dowling and Bilderback ditches are not serving more land now than they were a few years ago. The Cole ditch is not now connected with the Bilderback or Dowling ditch, coming from the river in Sec. 28. Originally the Cole ditch was an extension of the Pick-up Bilderback. By Pick-up I mean that the Bil-erback ditch runs from 33 along the north edge of 32 through 27 to the northwest corner of 26 and dwindles out down in 23. Commencing at a point a little east of the quarter rock on north side of 26 is a ditch runs east about 400 yards and then skirts around above the rising ground and passes out about 400 yards into 24 south of the northeast corner of 23 extends across the northwest corner of 24 and across 13 and is carried across Five Mile creek onto what is known as the Cole land, lying east of Five Mile creek in Sec. 13. That is the Pick-up Ditch. Commencing at the quarter corner of northwest corner of 26 is a dam thrown across to pick up the water. There are old river beds and the ground is low, as it is a mile west of there. It was built by Hutton to irrigate the land in 13 and 23 under it. When Cole took up lands in Sec. 13 he built a ditch into the river about 800 yards north of the south line of Sec. 22 and about a quarter of a mile east of west line. That ditch extended down across 27, following the slough and connected up with this dyke or dam that extends from the quarter rock on the corner of 26 to the foot of the hill. They made a complete ditch from the river, but he could not hold his headgate, so they went on up into 28, followed the sloughs on up in there and they now take water out at that point. This Pick-up ditch was first designed to catch the water that was turned out by the Dowling ditch headgate and the ditch that distributes onto 33, 34, portions of 35, 27, 23 and 28.

When I first knew of the Heart ranch, the customary method of irrigating was to throw out dams in the old river bed, or dams through the meadows. The overflow from the river was
542 thereby diverted across and upon the meadow. All the irrigated lands in this country were irrigated that way. When I first came here Hutton had gotten out a ditch. The Bilderback ditch was first known as the Hutton ditch. It was before I came here in spring of 1877. He built that ditch to get water out of those old

river channels. The overflow was not diminishing at that time, it was to extend it and get more water onto the land. I have noticed the overflow diminishing more particularly in the last 15 or 16 years. There have been ups and downs in the flow of the river. There has been very high water. I saw as high water here about four years ago, nearly as I ever saw. The normal flow has been diminishing for the last 20 years nearly, on account of taking out new ditches. There are times even yet when we have an overflow. There has been one instance, I think four years ago, that the river rose and covered all these bottom lands it used to cover in years past. There has been very little overflow only the low bottom lands right close to
543 the river have been covered since that year.

The main Hutton ditch in 1877 was about a mile and a half in length. There were quite a number of laterals running from it. There was a headgate in it at that time near the quarter rock on the west side of Sec. 33, between it and the northwest corner of Sec. 33. That ditch did not run almost parallel with the river, it run south and east and then turned and ran north and east, a little north of east. It ran in a southeasterly direction about a quarter of a mile and then turned northeasterly and followed the general direction of the river.

The Dowling ditch was built about 23 or 24 years ago. They wanted to enlarge the Bilderback ditch covering practically the same lands and figured it was a better place to take water out above than where the Bilderback ditch did, on account of the river changing and leaving their dam in slack water time practically high and dry. The overflow waters were beginning to diminish when the Dowling ditch was first built. The headgate of the Dowling ditch is between the quarter rock on the west side of 33 and the
544 northwest corner of the section. The headgate of the Hutton or original Bilderback ditch was then extended up to the head of the Dowling ditch, probably 6 or 7 years ago. I built the ditch myself.

I saw the Sky Line ditch about 6 or 7 years ago. I first saw it about 8 or 10 years ago, the first time I was up in that country hunting. I wouldn't say definitely how long it was. I was right at the Sky Line. I probably did cross it. I did not see any water in it then. I am fairly well acquainted with a man connected with that ditch and would meet him quite often, and I could always tell when they turned in water up there, because about a week afterwards that would show down below here. The water would constantly drop in the river. The Sky Line ditch heads in Colorado out of Big Laramie river. The stream from which it heads is not very large, not as large as it is down here. The stream is considerably larger down here. I have seen streams quite a bit smaller than this stream where it heads. I have been at the head of the Sky Line ditch, where it leaves the stream. I am not able to give you the branch from which it takes water. It is capable of carrying about 150 second feet of water anyhow. They take water in it along the last of May and during flood waters through June. Quite often they shut down for repairs on that ditch. There is such a creek as

the Rawah creek, but which creek it is I could not tell. I probably have been right on it and along it. I think it flows into the Laramie below the Sky Line ditch. There is such a stream as the Deadman. I probaly have seen it. I could not tell where it comes into the Laramie river, because I always went up in that country through Sand Creek. There is another tributary known as the McIntyre. There is a stream known as Grace creek which runs into the Laramie at Grace creek ranch. There is La Garde creek. And Jimmy creek. I do not know whether there is such a stream as Stubb creek. I have heard such creeks all called, but never paid any attention, as I was after deer. Some of these streams are tributary of the Big Laramie river in Colorado below the Sky Line. That is they are down
547 stream from the headgate or diversion point of the Sky Line ditch. There are several others up there, Woods Creek and Fox Creek, in Wyoming, and Johnson and Beaver creeks. I am able to tell from the flow of river here when diversion of water through the Sky Line canal begins. When they shut down for repairs it would always show down here. It would be close to 100 miles, to follow all the crooks of the stream from the diversion point of the Sky Line canal to the headgate of the Dowling or Bilderback ditches. There are two or three branches on that upper end of the Big Laramie. There are lots of creeks there but I don't know one from the other until you get down to Grace creek. I could see lots of snow and drainage country that drained down in there clear on down beyond where I saw the head of the Sky Line ditch,—drainage that came off in the southwest there to the northeast. That is where the big snow is up there. I do not know the altitude
548 of the headgate or diversion point of the Sky Line ditch. Timber line in this altitude is about 10,000 feet. 10,000 to 11,000 is about as high as timber grows. The headgate or diversion point on Sky Line ditch is below timber line. There is timber all around there,—pine, willows and brush of all kinds. I wouldn't say positively that the difference in the flow of the stream, which I I have attributed to the flow of water through the Sky Line ditch was due to the diversion of water through that canal or due to a diminution in the amount of water occasioned by the melting or delay in melting of the snow of the lower area. W. G. Decker, connected with the Sky Line ditch, was one man I talked with about the matter and told him at the time of the sudden rise in the river. The water came down and then ceased to be so high and dropped back to the stage it was before. He told me to shut it off. That was about 7 or 8 years ago. I do not know who owns the Sky Line
549 ditch. I supposed Decker had charge of the diversion of water up there at least from what he told me and from seeing him fixing up his box, etc. Then he was making his headquarters up there. I met at Sodergreen's. Aside from this time I have known the flow of the river to be affected by diversion of Sky Line canal. Whenever water would be turned into that ditch it would make a sudden drop in the river by the time the slack got down there. The fall would be sometimes a couple of inches, sometimes 4 inches. If the river was low it would drop that much more. The river is highest

in June. The high water gradually comes up about the middle of May or a little before, gets to its extreme height here along about the 15th to 18th of June, and then suddenly drops off. It was in that flow that I would notice the diminution when the Sky Line was started. In the latter part of June, when the high water would be past, I would do repairs at the old dam we had at the Pioneer headgate to get a head into the Pioneer. If they shut down for repairs up there I would notice it very quick. I have never been at the diversion point of Sky Line in high water time only in the fall,—once at that point, but around Chambers Lake two other times. I have been at the headgate or diversion point of the Sky Line canal once.

550 The flume which crosses the river and takes water from the Bilderback ditch on the north side will go above the Walcott ditch. That flume was built this summer. No water has run through it. I first saw the Walcott ditch in 1876. That is called the old Penitentiary ditch. It heads from the river in the northwest of the northwest corner of Sec. 26-15-74, about ⅜ of a mile. It is within 100 feet of the northwest corner of the southeast quarter of the southeast quarter of Sec. 22, the same point as when I first saw it. There is no headgate but the old original dam is there. That ditch is used to take water in high water times. It was a low water ditch when it was built. Now water can run out of it only in high water time. It was built primarily to carry water across

551 the river to the Penitentiary lands in west half of Sec. 32, Tp. 16, R. 73. The Walcott ditch is not now used to carry water as far down as the old Penitentiary land, but only to Sec. 23. The lands it covered have been covered by the Pioneer ever since it was built. The Walcott ditch is only about a mile in length—all the way down through Sec. 12. I used it in Sec. 12 to distribute water from Pioneer. The headgate of Walcott is all rotted out, and the ditch is in disrepair, and has not been cleaned out in years. The lands are covered by Pioneer. The Walcott as diversion ditch from river, was practically abandoned, when the Pioneer was completed, and it took water onto those same lands through the Pioneer.

Cross-examination by Mr. Delph E. Carpenter:

I gave the portions or tracts of land irrigated by the Dowling and Bilderback ditches. In 1877 these ditches were taking water from river over these lands which constitute a flat portion of the Laramie Plains lying right next to the river and only a few feet above it along the east bank. That flat was evidently made by the filling in of sand and gravel and silt,—river wash. There are evidences of old river channels all through that flat. In the upper portion in Sec. 32, 33 and 34 these channels run east, are very numerous and can easily be traced. In Sections 35 and 26 they turn nearly north. The river, in ages past, used these channels as its water course. They have filled up with silt and sediment and you can now go right over them anywhere with a mowing machine. These old river beds are misnamed when called sloughs, which generally have water in them all the time. These do not. The ground is a foot and a half to two

feet higher between these old channels than it is in the bot-
553 tom of the channel. These old channels have not been exactly used by the irrigators as lateral ditches. They put in dams of earth and manure at a favorable point and raise water up and throw it out onto the higher ground on each side. Then the water would come back again. Another dam would then be constructed. These channels are from 40 feet to 100 feet in width, some 150 feet. They hold water from half a foot to 2 feet in depth while it is being dammed up to force it out over the adjoining land. The water in them is backed up and standing still except whereit flows out over the higher ground. It looks more like a lake than a river when the land is under irrigation. In the northwest corner of Sec. 26 the water plane is about 4½ feet below the surface. In places in 33 and 34 it is not over 3 feet, and in other places it is 5 to 6 feet. Some of these channels run close together, paralleling each other, and some of them cross each other. Some are 300 or 400 yards apart. Some cross the old river channel almost at right
554 angles. Wire grass or water grass grows in these sloughs. That meadow there is nearly all wire grass and a little red top mixed in. On the extreme high upland it is kind of flat blue grass and wire grass that we consider the best hay in this country.

The Braden ditch or Dowling ditch heads pretty well up toward the south line of Sec. 32 and flows southeast from there. Its dam holds up the water for the Sutherland land. It sub-irrigates it and irrigates it in high water season. That ditch is used for the irrigation of this land on east side of river now. The Dowlng ditch and the Bilderback ditch start at the headgates of the Bilderback ditch, running a little bit north of east until it connects with the old Bilderback ditch near where it originally came out of the river. Practically all of Sec. 33, except what is in the river channel, is irrigated from this ditch. From 160 to 200 acres in Sec. 32 are irrigated from it. Not to exceed 80 acres in Sec. 34 is under irrigation. That portion not irrigated is on the southeast side of the southeast quarter

555 There are about 180 to 200 acres irrigated in Sec. 35. All of the northwest quarter and 100 acres in the northeast quarter and about 160 acres in the southwest quarter of Sec. 26 are under irrigation. All of Sec. 27 except about 60 acres is irrigated. Nearly half a section, less 80 acres, is up on the high ground in Sec. 23 and is not irrigated. Pretty close to 300 acres in Sec. 13 are irrigated. The Cole ditch is the same as the Bilderback ditch. These lands above described go to make up the acreage of the 3100 or 3200 acres irrigated from this Dowling and Bilderback system. Along through 23 and 13 on this river wash and sand and gravel, in a strip next to the river, they get their very best hay.

I never saw over 1000 tons of hay put up over this acreage but they tell me they put up more than that when Hutton ran it. Some years they use it as pasture and don't cut any hay. Other years they cut just the best half of it. About 15 or 16 years ago they used it for pasture. Homer rented it for cattle 3 years and used it for pasture. He irrigated it and ran 1500 to 2000 head of cattle in

there. Sutherland ran the place about 14 years ago. Some of the meadow land he used as pasture and some he cut hay from. When they were cutting the very heart out of the hay they were
557 getting from 400 to 500 tons. I do not know what they paid for those meadows for pasture. As meadows, without pasturing them under the present of irrigation, they would produce 600 tons or more of hay on an average year. The lower field last year put up nearly 300 tons. My boy put up 380 tons on shares last year on that land. That was an extra good crop year. The lower field would average that. Hard to state what the whole tract would average, one year with another, for native hay, if used exclusively for that purpose, for the reason that they never cut all the hay. First this man has it and cuts the hay, don't know the method, strikes a little rough ground and runs around it. It is good hay but too rough to run his machine in. He strikes another rough spot and the same thing happens, lots of hay is left in the fields, never cut, just as good as that cut. If it were all cut it would cut on an average of 1000 tons of hay over the entire area, if brought up to its highest development as a meadow. I haven't figured the hay in 23. I have had a lease on that from the Wyoming Central Land and Improvement Company until this year for 7 or 8 years, the terms of which are a personal private affair, for ranch-
558 ing and hay. I pasture portions of 14, portions of southeast half of 15 and I raise grain on southeast half of 11 and alfalfa on portions of 14. I put up 116 tons of hay on about half a section of that land. About one-half a ton to the acre is a pretty fair average. Every ditch on these lands now was drawing
559 water in the eighties. With the exception of the Cole ditch, that ran right in there through the irrigated land, when he extended that on up to the river, they have been operating since the latter part of the seventies. Cole built the ditch to get the water directly from the river to his land. He caught the overflow of the other ditches. Since those ditches were constructed, and even now, the land is watered by manure dams in the old riverbed. They use the same methods of irrigation now that they always used. This land is primarily valuable for wire grass hay. I think they could make more money if they put this land into alfalfa. The water plane is pretty close to the surface. There are 10 to 20 acres that are good for alfalfa. That land is higher than the lowland is in those old river channels. Those low river channels are primarily adapted to wire grass. Taken as a whole the meadow is valuable for that purpose. If I owned it I would thoroughly ditch
560 it in a proper manner. Throughout all the western states there are spots along the rivers that are naturally overflowed originally. That bottom there was 2½ miles wide. The first time I ever saw it in the spring the water spread clear across from the foot of the hill to the ranch buildings. It was the same on other streams that I have seen,—the Little Laramie, the North Platte Valley. Don't know much about the South Platte. As years went by and they took to using the water of the streams for irrigation of land entirely, they cut off this high overflow. When they began

to take water back on the highlands to distribute it takes a long time for that water gradually to get back to stream. After the consruction of these other ditches men who owned meadow land simply constructed ditches to irrigate meadows. A much greater benefit was had by taking out the other ditches and making the new ditches than would have been received had they simply allowed the water to flow on down the river and overflow these small meadows. The greatest good to the state in which these streams were, has come from the construction of irrigation ditches. The small amount of real bottom land along the streams is the easiest land to irrigate. There is practically no difficult construction in making the ditches. In these meadow ditches the water is applied almost as soon as it gets away from the river. It differs in that regard from the canals on the higher land.

None of the meadow ditches on the Big Laramie river are over a few miles long,—the Riverside ditches about 4 miles. They cover the bottom land as well as the first bench which is but a little higher portion of the bottom land. Even on the first bench you notice these depressions or channels running here and there across them back into the stream. When lands are watered even here they overflow the higher portions and gather in these lower depressions and go back toward the river. It is that way on Riverside ranch and all lands along river. In fact, everything between the bluffs
562 proper, everything in the floor of the river valley is marked by these characteristics. Underneath these river bottom meadows and pasture lands the soil is usually a river wash of sand and gravel. Water which sinks down into them simply goes into the water plane of the stream.

Some lands which originally belonged to the Heart ranch were later acquired by the Denver-Laramie Realty Company and some 2000 or 3000 acres of that land now belonging to the Realty Company and formerly belonging to the Heart ranch was irrigated from the Laramie river. Quite a considerable of that land was formerly owned by Mr. Hogue. He obtained the upper portion of the Hutton home ranch or Heart ranch when it was divided up. There never was enough water from Sand Creek to thoroughly irrigate it. I have heard the Dowling ditch called the Richards ditch after Richards surveyed a ditch from the Hutton Lakes a number of years ago, but it never was constructed. Richards did the earthwork on the Dowling ditch. He was general foreman of the
563 ranch at that time. A considerable portion of Sections 18, 19, 7, 8 and portions of 17, 20 and 5 were purchased by Mr. Hogue. The bigger portion of that land was originally irrigated by Sand Creek overflow. Sec. 7 and the west half of 18 were irrigated from old Calwell, which came onto Sec. 12. Water was carried on into these lands on the Heart ranch in a similar manner to which water was spread on the fields lower down. The land was so flat that they wasted the water over from the lands under the Caldwell ditch and it flowed over these sections. A great deal of water came from the Caldwell ditch into the Hoge holdings. Ever since Hoge built the Hoge and Hailey ditch, these lands have been

irrigated from that ditch. The northeast quarter of Sec. 18 was irrigated by old creek channels that run through. They were made into ditches. They obtained their water from the overflow that came down into Sand Creek from Caldwell field and Caldwell lake. The only ditch of which I know that comes out of Sand Creek and irrigates land on the east side of Sand Creek, came out in the township west of that in range 75. It irrigates a small piece of land but whether it is called the Wright ditch or not I could not say. It is between the river and the creek. I do not know of a ditch called the Wright ditch taking water out of Sand Creek to irrigate the northeast quarter of that section. There is these old creek beds. The creek has changed backwards and forwards through these lands. 22 years ago I saw George Hutton at work on these old creek channels and cleaning them out and distributing the water. Sec. 19 is irrigated by the Hoge and Hailey ditch. The Caldwell overflow comes into Sandy Creek and then is picked up by these old creek channels and distributed all over these lands. One principal branch of the Caldwell ditch follows the river miles away from Sec. 19. One branch throws water into what is called Caldwell Lake, an artificial lake made by overflow from irrigation. It probably covers about 160 acres. Water was run from the river through the
565 Caldwell ditch and into that lake from irrigation. It has been there for many years. There are times that it goes dry. It fills next season. It acts as a reservoir for those lands east of there. There is no ditch out of it, it carries through underneath by sub-irrigation. There is greasewood land in there, underlain with sand and gravel and it will run in there. Sometimes the sand and gravel is 6 inches from the surface, sometimes 2½ feet of pure sand and gravel. A few inches of that sticky Billings soil, if mixed with sand and gravel, will make it impervious to water. Water goes into the ground. There is always a thin spot where you strike sand and gravel. In digging post holes there are places where it is only 2 or 3 inches through that sticky stuff, into the sand and gravel. There are places where it is a couple of feet thick.
566 The sand and gravel practically come to the surface in a great many places in vicinity of Caldwell Lake. This water simply percolates out of the lake and through the sand and gravel and back into the river.

The Sand Creek ditch irrigates a narrow strip of land between the ditch and Sand Creek running north from the Hutton lake to the river, no place over 150 yards wide. The bulk of the water comes from the Laramie river through the Hoge and Hailey and Caldwell ditch, for the irrigation of Sec. 19, the east half of 18, all irrigated lands on 17 and 8, and on Sec. 5, west of Sand Creek. The Caldwell ditch not only had water enough for its own land, but enough to overflow and irrigate this other land.

The Walcott ditch, shown as heading in Sec. 32, Tp. 15, R. 74 on the three maps attached to the publication entitled "Advance sheets of field operations of the Bureau of Soils, 1903, U. S. Department of Agriculture, soil survey of the Laramie Area, of Laramie,

Wyoming, by N. D. Neill and party," is an error. That was evidently intended to indicate the Dowling ditch.

567 Between 2000 and 3000 acres of the lands under irrigation, and making up the upper portion of the Heart ranch, were sold to Hoge. I have seen more than 1000 tons of hay
568 out there from land watered by the Sand Creek ditches, the Caldwell and the Hoge and Hailey ditches. That meadow compares quite favorably with the meadow under the Dowling ditch. The Hoge land has not been abused like the lower lands have by pasturing it with water on it. This Hoge land is best adapted for raising native hay.

I paid in the neighborhood of $200 a year cash rent for Sec. 23.

R. E. FITCH, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

569 I was formerly engaged in ranching; now engaged in real estate and insurance. Live at Laramie, Wyoming. Have lived forty years in the county. I ranched nine miles north of Laramie on the Big Laramie River. Have had occasion to know a good deal about irrigation along the river since 1872.

570 The first settler that used water from the river was Catherine Erhart in 1873. She still occupies the place. She has irrigated about 75 acres. The next settler, James Coughlin, irrigated about 100 acres from the river from 1880 to 1909. His sister Maggie Coughlin owns the land since 1909 and irrigates about 50 acres. David Salisbury irrigated about 45 acres from 1880 to 1894; then M. E. Sticknel took the land from 1894 to 1903, irrigating the land. Noah Wallis irrigated about 70 acres from 1881 to 1900. Ed Farrell irrigated about 60 acres from '73 to '75.

571 N. F. Spicer occupied the same land 1880 to 1883 and irrigated 80 acres; C. L. Huston 100 acres including the same land, '83 to '93. J. J. Fisher occupied it from '93 to 1904. Then H. Maynard from about 1904 to the present time, irrigated about 100 acres. Valentine Spindler occupied the land from '73 to '84, irrigating 75 acres. Herman Clerk from '84 to '87 irrigated 50 acres; J. J. Fisher, '87 to 1904, 60 acres. Maynard occupied the land from 1904 to the present time, irrigating 50 acres of this land. Ed Brady a little further down irrigated 75 acres from '72 to '77. Don Cameron irrigated about 90 acres from '77 to '80. Caldwell & Fitch, from '80 to '82, irrigated about 90 acres. In the same vicinity Brocker and Brammer irrigated about 300 acres from '75 to '83. Fitch and Stark irrigated about 1200 acres from '82 to '86; R. E. Fitch from '86 to 1900 about 1000 acres; R. E. Fitch from 1900 up to the present time, about 200 acres. T. D. Abbott occupied land there from 1879 to 1885 and irrigated 1000 acres. Abbott & Shears from '85 to '89 irrigated 1500 acres. The Haley Land & Live Stock Company then took this property and with other

land occupied by them from 1889 to 1909, irrigated something like 3000 acres. These dates and figures are not absolute.

572 All that I have mentioned has been taken from the Laramie River direct. Mrs. Erhart was located on Section 16, T. 16, R. 73; Coughlin Section 9, same township and range; Salisbury in Section 8. Stickney the same land that Salisbury had; Wallis in Section —, T. 16, R. 73; Farrell in Section 4, T. 16, R. 73; Spicer same section; Huston same section; J. J. Fisher and H. Maynard in Section 4, T. 16, R. 73; Spindler in Section 32, Township 17, Range 73. Clark, Fisher and Maynard occupied approximately the same land. Brady was on Section 24, T. 17, R. 74. Cameron occupied the same practically and Caldwell & Fitch and Brocker & Brammer occupied land in Section 24, T. 17, R. 74 and in Section 13, same township. Fitch & Stark also irrigated land in Section 24-17-74 and in Sections 13 and 25 in 17-74. R. E. Fitch irrigated the same land during the time stated and at the later date, 1900 to 1913, only in Section 24. T. D. Abbott occupied land in Sections 2, 3, 11, 12, 13 and a little in 14, T. 17, R. 74. Abbott & Shears occupied practically the same land. The Haley Land & Livestock Company, or Ora Haley, irrigated lands in, although not all of, sections 2, 3, 11, 12, 13, 14, 5 and 6, in T. 17, R. 74.

573 Taking out all duplications in T. 16, R. 73, there were approximately 500 acres irrigated; in T. 17, R. 73, 75 acres; in T. 17, R. 74, close to 3000 acres. These other two townships north I approximate at 3000 acres. I think there was more land than that irrigated. My ranch is located in T. 17, R. 74.

574 These people who irrigate successively the same tracts were successors in title. I should say that these lands have been irrigated to my knowledge from 1872 to 1913 practically continuously, not all the same year, however. These lands are all irrigated directly from the Laramie River and not from the Pioneer Canal. The method of irrigation is still primitive and becoming more systematic and scientific. In early times we had very meager laws on the statute. It was a very much go as you please proposition. The irrigation was largely from natural overflow. After that, when they didn't have quite so much snow, the water would be impounded in little sloughs and natural ditches and utilized in that way. When the high water flow ceased, people had to be more systematic and constructed dams and ditches and headgates and utilized and watered in a more economical way.

575 In some of these smaller tracts that I have mentioned I don't think they have yet gone into very elaborate irrigation work. In other parts considerable amounts of money have been expended in constructing ditches, dams and head-gates, and the waters used in that way. The early ditches were never on record so far as I know. I know the Oasis ditch. It was started about 1884. Some work done on it as late as 1907. That ditch covers something over 12,000 acres. There are no new ditches being constructed because those existing are adequate to supply the settlers, I think.

576 They raise hay always, alfalfa, oats, rye and potatoes and all kinds of vegetables. I am nearly 70 years old.

R. E. FITCH.

Cross-examination by Mr. Fred Farrar.

576 I live in Laramie, engaged in real estate and insurance business. The memoranda from which I refreshed my memory was prepared August 30. The first ditch taken out of river below Laramie is called the Martin ditch, somewhere in Sec. 16, Tp. —, R. 73. It irrigates the Erhart place, about 50 acres.

577 I could not state that it was in use from 1880 to 1890. These primitive methods included taking water out of the river in any possible way. I would not be certain about the nature of the ditch or headgate or anything of that kind down there. Water from the river produced hay. Just how it was taken I cannot say definitely. I have not been on that place since 1890. Catherine Erhart, who resides on the place, had some cattle when Mr.

578 Martin was operating with her. At the present time she sells in town, eggs, butter, chickens, and possibly some little garden truck. During the period when I was acquainted with the place the land was irrigated for native hay and some little garden. The land was on first bottom, the 50 acres irrigated lying contiguous to river. Hay produced on land would average generally with that in Laramie Plains.

579 I have known the James Coughlin place in Sec. 9, Tp. 16, R. 75 and had intimate knowledge of it from 1880 to 1890. I could not say whether or not they had a ditch but think they irrigated some from natural sloughs. I would not be positive that Mrs. Erhart's irrigating was not much of the same character. The method was to allow overflow water to pass over land by throwing dykes across these sloughs. They would plough furrows to carry the water when they wanted it. There was no definite system of ditching then nor do I know of any in this Coughlin land today. Coughlin irrigated about 100 acres in palmiest time of his irrigation, not continuously, but the place has not been irrigated

580 very much since he died in 1909. His sister fell heir to his property and it has been rented since and pastured. Mr. Coughlin engaged in breeding and raising horses and selling. This land he irrigated was not cultivated, except irrigation for native hay. The David Salisbure place is situated on Sec. 8, Tp. 16, R. 73. There was a little more system to the irrigation there than on the Coughlin place. He was a rather hard working old man and did a little more in the way of irrigating. He lived on the place and Coughlin was off the place. The Salisbure place was hay land principally. They had some garden patches and about 5 acres of potatoes and a little grain. I wouldn't be certain whether he raised potatoes continuously during the time I knew him. He raised grain rather periodically, just for his chickens and horses and not for commercial purposes. Salisbure did not have a very expensive

581 system of ditches. When I first knew these ditches the country was fenced just along river, the balance being open range.

Noah Wallis irrigated about 70 acres on Sec. 9, Tp. 16, R. 73.

That also was hay land. His business was stock raising, principally horses at that time. He did not have a definite system of ditches.

The largest amount of land that I am aware of being under irrigation on Sec. 4, Tp. 16, R. 73 was 120 acres, contiguous to the river, all along the river bottom, called hay land. That was in 1904. None of it was cultivated, except for garden in a small way, except across the river, and that came under the Pioneer canal and I have not been alluding to that, although it is held by same people.

582 The system of irrigating there was about the same as these other tracts. I don't think I ever saw any ditches on the east side of river where this land is situated. On west side there was a portion of it under the Pioneer canal.

The Valentine Spindler place was in Sec. 32, Tp. 17, R. 73. My most intimate acquaintance with that place was from 1880 to 1890. There were at that time about 75 acres under irrigation. I have estimated that there are not now over 50 acres irrigated. That portion along the river bottom was hay land, irrigated largely in the same way. There was some little grain raised there and potatoes and garden truck. I don't suppose there has been over 10 or 15 acres cultivated outside of the hay land. I saw most of these

583 places in a cursory way a week ago today, not in a way to explore them carefully, but to look them over. This place is not very different than it used to be. It is maintained much better than it used to be. There has been a great deal of money spent there in the last 5 or 6 or 8 years. The place where Houston was at one time interested comes into Maynard ranch now and he has charge of that and is taking good care of it. The Coughlin place has been leased and it is not so well taken care of since 1909. The Erhart place is kept about as usual. The Salisbure place is possibly not so well maintained as it was when the old gentleman lived there. Herman Clark has located on the same place where Maynard is now located, Sec. 32, Tp. 17, R. 73. That is the same as the Spindler place, enlarged somewhat. Ed Brady and

584 Don Cameron owned the same land, Sec. 24, Tp. 17, R. 74. Caldwell and Fitch owned considerable more, a half section that was not owned by Brady and Cameron, although their holdings included same as Cameron had. Caldwell and Fitch had a contract with the Wyoming Central Land and Improvement Company for half of Sec. 13 and part of Sec. 25 and other lands, and they were irrigated by them. That is what made their holdings larger than had been previously held in the same locality. While Brady was there he irrigated about 25 acres. Caldwell and Fitch now irrigate about 90 acres. To correct my former testimony, Fitch and Stark had the contract with the Wyoming Central people and Caldwell and Fitch. It was a little later. Caldwell did not have anything to do with the land in his time except portion owned by Cameron. At the time the Caldwell and Fitch place was purchased from Cameron and for some years after it was devoted first to sheep raising and incidentally to cattle and horses. All this irrigated land is bottom hay land devoted to raising of native hay.

In my estimate of land irrigated by the Oasis ditch I did
585 include land in Sec. 24. The Brocker and Brammer lands are on the west side of the river largely. They had some lands leased from the Union Pacific Railway Company, before the time of the Wyoming Central. They leased from the railroad company on the east side. They had some system of ditches for the irrigation of those lands on west side of Laramie river, called the Brocker and Brammer ditch. It led from an old river bed that had been the river before the channel had changed, and it carried a lot of water and they took their water from this. They had a dam but I don't remember any headgate. Their system was somewhat better than some of these ranches up the river. It was more definite and did not depend upon the overflow so much. They had this means of damming the water and taking it out later after overflow had passed. This was hay land and upland. They cultivated some upland. They had a 20 acre tract of potatoes in 1880, '81 and '2, and up to '83. That land is devoted mostly to hay now, no
586 cultivation on it. The Fitch and Stark place included the Brocker and Brammer place. That was purchased in 1883. All of Sec. 24, that formerly formed a part of the Brocker and Brammer place, is now known as the R. E. Fitch place. That portion of the Fitch and Stark place which was not included in the R. E. Fitch place went into the Hailey Live Stock Company, and has been sold since to the Talmadge-Buntin people and by them possibly to other people. A portion of the land included in the Fitch and Stark place is hay land. I have a part of Sec. 24 cultivated. I haven't noticed the lessee's operations recently, but I am quite sure that it is cultivated—potatoes and oats principally and some rye, but not over 10 or 15 acres altogether. The Fitch and Stark lands were irrigated from the Laramie river, by a better method than I have described. There was a ditch taken out
587 some distance up river and water brought down to land. It was known as the Cameron ditch. Afterwards it would be the Fitch ditch. I had more interest in it than anybody else. The Abbott ditch had its headgate a mile up river from Sec. 24, on Sec. 30 in Tp. 17, R. 73. The Cameron ditch has been obliterated largely by this Oasis canal that ran through it and I had contract with builders of canal to use water from that, so I paid little attention to other after Oasis was built. Brocker and Brammer were engaged in stock raising, both cattle and sheep. Fitch and Stark were principally engaged in sheep, some cattle and a few horses. These lands that were irrigated were largely hay lands. Hay was cut and stacked and made good use of. The stock business was quite extensive in that section during the years I was acquainted with it. Today it is a good deal of stock business though conducted in a different manner. There are less open range operations
588 and more of irrigation and raising larger quantities of hay and forage and feeding stock in the winter and keeping them in the fields a large part of the year, except the sheep. In 1900 I irrigated about 200 acres. That is less in amount of land in that section than had been previously irrigated. The shortage of acre-

age was occasioned by low condition of water in river, which used to enable us to take out water in this old river bed and utilize the overflow. We didn't have that much in 1900, too much water had been taken out before it got down to us. I did not have a system of ditches which permitted me to irrigate the land, which had formerly been overflowed. The greatest amount of land on Sec. 24, Tp. 17, R. 74 which has at any time been irrigated would be about 500 acres, although I harvested over 700 tons of hay on that land. A little portion of it might have been on the outlying parts of sections 13 and 25. The average yield of hay cut in that section would vary from half a ton to, in exceptional cases, two tons, an acre. The two ton crop would be cut from land where the water conditions would be different. There was not much land on which we could cut two tons, perhaps 10 or 13 acres. A fair average yield on ordinary hay land in that vicinity would be about a ton to the acre. The yield would be about same as that which they raise on river above Laramie.

589 Mr. Abbott irrigated about 1,000 acres on the Abbott and Shears place. Originally there were about 4 sections in that place. Afterwards they extended it somewhat. Irrigation on that place was conducted by ditches and dams from the Laramie river up to the time the Oasis canal was constructed, and most of the irrigating was done through that after its construction.

The Oasis canal was constructed in 1884. It was used for the irrigation of the Abbott and Shears lands. Prior to its construction they used a canal called the Coleman ditch and the Abbott ditch. These ditches were on east side of river. They are not used very extensively today. This Oasis canal is a large structure, and brings down all the water they need. These irrigated lands were hay lands. These men were engaged principally in cattle raising and some horses.

590 These lands were largely irrigated originally from the overflow method, but they were now beginning to use ditches. There has not been a great deal of overflow irrigation in that locality since 1888 or '9. From that time on method of irrigation changed by gradual construction of irrigation ditches, not entirely but there has been an improved system. Outside of the Oasis ditch, the ditches constructed to irrigate these lands were in some instances 3 miles long and approximately a mile from the river. The Coleman and Abbott ditches were of that character. I don't remember which was the longer and further out. I crossed them a great many times and noticed their course and the condition of things.

591 The Oasis ditch is close to 10 feet wide on bottom and 12 feet wide on top. It is more than 18 miles in length. The Coleman and Abbott ditches are now abandoned, and the lands are now irrigated from the Oasis ditch. The headgate of this canal is in northwest quarter of Sec. 30, Tp. 17, R. 73. Commencing there the following lands are irrigated from the Oasis ditch: The East one half of Sec. 24, Tp. 17, R. 74; pretty nearly all of Sec. 13; practically all of Sec. 12, the east half of 11, all of 2, about all of 3 and a part of 5, in the same township and range. About one-half

of 5. There might be some contour of the surface in there that I don't remember that might affect this matter of irrigation. The northeast quarter of Sec. 6 that is all in Tp. 17. Now Tp. 18- there would be the east half of Sec. 31; about 2/3 of Sec. 32, about one-half of Sec. 27; nearly all of Sec. 28; the east half of Sec. 29; pretty much all of Sec. 21 and Sec. 22. The country is rather flat along course of the Oasis ditch. I don't think that fall of
592 ditch would be much over 2 feet to the mile. The general slope is from line of canal to river. As a general rule the land a short distance from river is not lower than that immediately adjoining river. After irrigation my water generally finds its way back into river. The lands irrigated by the Oasis canal extend at least two miles from river in some places. These are bottom lands and what we call second bottom. On land in Tp. 18, R. 74 there is a very good bottom, dark soil, sandy loam, good hay land, good alfalfa land and good for oats, rye and potatoes. It is devoted largely to native hay. At present oats are not very extensively raised in that vicinity. They have been raised to quite an
593 extent, periodically, for the last 15 years for commercial purposes. Rye is raised more for forage and made into hay and used for pasture and not so much for commercial purposes. Potatoes are produced to a certain extent, but all these men use a good many potatoes and they raise them for their own use, but often more than they use. I would not call this a potato district like Greeley. In my statement of the amount of land under the Oasis canal I may have gone below the end of the canal in taking that last estimate. My estimate of 12,000 acres under the canal also included land irrigated by ditches next to the river and which had been previously irrigated by overflow. The major portion of the 12,000 acres under the Oasis canal is included in the Talmadge-Buntin project. There are about 1,000 acres under the canal not included in the project. These lands are principally in Sec. 24, Tp. 17, R. 24. They are called the R. E. Fitch place. I own them. I did not go into the Talmadge-Buntin project. I have no connection with that. I think the Oasis ditch irrigates some land to
594 the east of its line by laterals. I understand that the James Lake Water District owns the Oasis canal at present. The Talmadge-Buntin funded bonds for building the James Lake reservoir and ditches and turned all of their holdings practically all of the indebtedness to their clients over to this water district. The Talmadge-Buntin people were original promoters of district. There is no Talmadge-Buntin irrigation district,—It was called the Laramie Valley Irrigation District at one time. The lightening changes here are shown by the Talmadge-Buntin. The two
595 gentlemen came out here and abought about 60,000 acres of land of Mr. Haley and promoted a colonization scheme and when they got done all they wanted to do with it, they got out of it as nearly as they could, and the bondsmen, the people who put up the money to bond this reservoir and ditch business, were left holding the mortgages against the settlers. I don't think there is anything crooked or unreasonable or unbusiness like. When I

speak of these lightening changes I don't mean to insinuate, but things have been changing so a part of the time and I attend to my own business, and I can't keep track of all these things. Mr. Talmadge I knew when he was here and understood he was a Chicago gentleman. Mr. Buntin is a Nashville, Tennessee gentleman. Both are nice gentlemen, perfect gentlemen, to all appearances and businessmen. Mr. Buntin is here in town now with his family and I think you would say that he is a nice gentleman as far as that goes.

I do not think that any of these lands are irrigated from the Pioneer canal. The Pioneer canal ends about a mile from the river. It ends in Sec. 18, Tp. 16, R. 75. It would be nearly a mile and a half from the river. I do not know whether it has been extended from that point in a northeasterly direction for probably 2 miles to a point at or near the river in Sec. 5.

596 There were probably 1200 acres of land between the Oasis canal and the Laramie river that water might be carried onto from the canal. I would think there were something like 6,000 acres of land actually irrigated from that canal now. A small portion of the lands between the Oasis canal and the

597 river are irrigated by the Boughton ditch. My estimate of land under the Oasis ditch would include, to a limited extent, the land under the Boughton ditch. That ditch belongs to a different company entirely and there is no way to appropriate that water out of this ditch for these particular lands. The Boughton ditch is owned by the Iron Mountain, a live stock or ranch company, whatever it is. Mr. Frank Bosler is the head and front of it. J. H. Boughton built the Boughton ditch. It was never intended to irrigate any of the Haley ranch, but to carry water from the river quite a distance and irrigate lands owned by this Iron Mountain Live Stock Company and the Diamond Cattle Company. These companies all belong to the same general owners. When Mr. Boughton built the ditch the company was the Iron Mountain Company. The Boughton ditch is below the point where the Little Laramie joins the Big Laramie.

598 This ranch was a large tract, of some 60,000 acres of hay and grazing lands, owned ostensibly by the Haley Land and Live Stock Company, of which Mr. Haley was the whole works. It was a stock ranch devoted largely to cattle and quite largely to horses and to some extent to sheep. Half of it lay between the junction of the Little Laramie and the Big Laramie rivers. The Abbott ranch was acquired by this concern, and a large lot of railroad land on both sides of the river clear up to within 3 or 4 miles of Laramie was included in that whole proposition. Outside of that it was pretty largely grazing land, second bottom land. The land extended along the Little Laramie some little distance, but we have not been referring to that at all, but that was included in this tract of land. These lands along the bottom of the Little Laramie were also hay lands. Mr. Haley got some cattle for the Marcus Town land

599 in Sec. 2, Tp. 17, R. 74. The natural course of the water from the Oasis canal, after it has been used for irrigation, would be to the Laramie river.

After the land has been irrigated pretty successfully for 2 or 3 years it does not require as much water to irrigate it as when you first started to irrigate. The bottom lands along the river are similar to the bottom lands above Laramie, with the exception that the lands below Laramie are not as easily irrigated as those above, on account of the sluggishness of the stream. The soil of these lands below Laramie is a sandy loam, sometimes a very dark and deep soil.

600 Except since the Talmadge-Buntin people sold the Haley land, and the water district took charge of it, there was very little measuring of water from these ditches. The measurement of water on these bottom lands is not a strictly scientific proposition. On the lands above the Oasis canal and those irrigated from it, the primitive method still prevails largely. There is no measuring weir, at the head of the Oasis canal. They have a very well constructed and substantial dam, mostly of rock, placed in the river. It is rub-le rock, piled in loosely,—flat stones, but not laid up in masonry,—round stones and all kinds. They went out into the hills and collected them. They are largely just piled in. There is also woodwork construction connected with it of some

601 character. It is a very substantial structure. The James Lake Irrigation District has a board of trustees who control the canal, and they have a water superintendent, who has three or four assistants who parcel out water with considerable regularity and system under the Oasis canal.

The water commissioner never interfered with the use of water on those lands which are not irrigated from the Oasis canal. It might be done without my knowing it, but I usually hear my neighbors talk about those things.

602 The R. E. Fitch ranch in Sec. 24, Tp. 17, R. 74 is about 10 miles from Laramie. Referring to the soil of these bottom lands, some kind of rock, limestone, underlies the sandy loam when you get d[illegible]n far enough but I never prospected much. It varies quite a go[illegible]l deal, sometimes you will find gravel and in a very short distance [illegible]ow within the length of an ordinary fence post setting, sand [illegible]nd [illegible]ood from there you will find solid soil. The river bottoms in t[illegible]is district below Laramie would range from half a mile to two miles in width. More particularly the portion near the river was irrigated by the natural overflow. Not the whole of the bottom, as a rule. Some very high water might spread out and cover all of it now and then.

Z. E. Sevison, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

603 I have lived in Albany County since March, 1908. Am a Civil Engineer and County Surveyor of Albany County. I know the Oasis ditch and surveyed it in 1908. The aggregate number of irrigated lands underlying the ditch as ascertained by me on that survey was 9151 acres. Two small tracts of irrigated lands lying between the ditch and the river were not included in the sur-

vey. One of those tracts contains 120 acres, the other 180 acres, making 300 acres irrigated in addition to the total irrigated from the canal.

Cross-examination by Mr. Fred Farrar:

604 The amount irrigated from the Oasis ditch is 9,151 acres. There are 300 acres which are not irrigated from the Oasis ditch. The Oasis ditch heads in Sec. 19, Tp. 17, R. 73. I do not know its dimensions. I estimated its capacity at 120 cubic feet per second by taking cross-sections every 200 feet nearly the entire length. I do not have the notes. They have been turned over to the Arnold Company of Chicago. Before coming to this country,
605 I lived at Cheyenne about 8 months. I have been engaged in engineering a little over 7 years. I graduated from University of Michigan in 1906 with degree of Civil Engineering. I was in the engineering department of the Lake Shore Railroad at Cleveland, Ohio, from July 1906 to September 1907, in the resident engineer's office, maintenance of way and the construction department. I was in Cheyenne from September, 1907 until March, 1908. From Cheyenne I came to Laramie in 1908. I have been county surveyor of this county since January 1, 1913. From March 22, 1908, until September 1, 1909, I was resident engineer for the Arnold Company on all their work here, including the James Lakes project and the Lake Hattie project. From the first of September, 1909, to July 1, 1910, I was on other work for the Arnold Company in Denver and Montana. Since 1910 I have been in Laramie continuously. I had other experience in irrigation engineering.
606 In Colorado I was on the Standley Lake project for the Denver Reservoir Company. From September, 1909, until April, 1910, I was in charge of construction of the distribution system on the Standley Lake reservoir. In Montana I was in charge of all construction on the Conrad project at Valier. I do not know that the Arnold Company goes by any other name. It had charge of the engineering work on the James Lake system. It is an engineering firm. I do not think they had any interest in the James Lake project other than engineering. B. J. Arnold of Chicago is the head.
607 He has never been actively engaged since I have been connected with or worked for the company.

Z. E. Sevison.

Redirect examination by Mr. N. E. Corthell:

608 The total acreage under the Oasis Canal having water rights from the canal is 11,246.03. The discrepancy was caused because the total I gave yesterday was the land included in the Laramie Valley District instead of the total under the canal. The 11,246.03 includes all of the lands under the canal.

608 Cross-examination (cont'd).

By Mr. Fred Farrar:

I am unable to give in detail the lands irrigated under the Oasis canal. I have prepared a table. The Laramie Valley Irrigation District is a municipal irrigation district organized under the laws of Wyoming. It is what is popularly and commonly known as the Talmadge-Buntin district. It was promoted by Talmadge and Buntin. I made a survey under the Oasis canal in the period from March to July, 1908. I used a transit and a chain. That survey was not made with as much care as one later, but with ordinary transit methods, being the deflection angles, and the distances between hubs were measured with a chain, and ties were made to the section corner wherever the ditch line crossed the section line. My finding of 11,246.03 acres of irrigated land was the result of the second survey, made in 1910 under the direction of N. W. Scott. They were making a new map of the irrigation district and this survey was made to determine accurately the boundaries of the district, as formed by the Oasis ditch. It was also used by the land company in making deeds. It was the final description of right of way of ditch. In making this survey no level was used. No measurements of the relative heights of land included were made. The lands irrigated under last survey are correctly shown on those two blue print tabulations which I handed you. In some instances I have two figures, one above the other, in each square of the table, each square representing 40 acres. Some of these 40 acre tracts are described in two or more adjudications or permits from the state engineer. I
610 designated them by different permits or adjudications. Perhaps in one adjudication they are described 10 acres and in another 30 acres, making 40. The acreage along canal and river was necessarily taken from survey. In some cases the figures were taken entirely from permits and not from survey, if there was any question but that land was entirely irrigated from canal. It might be a mile from canal, down close to river. In making this survey we did not actually measure each tract. My tabulation is, in a measure, the result of an estimate. These lands lie between the canal and the river entirely. That is all the land irrigated from this canal. I think it is all the land between canal and river. We did not use a level. I would not say that every acre of that land is under irrigation. There are some places where there is some rough land, some hummocks or other small tracts that are not irrigated. That table does not represent just land that is being irrigated, but all land under canal having water rights.

I don't know how many acres are actually irrigated. It varies from season to season. I have seen some variation in the last few years. 11,246.03 acres is total amount of land under canal, and not necessarily the amount of land irrigated. Some of this land cannot be irrigated. There is a trace of an old ditch in Sections 11 and 12, Tp. 17, R. 74, on east side of river. I think that is the Abbott and Coleman ditch, called that at one time, and there are the Abbott and Coleman water rights. This ditch irrigated lands that are in-

cluded within my estimate of the total amount of land under the Oasis canal. I know the Boughton ditch. It heads in Sec. 16, Tp. 18, R. 74. It runs parallel to the Oasis ditch from its headgate for a distance of about 5 miles. It is between the Oasis ditch
613 and the river. The lands under the Oasis ditch include lands between the Boughton ditch and the river. They are irrigated from the Oasis ditch. The laterals from the Oasis are carried across the Boughton ditch in flumes in two places, and there might be more. The strip of land, approximately 5 miles in length, between the Boughton ditch and the river, is from a quarter to a half a mile wide. I never saw any of that strip irrigated from the Boughton ditch. I don't think any of the lands in this strip are irrigated from that ditch. I never saw any so irrigated, and they have no water rights from it. I do not know whether 2,-
614 094.03 acres of the land included within the total of 11,-246.03 acres, given as the total acreage, belong to the Laramie Valley Irrigation District or not. There is not that much excluded from the district. The figures 9,151 acres, in my direct examination, were intended to represent the land under the Oasis canal and within the boundaries of the district. That figure was only approximate and does not represent all the land so situated. There are two tracts of land containing 372.56 acres which are within the boundaries but do not form part of the district. I do not have their descrip-
615 tions. I do not know number of acres under canal which are actually included within area and jurisdiction of the irrigation district. I can't give exact acreage within the district on the Oasis canal. There are lands under the canal not within boundaries of district. I know the Bilderback ditch. It heads in Sec. 29, Tp. 18, R. 74, and is approximately 3 miles long. It runs
616 northeasterly nearly parallel to the river. It ends just about a mile due east from the head of the Boughton ditch. The lands under that ditch are included within the 11,246.03 acres. They are not irrigated from the Bilderback ditch, except as it is now used as a lateral for the Oasis. I think that is only use to which it is put. During last few years and since my acquaintance with it, it has not diverted water from river. This is not the Bilderback ditch situated south of Laramie. There were two
617 adjudications for Bilderback ditches, but I don't know whether there are two ditches. This is only one I know. The 372.56 acres not a part of the district, are in Sections 24 and 4, Tp. 17, R. 74. Mr. Biddick owns the land in Sec. 4. I don't know who owns that in Sec. 24.

Z. E. SEVISON.

Redirect examination by Mr. John D. Clark:

618 I was engaged in this survey about two weeks during the irrigation season in 1908 and was there a short time at different times in 1910 prior to the irrigation season. Have been over that land every week or ten days or oftener during the past five irrigation seasons excepting parts of 1910. About 75% of the land

between the ditch and river is irrigated to wild hay, alfalfa, oats, potatoes, barley, wheat and various kinds of garden truck.

619 The total was as large in 1908 as at any subsequent time. I know Cooper Lake ditch. Made a topographical survey of the land under it. Ascertained the acreage of irrigated land under that ditch.

620 The survey was made the winter of 1908 and '09. The headgate is in Section 27, T. 19 N., R. 74. It diverts water from the Laramie. Runs northwesterly, irrigating 750 acres of land west of the river in 1908 and since.

Recross-examination by Mr. Fred Farrar:

620 The headgates of the Bilderback ditch and of the Boughton ditch are below the junction of the Little Laramie and the Big Laramie rivers. The lands formerly irrigated from the Bilderback ditch are now irrigated from the Oasis ditch. I only know where it takes water out of the Oasis at the present time. The headgate of the Oasis ditch is above the junction of the two rivers. It is supplied with water entirely from the Big Laramie river.

621 The old Bilderback ditch and the Boughton ditch were supplied with water from both the Big and the Little Laramie rivers.

Recross-examination by Mr. Delph E. Carpenter:

I made a topographical survey of the lands under the Cooper Lake ditch for the Arnold Company. They did not own this ditch. The survey was made in connection with a topographic survey of all land under this project, James Lake and canals, that is, all of the land west of the Big Laramie River. I made a complete topographic survey of all of the lands included in the Laramie Valley Irrigation district. This land under Cooper Lake ditch is a part of the district. In the general promotion of the Talmadge-Buntin project, or the Laramie Valley Irrigation District they took this ditch and its lands into the general scheme. I do not remember just how

622 many acres under the ditch were actually irrigated when I made the survey. There were 750 acres under the ditch. Prior to 1908, the land was all ordinary hay meadows. Perhaps 50 per cent of the 750 acres being included therein. Mr. Haley was using the meadow at that time. I did not ascertain how much hay he cut. The Laramie Valley Irrigation District owns the Cooper Lake ditch now. They obtained it when they took over the Oasis ditch when the district was formed in 1908 the Cooper Lake ditch was included in it. The Cooper Lake ditch has been used since 1908 directly from the river. I never made any measurement of the ditch.

623 It irrigates native hay river bottom land. The land was sold to settlers the same as a lot of other land there. I don't know who was the purchaser. There has been a man living on the Cooper Lake land and he bought most of the land that is under that ditch. That portion of the lands under the Oasis ditch above the

mouth of the Little Laramie and in Tp. 17, R. 74, is practically all wild hay lands, hay meadows. I do not know how much hay it produces per acre. I was there when hay was being cut on
624 Sections 1, 2, 3, 11, 12 and 13, Tp. 17, R. 74, also Sections 7 and 18, Tp. 17, R. 73. Practically all of section 1 under the canal is hay meadows. Nearly all of Sec. 2 that is under the canal and Sec. 11 and also Sec. 12 are hay meadows. Those meadows have changed hands several times during this period. Mr. Haley owned all of it in 1908. All of the land under the Oasis canal in that township is native hay land. There are a number of settlers with 80 or 160 acres in Tp. 18, R. 74 that are raising other crops besides
625 hay. One of them, Mr. Dougherty, raises oats and alfalfa. Two years ago he had about 40 acres of oats and also potatoes. He had just a small patch of alfalfa in 1911. He lives on the land. Herman Luven is another settler. He had 40 acres of oats in 1911. I don't know what he had in 1912 or 1913. He lives at Vosler. I do not know how much his oats produced. Mr. Davis also lives there. He had about 20 acres in crop in 1911, nearly all oats. I do
626 not know what he obtained or what he had in 1912 or '13. At one time there were quite a number of settlers west of the railroad in that township, some have moved away, and their buildings are idle. I did not make a plane table or topographic survey of that land lying east of the Union Pacific railroad and irrigated by the Oasis ditch. I did not classify it as to its fitness for agriculture. I do not know of any such survey being made. I do not know how many tons of hay were cut all told west of the Union Pacific Railroad and under the Oasis canal in 1913. There
627 was not very much hay cut in Tp. 13 and west of the Union Pacific Railroad in 1911. There was a good deal of land back of that. I think that was during the time they were changing around there a good deal and the meadows were neglected and some of them were broken up. The bulk of bottom lands are still the same as in 1908. I could not give the percentage of meadows that have been broken. I know how much irrigation has taken
628 place under the Oasis canal since 1908. I have never kept track of the settlers or their locations or of the amount of hay cut or anything of that sort. I haven't measured up the hay ground in all these seasons. Right along the river the land is barren. That is river bottom and it overflows. The land between the bench and the river is barren. There is a strip of land starting at the edge of the bench and going toward the ditch that is barren. About all of the land upon which there is native hay is over near the ditch, that follows along practically paralleling the ditch and as you get near the railroad it widens out and extends pretty well down to the Boughton ditch. Along in about Sec. 27, Tp. 18, R. 74 the hay land is about a half a mile wide. The hay land narrows down there probably by the time you get to the west line of Sec. 28. That is about the end of it. Between there and the river it is practically grazing land. Further down on both sides of the railroad
629 there have been some attempts at farming. Leaving out the Oasis and the Ghost place, under the entire Oasis ditch there

are 6 sets of farm buildings, including residences and outbuildings, not all occupied now. There was one good patch of alfalfa on the Ghost ranch in 1910, '11 and '12, about 20 acres in Sec. 35, Tp. 19, R. 74. I don't know anything about the production of that land. Portions under the Oasis canal showed evidence of
630 seepage and alkali in places.

My experience has not been entirely limited to handling irrigation in the Laramie Valley, outside of some little work on the Denver Reservoir Irrigation Company's promotion. I have done considerable work in the Platte Valley over in Carbon county, in the Platte Valley in Wyoming, under quite similar conditions to those here. I did some work in northern Montana, near the town of Valier. The conditions were not the same there. I had charge of th construction of the Conrad and Valier project.

631 Recross-examination by Mr. Fred Farrar:

I made a topographic survey of the lands west of the river in this district. I used a transit in making this survey. My contour intervals were 5 feet. Talmadge and Buntin are commonly known as the promoters of the Laramie Valley Irrigation District project. The district is sometimes known as the Talmadge-Buntin project. It is also known as the James Lake system. James Lake is a reservoir that supplies a portion of the system. It receives its water from the Little Laramie and other creeks, but no water from the Big Laramie river. Water from James Lake as applied to land in this district is not water which is taken out of the Big Laramie. The lands under the Oasis canal get no water from James Lake. Those lands are on the opposite side of the river from James Lake.

The capacity of James Lake is 41,100 acre feet. It has a storage depth of 30 feet and an area of about 1400 acres at the upper high water line. It has as other sources than the Little Laramie, the Four Mile creek, Seven Mile creek, and the Mill creek. The dam and outlet, the structure which regulates water taken from reservoir, were constructed in 1908 and '9. In 1912 there was a change in the dam and outlet. The two gates were cut out entirely and closed up and one of the structures changed from an overflow to a sluice gate. Two steel sluice gates were installed and these passages were arched over and filled in with earth. The only reason for these changes that I know of is that the Government asked to have them made before they approved this system. The original concrete work was rather
633 badly cracked in places. The outlet ditch from James Lake was constructed in 1908 and the spring of 1909. The main outlet is 4000 feet to the bifurcation works. Then the main canal divides into the north canal and the south canal. These were constructed at the same time as the main outlet and were completed in July, 1909. The north canal is 32 miles in length and the south canal 9 miles. They were completed at the same time. The outlet ditch has a capacity of 300 cubic feet per second. The north canal ends near the west line of Sec. 34, Tp. 19, R. 75. The south canal ends near the northwest quarter of Sec. 14, Tp. 17, R. 75. At the

head the south canal has a capacity of 90 cubic feet per second and the north one has a capacity of 250 cubic feet per second. Four Mile creek is now diverted into the reservoir, and there is no water taken out of Four Mile creek below where the north canal crosses the old Four Mile creek channel. The ditch is constructed across the old creek channel and a dyke constructed in the old creek bed on the lower side of the canal.

The feeder ditch into James Lake was really completed in 1911. There was enough of it completed so water was turned into the reservoir and it was used as a supply canal in 1909. That original construction was not for its whole length. It utilized the old Bellamy canal for a distance of between 16 and 17 miles. The Bellamy canal lead out of the Little Laramie river. It had previously been used for the irrigation of lands along the Little Laramie.

The first water for purpose of irrigation was stored in James Lake during the season of 1909. Approximately 18,000 acre feet were stored and a small amount used that year. Including the
635 balance which was carried over, I would say that there were about 10,000 acre feet stored in 1910. 8,000 acre feet was not used in 1909, counting the seepage and evaporation there was more than that used. There was not 10,000 acre feet carried over. The reservoir was practically dry at the end of the season of 1910. During that year all the water except that lost by evaporation and seepage was run through the ditches and laterals. Some of the settlers used it, those who had land under it. It was all applied to lands. In 1911 about the same amount was stored as in 1910. Not more than 10,000 acre feet. All of it was used for irrigation that year. About 22,000 acre feet was stored in 1912. It was not all used but about 18,000 acre feet were carried over. During the summer of
636 1912 the district was repairing the dam. The season of 1913 was commenced with about 18,000 acre feet in the reservoir. I do not know what has been stored this year, 1913. Early in March the water on the dam indicated about 21,000 acre feet from the depth of the water. The greatest supply of water is obtained in June. In 1913 they had about 21,000 acre feet of water in the reservoir with the high water yet to come. 22 feet in depth at the outlet tube would amount to 21,000 acre feet on storage. I have no information as to the amount in the reservoir subsequent to 1913.
637 I know the Loback ditch. The Bellamy ditch is an auxiliary supply for the Loback. The Loback is further west. It heads on the north fork of the Little Laramie. The Loback and the Bellamy ditches join in Sec. 12, Tp. 16, R. 67. From that point on they are one ditch.

From the Little Laramie river to Mill creek the Lake James Supply ditch has a capacity of 400 cubic feet per second. From Mill creek to the headgate of the Blackburn ditch it has a capacity of 550 second feet. From the Blackburn headgate to Seven Mile creek it has a capacity of 400 cubic feet per second. We utilize the channel of Seven Mile creek for two and a fourth miles above James Lake as a feeder ditch. The water from Four Mile creek is diverted into the lake on the other side from where the Seven Mile creek enters.

The lake is built in the channel of Seven Mile creek, which simply flows into the lake. The outlet structure is built into the lowest point of the arm of the lake. It don't overflow there if it ever
638 overflows. My topographic survey was all on the west side of the river in this district. I could not say what percentage of the land is too high for irrigation.

The original surveys on James Lake were started March 22, 1908. The original surveys on the north and south canals were started within the next 5 days. The original survey of the feeder or supply ditch was started on March 22. The reservoir survey was started 2 or 3 days later.

The Bellamy canal was originally enlarged all the way from the Little Laramie river. The Loback canal is not used as a feeder for the reservoir. The enlargement was rather irregular. It was 8 feet on the bottom and carried 2 feet of water. The enlargement for the Little Laramie to Mill creek is 14 feet on the bottom and carries 4½ feet of water. From Mill creek to Blackburn headgate it is 18 feet on the bottom and carries 4.8 feet of water. From the Blackburn headgate to Seven Mile creek it was 22 feet on the bottom
639 and carried about 3 feet of water. I assisted in making these original surveys. No water that is taken through the Loback canal is carried into James Lake. Prior to the enlargement of the Bellamy canal the Loback canal was used, but since that was completed the Loback has been used very little, if any. It was not the original design to use the Loback canal as a feeder for the reservoir. It is available as a feeder, however. The Loback canal heads on the north fork of the Little Laramie river. I do not have the topographic map which I made of this ditch. The original is in the office of the Arnold Company. I don't believe there are any copies here in Laramie.

LARAMIE, WYOMING, September 3, 1913.

Cross-examination by Mr. Fred Farrar:

640 I do not have the records showing the capacities at the various contours on James Lake reservoir. There should be one in the state engineer's office. I filed such a statement or tabulation. I have never worked directly for the district. Mr. W. H. Tuller has charge of the irrigation works for the district. He has charge of the distribution of water for the Carey Act land and for the district also. He lives at Bosler. There is an election held in the district every year.

Z. E. SEVISON.

Redirect examination by Mr. John D. Clark:

641 The Talmadge-Buntin lands lie on both sides of the Laramie. The lands on the east side aggregate about 11,000 acres under the Oasis Canal. About 75% of those were irrigated prior to the Talmadge-Buntin Project and the balance under the

Oasis Canal are included in the projected scheme and are in the Laramie Valley irrigation district.

642 The Big Laramie supplies water for these lands, James Lake Project has nothing to do with them. The Cooper Lake Ditch is a part of the present Talmadge-Buntin Project. The lands under that ditch are irrigated principally from it, but it was also planned to furnish some water through an auxiliary supply from the North Canal of the James Lake system. The Big Laramie supplies Cooper Lake ditch. There are still other lands on the west side of the Laramie in the Talmadge-Buntin Project and also in the Laramie Valley irrigation district.

643 There are also Carey Act lands on the west side secured by the State of Wyoming for reclamation under canals constructed by the Talmadge-Buntin Project. There are about 30,735.92 in the Talmadge-Buntin contract on the west side of the river including 750 acres lying under the Cooper ditch and also including Carey Act Land and Municipal irrigation district land. About 9500 acres are Carey Act lands and west of the district 3577 acres additional to Carey Act lands not included in the district. The district lands west of the river are about 18,000 acres. The main tract of 30,000 acres is susceptible of irrigation from the irrigation system that is constructed. This system is completed.

644 James Lake Reservoir supplies these lands west of the Laramie River outside of those supplied by Cooper Lake ditch. Lands lying on the west side not under the Cooper Lake ditch have been irrigated since the construction of the system, principally by settlers who commenced to occupy the lands in the spring of 1909. A few new settlers have been coming in every year and others moving away and shifting around. The entire area has not been settled up.

Recross-examination by Mr. Delph E. Carpenter:

This is the first that I know of the news ever being published that the patents have been issued. I could not tell the number of settlers that we had on the project in 1909. I should say that in 1912 they had about half as many settlers as they did in 1909. I am not so familiar with it this year as to the actual number of settlers and the lands they are irrigating.

645 Recross-examination by Mr. Fred Farrar:

This is the first year that I have known of a report being published to the effect that the patents were issued. One protest has been made against the issuance of patents before, by a number of settlers. I think that was sometime during 1910 or the early part of 1911.

Redirect examination by Mr. Corthell:

645 I assisted in laying out the work of the Lake Hattie irrigation system, now owned by the Laramie Water Company.

646 Began the work April 16, 1908; surveyed first Lake Hattie Reservoir, then the intake canal from the Laramie River,

also preliminary surveys for outlet canals and distribution system. These surveys continued with slight interruptions for a little over a year. The final location of the canals was started about May 1, 1909. Surveying parties were continuously employed. Actual construction work was started July 17, 1909. The contract was let June 14, 1909. Two drag line machines were at work on the construction, about 35 teams on the dam and 150 teams on the north canal and
75 teams on the south canal.

647 The machines worked double shift, about 1800 yards of excavation per day for each machine. The capacity of Lake Hattie reservoir is about 60,000 acre feet. I surveyed the Boswell reservoir, later called Roberts-McConnell reservoir, June 1, 1908. The dam is at the upper end of the cañon about a mile north of the
state line between Wyoming and Colorado. That was to

648 be a part of the Lake Hattie System. All these works were to draw water from the Laramie River. When I returned to Laramie in July, 1910, the Pioneer Enlargment was completed; Lake Hattie Supply Canal No. 1 was completed to within 2000 feet of Lake Hattie, the earth work on the dam was finished, the main outlet canal completed to the bifurcation, the North Canal completed, except the bridges and a few small patches of earth work left for road crossings, as far as a point directly west of Laramie; the South Canal was completed almost to the Big Laramie River except bridges. Since, the dam has been finished, concrete facing put on, the intake canal finished, the dam in the Big Laramie at the head of Pioneer Enlargement re-built, the bifurcation of the North and South Canals finished, the bridges put in, turnouts for the laterals or lateral headgates completed. Lake Hattie Supply Canal No. 2 had been built from the Little Laramie and the dam built
in the Little Laramie.

649 The system is in operation since early in 1912; the intake canal to its full capacity since 1912, North Canal in operation for about two months. They stored a small amount of water in Lake Hattie Reservoir in 1911; considerable in 1912; no water has been flowing into the reservoir so far as I know in 1913. The intake canal from Sodergreen Lake to the reservoir has a capacity of 1000 second feet, the outlet canal of 700 second feet. The first filings on land lying under the canals called for 60,000 acres. The system takes its water from the Laramie River and the return flow goes
into the Laramie.

650 In making the survey for the Lake Hattie Supply Canal, I found stakes of previous surveys, following very closely the line of my survey. 100 to 200 feet apart was the greatest variation. It was designed to irrigate practically the same land and the water to be taken from the same source.

650 Cross-examination by Mr. Delph E. Carpenter:

At the time I began these surveys on April 16, 1908, I was working for the Arnold Engineering Company. Mr. Rosecrans directed me to start. He was chief engineer for the Arnold Com-

pany. I was in Laramie when I received the order where
651 I have been since March, 1908. This project was surveyed by the same field parties that surveyed James Lake. We shifted back and forth from one project to another. This preliminary work was under my immediate supervision. I know a man by the name of G. I. Speer. He was from Chicago. He had something to do with the financial part of the project. The Arnold Engineering Company were doing this work up to about the first of June, 1908, for Trowbridge and Niver, of Chicago. I do not think the Arnold Company is a promoting company as well as an engineer company.

I ran three preliminary lines from the Pioneer headgate to Lake Hattie. One followed the Pioneer itself to the Sodergreen
652 lake and then followed the line of the present supply canal No. 1 to the reservoir. Another one started at a point so as to follow what was known as the old Collins ditch and a little bit higher up than the Pioneer. The third one was still higher up so as to be independent of the other ditches as much as possible. The last one headed on the river just about Lund's ranch. I found the first line to be the most natural and feasible line. Good engineering dictated that it would be the most economical to build, provided satisfactory arrangements could be made for the use of the Pioneer to Sodergreen Lake. This line was finally adopted. In surveying these lines I considered the question of economy of construction as well as the mere location of the line itself.

The first survey was made at the reservoir site to see if it was feasible. By constructing a dam at its present location we
653 could make a reservoir there. The final contour map showed about 15,000 acre feet of dead water, that is water that you cannot draw off in the reservoir. We made a cut so as to let off water that would otherwise have been detained in the natural old original lake basin. After drawing off all of the water possible by way of the outlet, there would be about 15,000 acre feet of dead water. I do not know how deep, as we did not make any soundings as to depth in this dead water area. I simply ran the contours, starting with the lower or zero contour at the elevation we could draw water from the lake, and ran from that up. These contours were run at two foot laterals. I did not reduce these surveys to the form of a map. That survey was in progress when I left, making a careful contour survey of the reservoir site, but I have seen the map. My work was largely preliminary work on the Lake Hattie reservoir, work that is usual on any project of any size. My time was taken up with that instead of final contouring and
654 similar work. I estimated at that time that there were 60,000 acre feet of storage capacity available for use from the reservoir. The final maps were filed with the state engineer of Wyoming. They should show just what the capacity is.

After I had worked on the reservoir I went over to work on the inlet canal, being the canal from the Big Laramie river to the reservoir. I moved my party over to go to work on the inlet ditch a

week afterwards. I was 4 days in locating the lower or final line as the feasible one. The country between Lake Hattie and the river is very easily surveyed. Most of it is across a table land that is quite uniform. There is a little brush on the river, but away from the river there are no trees or brush to interfere. The ditch follows the line which would be run by a level. There is no tunneling or heavy cutting with but the one exception where you go through the arm of the bluff. There are no railroads or mines, or anything of that kind to conflict. I had an unlimited field in
655 which to work, without any obstacles. There was only — place at the southwest of Lake Hattie that had a small irrigating ditch through which we ran. There was only a very little rock work, close to the lake. The line was afterwards changed so finally there was no rock work at all on the new ditch. The lower end of the inlet ditch was very readily and economically constructed by the use of water running down into the channel rapidly and eroding into the ground. Last 200 feet was so constructed. I do not remember the yardage in so excavated between the river and the upper end of the Lake Hattie inlet ditch. It was all done with a drag line. Approximately, the price paid for that drag line work to the subcontractor was 13 cents per cubic yard. I did not classify
656 any of that work. The Pioneer canal was finally enlarged to have a capacity of 1200 cubic feet per second. The old capacity was about 300 cubic feet per second. That portion of the old Pioneer canal south and west of the Sodergreen reservoir, about half a mile in length, was re-located. The other portions followed the old Pioneer very closely. The old Pioneer was straightened out in places and given a little better alignment. It was made larger by widening it on the upper side and excavating into the upper side of the embankment. The old or lower embankment was left in place. The capacity was increased by using the material so borrowed from the upper side for the purpose of raising the lower embankment. It was planned to carry a certain amount of water against the lower embankment made from material
657 excavated within the prism of the canal. In relocating the Pioneer we cut out the old bend and straightened the channel by going straight across from about the center of Sec. 29 to the lake. This involved a cut right at the point of departure from the old canal through a little hog-back. That work was done with the drag line. From the Sodergreen Lake on down to the reservoir the ditch was made with a drag line, excepting that particular portion cut out by the use of water. In the drag line work the dirt was deposited on both the upper and lower sides of the ditch. That portion of the ditch was made by simply cutting down across an almost flat table land.

The dam at Lake Hattie was made from earth borrowed in the vicinity of the structure. It has a reinforced concrete facing. The maximum height of the dam was 36 feet, called for by the
658 first plan, afterwards increased. At point of maximum height fill did not include any of the old natural embankment because there was none at that time. The preliminary estimate and

figures on yardage on which contractor took contract for dam was 180,000 cubic yards. The general contract price was 26 cents. Do not know what the sub-contractors obtained and do not remember the yardage in the outlet work and the outlet canal, the north and south canals. I have not figures,—they should be in possession of the Laramie Water Company.

The final location and line was made in May, 1909. At that time I staked out all these final lines. I did not include
659 the lands under the Pioneer canal in the 60,000 acres to be irrigated from this system. The lands to be irrigated from the Lake Hattie reservoir were between the Pioneer canal and the north canal, the bulk being between th Little Laramie and the Big Laramie rivers, in Tp. 17, R. 74. There were also about 14,000 acres south of the Big Laramie river, which was proposed to irrigate from the south canal after crossing the river. That was situate over north and east and some west of Creighton and Hutton Lakes. This irrigation of the land east of the river was never finally developed. The south canal was constructed only to the Big Laramie river. The north canal was constructed around to about the center of Tp. 16, R. 74, and completed in 1912, the main canal. All worg on the main outlet canal, and on the north and south canals, was the ordinary small ditch building,—entirely plain earthwork, no
660 tunnels or rock work or flumes or anything of that sort. The whole Lake Hattie System was one of remarkably small cost and economical construction. At no place in the entire system did we encounter any difficult engineering problems. They also intended to irrigate about 12,000 acres in the Big Hollow with water of Lake Hattie. Nothing was ever done toward the construction of those laterals. We got into Big Hollow with rather a deep cut. The High Line of course—the ditches from Lake Hattie were rather low down in the Big Hollow—and the High Line was to irrigate practically on the north of the Big Hollow, follow the ridge to the north.

The High Line canal could not draw water from the Lake Hattie Reservoir but it could from the Boswell or the Robertson—McConnell reservoir. I do not know by whom those old stakes on the High Line, which Mr. Corthell mentioned, were placed. Jud-ing from their condition they were pretty well weatherbeaten, I should say they were ten years old anyway. They were indicative of an old survey having been run before.

661 It is nothing unusual to find stakes of old surveys in running lines. This was the natural and most feasible line for the continuation of the lateral or High Line from the Pioneer canal. No old maps were given me that I followed and no old surveys. Until I ran onto those stakes I didn't know there had been a survey run there. I would think that these stakes had evidently been placed on some preliminary line run from the Pioneer canal in the neighborhood of Sodergreen Lake. They would indicate a grade line run from Sodergreen lake.

It was not a part of the original plan to take the Pioneer canal as well as the land under that ditch. That was brought about some-

time during the latter part of 1908 or early part of 1909. There had been a union of the two enterprises just before the actual construction work was started. I met Mr. Wendelkin and Mr. F. C. Grable in 1908. They were not interested in the promotion of the Lake Hattie, but were interested in the Stewart project. The two projects overlapped to a certain extent. As to their subsequent
662 connection with this enterprise, I don't think they were vitally interested in the project until after the construction work was actually started on the Lake Hattie project. I ran across these old stakes on the High Line about every 300 to 800 feet. I should say that they were indicative of a fly line survey or preliminary survey. They certainly were not final location stakes.

It was not a part of the original plan to construct a series of laterals in townships 16 and 17, R. 74. That was a later arrangement on the part of Mr. Goldsborough. They have not been constructed and I don't know how much has been done, as I have not been out there this summer. The work on that portion of the Lake Hattie project was discontinued recently.

663 No construction work was ever done on the High Line from Lake Hattie after I left. There were other surveys made later in the nature of a final location survey. I had nothing to do with that. No work was done on the south side of the Laramie river. The location of the dam of the Robertson and McConnell reservoir was across the bed of the Laramie river at the upper end of the canon. The water would have been backed up in the river valley had the dam been constructed. The work of construction has never commenced on it, other than a mere survey.

There might have been water run into Lake Hattie reservoir during the fall of 1911 and during 1913, particularly the spring or early months. A great deal of the water which flows off from the irrigated fields or away from the ditches, other than onto the
664 land up under the Pioneer canal and under the north canal, down pretty well toward Laramie City, flows into numerous ponds or natural lake basins. It eventually goes away by evaporation. The return flow from this system into the Laramie river results from the irrigation of lands in townships 16 and 17, R. 74. It does not include that portion which runs into numerous lakes under the Pioneer system and evaporates.

Cross-examination by Mr. Fred Farrar:

This Stewart project combined with the Lake Hattie project. Lake Hattie reservoir derives its water supply from other sources besides the Big Laramie river. There is a supply canal built from the Little Laramie river. There are also two little creeks which flow directly into Lake Hattie. They are very small torrential streams,—flood water streams—dry in the summer time, as a rule. They drain a small water shed into the west or north of Lake Hattie, the easterly slope of Sheep mountain. The obtaining of water supply from
665 Douglas creek was a part of the Stewart project. It is intended as a part of the water supply for this reservoir. Con-

struction work has been started on a diversion canal from Douglas creek. The creek coming into Lake Hattie from the west is called Johns creek, and is the only one of any size. The work I did in connection with the Arnold Company was done for Trowbridge and Niver. The Lake Hattie Reservoir and Irrigation Company succeeded them. They were succeeded by the Laramie Water Company. Mr. George Robertson of Shamokin, Pennsylvania, was at the head of the Lake Hattie Reservoir and Irrigation Company. Senator McConnel of Shamokin was also interested in the company. The High Line canal from the Pioneer to Sodergreen lake for which I made a preliminary survey, was never constructed.

666 The Big Hollow takes in the north half of Tp. 15 N., R. 75 W., about 3 sections in the northwest corner of Tp. 15, R. 74 and about 3 sections in the southwest corner of Tp. 16, R. 74. It is about 11 miles long and averages about 2½ miles wide. The depth would average about 150 feet at the bottom below the surrounding country. It is a great hollow lying in the center of the Laramie Plains, between the Little Laramie and the Big Laramie rivers. There is no outlet of any kind. It has no seepage water in it now. There is a small pond there in the bottom. There have been two or three ponds of considerable area at various times. I have seen more than one there in other years besides this. Any water which gets into the Big Hollow must either evaporate

667 or pass away by seepage through the soil if it gets out. The 12,000 acres in the Big Hollow which it was expected to irrigate with this system and 14,000 acres on the south side of the river, forms a part of the 60,000 acres, but the project is not completed to irrigate either of these tracts. It is very doubtful if any of the waters would ever circulate away from the Big Hollow. If it should so percolate it would be in an easterly direction toward the Big Laramie river. I do not know the number of acres in this project that are now under cultivation or irrigation.

No work on construction of The Robertson-McConnell reservoir was done that I know of. The dam site of that reservoir was in Wyoming, nearly two miles north of the Colorado Wyoming state line, right at the mouth of the canon where the river enters.

668 Cross-examination (cont'd).

By Mr. Delph E. Carpenter:

All of the water which runs into the Big Hollow now from natural drainage from the area within the hollow settles down into those lakes at the bottom. It remains there until it evaporates. If the slopes of this hollow were irrigated all water settling into the bottom of the hollow would have to evaporate. The consequence would be that the lower part or bottom of the Big Hollow, and particularly the large flat in the bottom, would eventually become wet seepage lands, covered more or less with water and alkali. The only land which would be fit for cultivation would be that which would remain on the slopes of the hollow. That land has a slope of about 150 feet to the mile. I would consider it pretty steep for successful irrigation.

J. T. DODGE, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

669 I have been living in the vicinity of Section 34, T. 23, R. 73, since 1893. Engaged all that time in ranching. I irrigate 120 acres of land from the Laramie River through the Dodge ditch and 93 acres through the south side ditch. The Dodge ditch was built in 1894, the south side ditch in 1906. Have irrigated these lands ever since. Grow alfalfa, wild hay, potatoes, vegetables and some small fruits.

670 Cross-examination by Mr. Fred Farrar:

I am below the reservoir known as the Wheatland reservoir No. 2, possibly 10 miles by the river. I am about 12 miles above the diversion dam of the Wheatland system by the meander of the river. I am about midway between the dam of the reservoir and the diversion dam at the tunnel. These lands in Sec. 34, Tp. 23, R. 73, are irrigated. They lie parallel with the river and are mostly bottom land. The altitude of my place at my northwest corner is 7,001 feet. Where I irrigate it would be about 6800 feet. The river bottom lands average at my place from a quarter of a mile down to 100 yards wide under the ditches. I am just above the cañon of the river. I have unirrigated land that runs right to the head of the cañon, possibly half a mile from where I irrigate. I am immediately at the head or mouth, that is the upper end, of the cañon. The river runs in a northeasterly direction from my place. After it passes my place its general line is easterly. Immediately to the north of the land which I irrigate the land is just rough, rolling land. After you get off of the river bottom, probably 100 feet, the land would be rolling from there on north. A mountainous country east. This Black Hill range is east of that. It would be called the Black Hill range north to Laramie Peak. The country to the north of me is not all mountainous. The north

672 Laramie and other streams head to the north of me.

The North Side derives its water from the Laramie River. It gets the water out of the Big Springs. The north side ditch is the Dage ditch. I have a water right in the Big Spring, and the South Side ditch is from the river. I led water from the Spring run into the river and take it out at the dam. These Big Springs are about half a mile up the river from my section line. They are about 75 yards from the river. There are 7 of them and run 4 cubic feet of water per second. I have a ditch below the springs in the river and also a ditch from the springs past the dam. I can take water either way. The water commissioner stated that if I wished I could let the water run into the river and use the river as a canal the same as the Development Company. Both of these ditches use the same

673 dam. It is a rock dam with cribs, probably 200 feet long and its width at the base is 25 feet. The water from the springs reaches the river above the dam. I can use the water of the springs through the north side ditch or let it run down into the river and

take it out at the dam. It irrigates the same as the north side ditch. The south side ditch was designed to take river water. The north ditch is 6 feet wide on the bottom, 1 foot deep, and has a grade of 3½ feet to the mile. Both ditches are of that grade. It is 2¾ miles long. The south ditch is of about the same dimensions and grade. The slope on each side is from the ditches to the
674 river. The water is taken as much as a quarter of a mile in some places from the river. These lands are not natural hay lands. By wagon road I am 40 miles from Wheatland and 47 miles from Laramie. My nearest railroad station is Rock River, 28 miles. I actually irrigate 218 acres. 200 acres of that land is native hay. 13 acres is in alfalfa. I have one acre of potatoes this year. I have raised as high as 5 or 6 acres. I have a family garden. The water from these springs would naturally flow into the Laramie river. I have cattle and horses and run from 300 to 400 cattle. The country to the north, to the south and to the west of me is open range. To the east of me is the mountain range through which the river runs. About all the water is taken up. My cattle range in around the Blue Grass and Laramie Plains. The Blue Grass is to the southeast of me. By the Laramie Plains I mean the country south and west of me. My ranch is right on the edge of the Laramie Plains. My son and I run probably 30 head of horses. In the winter I keep my stock in the fields and feed hay when needed. We cut from 100 to 125 tons of hay on this 200 acres, it will average about half a ton to the acre. Part of that is new land and there was nothing on it when I started. It takes some time to make wild hay. I think that a fair average would be about ¾ of a ton to the
677 acre on the irrigated. We don't raise any other crops except for our own use.

The authorities never have regulated the amount of water I am permitted to take. We take what water when and in amount needed. I commence irrigating about the first of May and irrigate until July 1st. Sometimes the alfalfa, the little I have got, I irrigate later for a second crop. We make two cuttings of alfalfa. They are cut about the first week in July and about the last week in August. We irrigate wild hay the first of May. We irrigate alfalfa along about May 15, if the weather has warmed up a little. My north side ditch comes out at the springs on the west
678 side of the river. In order to get to Wheatland I cross the Black Hills. Not many settlers in my vicinity. Mostly open country there. East of me are quite a few little ranches.

Cross-examination by Mr. Delph E. Carpenter:

I have no gate in the dam to let the water down the river. I have headgates in my ditches is all. The water goes over and through my dam. I intended to appropriate the water of these springs for my north ditch. I don't believe I require the full 4 cubic feet per second. I have no appropriation out of the springs for the south side ditch. Both ditches and the place belong to my wife.

I raise my headgate and let in what water the ditch will carry

and use it. Let the water flow over the land and it all runs back into the river. I like lots of water. There is some water in the
680 river all the time, not enough to supply my wants if the springs were not there. The bulk of the water that comes through my place in the winter is through these springs. They shut their headgates down above. Those springs rise on Sections 32 and 33, 33 belongs to the Two-Bar. I settled there about 1892. I took out my ditch on the north side in 1894. My object
681 was to utilize the water from the springs for my land. The water commissioner measured my land irrigated from the north ditch and found there are 120 acres. The south side ditch was taken out in 1906, and finished in 1906 or '7. We irri-
682 gate about 93 acres from that ditch. No one has ever disputed our right to the water. We simply take what we want to irrigate our land. We get through with that meadow irrigation about July 1. We then let our hay meadows dry so that we can cut them. That finishes our hay irrigation except for alfalfa.
683 I sometimes later irrigate for a second cutting.

During the summer we run our livestock on the public range. In the winter on our own land. We generally have a round-up about the 15th of September and gather all the livestock and put them into the fields. My son and I have probably 2,000 acres of deeded land under fence. I suppose we had a section more inside, than we owned one time, before we tore the fence down. My son is T. B. Dodge. We run from 300 to 400 head. It is our custom to run these cattle on the range until the round-up.
684 We follow the same custom as do the other stockmen. This pasture land runs into the hills. Some years we ship considerable cattle and some years we don't. When the market is right we aim to dispose of our steer crop every fall. Our calf crop as a rule does not equal more than 50 per cent of the number of
685 cows. We usually care for from 50 to 75 calves in our weaning pens. We carry the cows and the rest of the stock in our fields during the winter time, feeding in time of storms. We do not always have sufficient hay to carry that number of cattle. We bought hay two or three winters. We had from 125 to 130 tons of hay the summer before last. That included our alfalfa.
686 With the feed we have in the fields, in the average winter our hay that we obtain from our place will carry us comfortably through. By saving this grass that grows on the 2,000 acres of pasture and putting that with our hay we are able to carry the cattle through. We run about 30 head of horses, we keep them on the open range in the summer. They are better able to shift for themselves in the winter than are the cattle. The loco weed bothers us in our country. We used to raise horses more than we do, but we cut down on account of loco and wolving. Wolves kill a good many colts. They seem to be very fond of colts. Between the loco and the wolves our horse industry is not profitable. I am not in the sheep business. These 30 head of horses we carry over from one year to another include all of our horses, large, small, saddle horses and work horses. We keep about 10 head of saddle horses on hand to

handle our live stock. We keep 10 or 12 work horses. We never work any saddle horses. There is no ranch between me and
687 the dam of the Wheatland tunnel at the cañon. My ditches are the last ones down the river before the river enters the cañon. The only ranch between me and the Wheatland reservoir is McGill's. That belongs to Senator McGill. He has his private ditch near the dam at the reservoir. Other than his ditch and these two ditches of mine there are no other ditches between Wheatland reservoir No. 2 and the head of the cañon. We have the only ranches on the river between those points. The range country is all open south of my place and over towards the head of the Blue Grass and east of the reservoir. The country at the head of the Blue Grass is very good summer range country.

688 We turn our stock out in the spring about May 15. We have a live stock association in that country and have large round-ups. From 15 to 20 riders follow the round-up wagons. The Diamond Cattle Company have a representative on our wagon
689 and we have a representative on theirs. The range over which our association works extends to the Union Pacific Railroad, about 28 miles, to Rock River and through there and clear in through north of Medicine Bow and Sheep Creek. It runs south up to Lake Lone. North up to the Sheep creek country, about 40 or 45 miles. The members of the livestock association turn their stock loose on this general range. This round-up lasts about a month in the fall. Senator McGill has the largest holding of cattle in the association. Our holdings are smaller than most of them. My business is primarily cattle business. We raise feed to carry our stock in winter and garden produce and potatoes to feed our family and men.

Redirect examination by Mr. N. E. Corthell:

When there is considerable water in the river it backs up over those springs.

Recross-examination by Mr. Delph E. Carpenter.

691 There are no other springs in the vicinity of my place than these Big Springs. There may be some little springs coming into the river between my place and the cañon. There are one or two little creeks between my place and the tunnel dam. That is a little stream made out of springs. The creek would not average over two feet wide. The water flows about six inches deep. It is a continuous creek, never dry. The stock water all along its way. Through the Black Hills are quite a number of springs. Take it east of my place through the hills there are a few springs. They are small and in dry years a good many of them go dry. The
692 Sybille springs are south of me, on the west side of the Black Hill range and their water runs into the Sybille. The stream flows through the range over to the east side. There are some springs along the Blue Grass. There are springs on the north Laramie and those streams. Then there is Bear creek, way north, but that runs into the North Laramie below Laramie creek. These Big

Springs of mine are the largest springs in the community. They are larger than the Sybille springs. Their size gave them the name "Big Springs." I do not know of any springs up the river between me and the reservoir dam. Other than the McGill ranch there are no ranches between me and Gillespie's at Lake Ione. There is the Two-Bar shearing pens, I don't know that you would call that a ranch. I don't think they irrigate any. There is no ranch between there and Gillespie's. The next large ranch above Gillespie's is the Bosler ranch. The Diamond Company owns it now. Their ranch I think is right there near Bosler station.

694 From Bosler station down to my place the ranches of note are the Diamond place, the Gillespie ranch and the McGill ranch. It is about 26 miles by wagon road from my place to the Diamond ranch buildings. On Gillespie's ranch I think they irrigate some hay. McGill's is the only other hay irrigated between there and my place. The country through there is open range, except for McGill's and Gillepsie's places. The stock range back and forth across the river between these places. We do not pass any houses on the wagon road between my place and the Diamond ranch, only McGill's on one road, and there are some buildings on the reservoir dam that you pass on the other road. Between Laramie City and my ranch I don't pass any houses along the road except McGill's ranch.

THOMAS B. DODGE, a witness on behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

695 I live near McGill Post Office. Have engaged in the ranch business all my life in Albany County on the Big Laramie. I know the Cramer ditch taking water from the Laramie River. Three people irrigate from the ditch.

696 On the Cramer ranch 80 acres are irrigated and he has another place near the end of the ditch. He raises alfalfa. That has continued 10 or 12 years. The ditch was built 12 to 15 years ago. The land has been irrigated all the time. Should judge Mertz irrigates 100 acres from that ditch, possibly more. He irrigated it for 10 years. He has two reservoirs.

697 He raises alfalfa and some small grain. All the water comes from the Laramie. Bonkey irrigates about 40 acres from that ditch. The ditch comes out of the range of hills at the east end or lower end of the Laramie River cañon 12 miles below the Wyoming Development Company's tunnel.

Cross-examination by Mr. Delph E. Carpenter:

That is the first ditch taking water from the Laramie river east of the mountains. It takes water from the north side. The ditch is 5 miles long. Duck creek is the principal creek discharging water into the Laramie river between Big Springs and the head of the Cramer ditch. Duck creek is small. The lower end of it is con-

stantly flowing. Outside of flood time it discharges probably
698 4 or 5 feet per second into the Laramie river. In the earlier months of the year it flows considerable water for a short time but not long. The flow is the heaviest in this creek about April. It does not flow very much water during June. More water in the fore part of the month than at the latter part. April to May is the heaviest flow of water. There are springs along Duck creek feeding it. It heads in the Black Hills range. The headwaters of the creek are almost due north of Big Springs. There are two principal branches that unite to make the creek proper. North Duck Creek and Main Duck Creek. Dodge creek is a small stream. It
699 enters the Laramie above the tunnel. I know the Collins creek, McFarland creek and I know of Lee's ranch and some springs there. These join to form a creek which empties into Duck creek very near its mouth. There are no streams coming into the Laramie river from the south side during its progress between the tunnel and the head of the Cramer ditch. There are some very small springs.

That land is about 700 feet lower than our ranch at Big
700 Springs. They raise both hay and alfalfa on the Seward ranch. Very little of the 80 acres is in native hay. Mostly in alfalfa. The Mertz place has a couple of small reservoirs. They fill them from the river through the Cramer ditch. The Mertz place is irrigated principally to alfalfa, he raises some small grain. The Northrop ranch has about 40 acres of irrigated land under this ditch.

It is cultivated principally to alfalfa. They commence to cut
701 their alfalfa the latter part of June. They generally figure on two cuttings. There is some water flowing all the time in the Big Laramie at the cañon, very little at times. It gets pretty low down below the Wheatland Development Company's dam. There is a little seepage at that dam. It gets some water from Duck Creek, and some from Little Springs. There are a very few springs through the hills below the dam. Mr. Seward is engaged in the cattle, sheep and horse business. They run considerable stock. The Mertz ranch and the Northrop place are stock ranches. I live on my ranch 52 miles north. It is 5 miles directly east of the Big Springs.

MAGGIE H. GILLESPIE, a witness on behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

703 I have lived on the Laramie River since 1883, 32 miles north of Laramie City. My husband took up the ranch in
1882 and took me there the spring of '84. He died in 1907 and I have carried on the business since. I have three irrigating
704 ditches. On the east side of the river the Gillespie-Dunn ditch started either in 1887 or 1888. My husband bought a half interest in the ditch in 1888. On west side the Dunn ditch was taken out either in 1887 or 1888, I am not sure which. I bought the Dunn interest in 1891 or 1892. The individual Dunn ditch is a year older than ours. We bought that in 1906. Since the times mentioned, we have been the sole owners. We also have

a short ditch half to three-fourths of a mile long, the Ione Lake and Laramie River Ditch, built in 1890. All the water from these ditches is taken out of the Laramie River. We irrigated 140 acres under the Gillespie-Dunn ditch.

705 Under the Dunn ditch on the west side 190 acres and under the extension which we started in 1908 and completed in 1910, 125 acres were irrigated; from the Ione ditch 620 acres. That ditch was made in 1890 and irrigated that land since whenever we had water. We take the water out for that ditch without a dam. There is a shortage of water after the flood water goes each year. The ditch is taken out from the bottom of the river, but when the river is low we can't get water.

706 That shortage has been every year but one. On the irrigated land we raise barley, wheat, oats, hay and alfalfa. Ione Lake was formerly filled with water but dried up after these big ditches were made before 1890. It was dry two or three years before we tried to irrigate it. Wheat is not very successful, because our season is so very short. Sometimes it ripens, sometimes it does not.

706 Cross-examination by Mr. Delph E. Carpenter:

The Gillespie-Dunn ditch has irrigated about 140 acres for a number of years. It is native hay land. We never had anything but native hay except on Lake Ione. We didn't get over 25 or 30 tons this year because we didn't have the water. The river was low. The Gillespie-Dunn ditch has a log dam. It has two headgates, one goes to the Gillespie-Dunn ditch and the other to the Dunn ditch. It irrigates about 190 acres along the river. It is better land on that side than it is on the east side, because it is lower. We are not able to get water into these ditches when the water is low in the river. Owing to the fact that the dam is not in very good shape we have not been able to take the very low flow of the river in the past years. In 1906 we made an extension of the Dunn ditch so as to bring it down to the home ranch. My husband had it surveyed and plowed some in 1906. I got an extension from the state engineer.

709 I completed it in 1910. That ditch irrigates 125 acres in the school section and in section ten. Owing to the water being low, we didn't get any water through that extension ditch. These ditches were originally builded to utilize water at the high stages. We used to have a dam between 31 and 6, and after the river kept getting so much lower we went a mile up the river and made another dam. We haven't got it high e-ough the way the water is now to utilize any water at all. We could not take water out of the river at very low stages. The 40 acres which I irrigate as a part of a desert claim is between the new dam and the old one. It lies partly on one side and partly on the other side of the river, these ditches go right through it. I have a little plot of it. The land on the desert claim is irrigated partly by one ditch and partly by another. We made the extension of those ditches up the river on Sep-

tember 16, 1908. We did not get the water onto this desert claim until 1911.

710 The Ione Lake ditch was built in 1890 to irrigate that tract of land which was known as Ione Lake. Ione Lake drained out and dried up. We raised 101 bushels of oats to the acre the second year we sowed it. We raised a little the first year to see if it would grow and the next year we put in probably 100 acres. We raise principally timothy and alfalfa on Lake Ione bottom now. About 2/3 of the 620 acres irrigated by this

711 ditch is in native hay. That has come in there since 1890. The soil didn't have a weed or anything on it when we sowed the oats. Since that time 2/3 of the 620 acres has been converted into native hay meadow. There is 1300 acres in the bed of the lake. The Ione Lake ditch was built as a low water ditch, but we had water as long as there was plenty of water in the river and of late years there is just a little channel washed so low in the river that it does not get into the ditch unless it is up, it has to be up 3 feet anyway. I think that the water has to be 3 feet deep in the river before it will run into the ditch now. We put a little temporary dam at the head of the ditch to irrigate our oats sometimes, but the last 3 or 4 years we have not had enough to put in a dam. My husband used to drive stakes and put in boards to raise the water a little.

We never raised as good a crop of oats as we did that second year. We haven't raised over 400 or 500 bushels since. We would raise that on 40, 60 or 70 acres. One season we raised a fine crop of wheat but the frost got it and the tip end was ripened and left a little black spot on it. It was the nicest wheat I ever saw except that, it was good wheat for the chickens. We never sowed wheat very often. We are engaged primarily in the live stock business. We run from 350 to 400 head of cattle on the range near our place. In the winter we put them in the pasture. We have about 6,000 acres in all under fence. There is 1,300 on the lake and we rent some from the Two-Bar and then we rent some state lands. We run from 60 to 70 head of horses. About Christmas we take them off the range and put them into the pasture. There is no irrigated land between the old bed of Lake Ione and the McGill ranch; it is about 11 miles from our place to the McGill ranch buildings. The river is open to the range on both sides clear down to McGill's pasture. The range in that section is nearly all used by the Two-Bar sheep, the Swan Land and Cattle Company's sheep. The Swan Land and Cattle Company changed probably nine or ten years ago from cattle to sheep.

713 The next ranch above me is what is known as the Sholtz place, 9 or 10 miles up the stream, on both sides of the river, almost due south of me, part of which was one time covered by the Cooper lake ditch. The next ranch up stream is a little land of the Diamond Cattle Company, just above Mr. Sholtz. I don't know whether it is on both sides of the river or not. Just above the Diamond Cattle Company a man named Smeedle has a ranch but I don't know whether his land reaches the river or not. His land lies

between the Oasis and the Diamond ditch. Mr. Bosler prin-
714 cipally owns the Diamond ranch; it was first settled as the Boughton ranch. Mr. Boughton made that reservoir and got those ditches out first. I think he got that ditch before we got any of our ditches and had the reservoir site arranged and all, and they bought hay from us when they were building the ditch, the contractors. The Ghost ranch comes in there just above the Smeedle ranch, southeast of Bosler station. They cross the river at his ranch to go to Bosler station.

715 Cross-examination by Mr. Fred Farrar:

The only land upon which we have raised grain is in the Lake Ione Bottom. We have no plowed land at all outside of this lake. Outside of the lake bed the only crops which we raise are native hay. There has always been water in the river past our place. Two years ago the river was so low we could jump it. The Lake Ione ditch goes right across from the river to the lake. It is not over half or three quarters of a mile long. We built two little cribs at the headgate of the Lake Ione ditch. We put planks up against them to raise a temporary dam and throw water out into the lake. We don't need the water very much after high water except for grain. We can flood it good in high water for hay, but we always need one irrigation
716 after the water gets low for grain. The Gillespie-Dunn and the Dunn are each parallel to and very close to the river. The land which is irrigated from them lies between the ditches and the river; the river bends so much that it varies from a few feet to probably 50 yards. At the time Lake Ione contained water there was a small channel that led into it in high water, where we took this ditch out. We just plowed it and put in headgates to irrigate from. The lake was never drained by artificial means. I could not give you an idea of the depth of that lake bed. It is very shallow.

We have lots of wind. We have frost all the year at our house. We have had our garden nipped in July. We usually sow in April, spring wheat. Our nearest railroad station is Lookout. It is 7 or 8 miles from the ranch, on the Union Pacific.

E. D. TITUS.

Direct examination by Mr. N. E. Corthell:

718 Between the Heart ranch and the City of Laramie, Sec. 13, T. 15, R. 74, and Sections 7 and 18, T. 15, R. 73, are irrigated through the old Hutton Pick-up ditch. They could not hold a dam in the river and they kept changing from one place to another to get water on the land. It was at one time known as Grant's River ditch. The original ditch was built in the early '80s. West of Five Mile there is something like 500 acres covered by that ditch, being that part of Section 13 lying west of Five Mile Creek in T. 15, R. 74.

719 It also irrigates a small piece in Section 12. At one place where a lateral crosses Five Mile Creek, there is a flume. At

another place Five Mile Creek is dammed up. Sections 7 and 18 in T. 15, R. 73, are irrigated from a ditch built by Mr. Grant. It is known as the Le Roy Grant place. We called this and the other ditch that I have spoken of the Grant Ditches. Fully 300 acres are irrigated in 18 and about 100 acres in 7. This has been irrigated for the last 18 years or more, portions of it for 25 years.

720 The lands in these three sections that I have mentioned are not included in my estimate of the irrigated acreage upon the Heart ranch. These lands lie east of that ranch.

Cross-examination by Mr. Delph E. Carpenter:

I do not think that these lands to which I now refer are the same lands to which I referred while testifying concerning the Bilderback and Dowling ditches and the Hutton Pickup or Cole ditches. The Hutton Pickup ditch and the Cole ditch are the ditches I mentioned the other day in connection with that testimony. This ditch also utilized some of the water coming down Five Mile creek whenever it came down, but I haven't seen any coming for a good many years. Five Mile creek waters were taken and utilized in what was known as the Homer ranch. I haven't seen water running in Five Mile creek, only in case of a storm, in 25 years. Five Mile Creek is made up of Lone Tree creek and Willow creek, further up. These creeks head up on Boulder Ridge. In case of a storm or high water from other causes the water comes down these two creeks and then joins to make Five Mile creek and flows on down to the Laramie river. Five Mile creek enters the Laramie river in Sec. 12.

722 On Sec. 7, I think it was three years ago, young Grant had in about 20 or 23 acres of oats. The balance of this land was irrigated for meadow. Prior to three or four years ago these lands had been irrigated to meadow, including that portion since plowed. Native hay meadow. It never produced as much of a crop of hay as they raised up in the Dowling ditch district. Three years ago they put up as much hay to the acre, it looked to me, as they did on the Heart ranch. The production on the Heart ranch, one year with another, was superior to the production on these lands. The Heart ranch land would average then as good again as these lands. The lands of which I have spoken this morning have been used for pasture for the last two or three years. Grant put up hay for several years in succession prior to that time. These are low river bottom lands crossed and recrossed with old river beds. They are

723 the northern extremity of the lands irrigated by the Bilderback and Hutton ditches, located at the point where the bottom ends butting up against Soldier creek. Soldier creek is a tributary of the Laramie river, entering about a mile and three-quarters east and three-quarters of a mile north from the mouth of Five Mile creek, in Sec. 5, Tp. 15, R. 73.

Cross-examination by Mr. Fred Farrar:

There was only one of these Grant ditches other than the Hutton Pickup. They first took water out of the river in Sec. 12. The dam

went out and they then tapped the river in Sec. 13 near the quarter rock on the north side of Sec. 13, and in the northwest quarter of 13, they put in a dam. That went out and they extended on up into the southwest quarter of 13 and put in what they called a low water ditch, a ditch that could draw water at any time. The Grant ditch now runs practically across Sec. 13, in a northeasterly direction to Sec. 18 and Sec. 7. I don't know whether they put in a headgate. The owner of lands in Sec. 13, lying west of Five Mile, demanded that they put in a headgate because when he wanted to dry up his meadow to cut hay, there was no way to shut off the water. I know he made a demand on them to put in a headgate. Grant and Cole built the Cole ditch about 22 or 23 years ago. The Cole ditch
724 goes into the Grant ditch. The headgate of the Cole ditch has also been changed. It was in 27. The main Grant ditch is about a mile and a half in length. It is just a small ditch. The lands that were thus irrigated were known as the Grant and Knabler ranch, at that time.

The water which we are now taking out of Lake Hattie we are using on Pioneer lands. Part of it is going into the river through West Ditch No. 1. That ditch is in Sec. 14, Tp. 15, R. 74. I have been running water down that ditch into the river for more than a month. There have been from a few feet to as high as 35 feet per second discharged into the river during that time. That is not the normal waste of Pioneer canal. We never have any waste water to run into the river through this ditch only in a storm. In this case we are running water through the outlet ditch of Lake Hattie to the bifurcation works of the north and south canals, then into the Pioneer through the south canal and down the Pioneer to the waste ditch, then through the waste ditch to the river. There should be some water passing into the river at the end of the Pioneer canal at the present time. It also is allowed to flow into the river for the same reason. To give water to the river for the use of the Wheatland people. Practically all of the water which passes at a point west of the town of Laramie in the Pioneer canal is now being taken into the river to supply water for the use of Wheatland. There is a waste ditch from the lower end of the Pioneer canal running clear
726 to the river. We send down to that ditch what we think it will carry, outside of what is used between the two points, and the balance we discharge into the river through waste ditch No. 1. The water that has been flowing recently in the north canal has been turned out onto different tracts of land. Some of it is running into the Pioneer canal across lands on Sec. 18. This excess water goes into the river. On yesterday we were discharging into the river through these three channels from 20 to 25 cubic feet per second. At one time we were running forty cubic feet per second to waste ditch No. 1 for 24 hours. At the same time water was pass-
724 ing through the Pioneer into the river, probably about 20 second feet. At one time we were placing into the river as high as 60 cubic feet per second of time from these ditches. I believe that is the largest amount we have put into the river at any one time. This has been continuous for more than a month, since some time

the latter part of July. The water is measured in the weir at waste ditch No. 1, at a weir on the mail canal at the University farm and I also took measurements. The north canal swings west in Sec. 6 north of town here, in Tp. 16, R. 73, and goes west and ends on the
east side of what is known as the Big Basin. The bend is
728 about 6 miles north of the University farm. The ditch ends
on the east side of the Big Basin. Several weeks ago, after a big storm, there was a lot of water going out of the north canal into Big Basin. It went to waste, spread out over those lands, that was rain water. I have not allowed any reservoir water to amount to anything to run down there. A little went down there. This is the first year we have been using that ditch, we have been trying it out. There has not been water toward the lower end of that ditch all summer. The water we did take through this ditch was turned out on different people's lands to irrigate the land that was under the ditch, cultivated lands, some of them. Some of them were uncultivated lands. Most of it was prairie land, the first time it ever had irrigation water.

N. H. ROACH, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

729 I have resided at Laramie 32 years. Have been surveyor
16 years. I know the lands at one time owned by Le Roy Grant in Sections 13 and 12, T. 15, R. 74, and in Sections 7 and 18, in T. 15, R. 73. Have known them 15 or 16 years. Ac-
730 quaintance has been close for 5 or 6 years. Know the amount of land irrigated from the Laramie River in those tracts. In Sections 7 and 8 about 507 acres are irrigated. I measured the irrigated lands under the Cole ditch in Sections 12 and 13, T. 15, R. 74. My recollection now is that it is 380 acres. The ditch was there before my time and the lands irrigated ever since I can remember.

731 Have known the Grant ditch 10 years. The land under that ditch has been irrigated continuously since that time until the last few years when they couldn't get any water. The water gets so low they can't get any. Know the John A. Fischer ditch. Surveyed it six or seven years ago. It has been there eight or ten years anyway. Think it is seven miles long; Carrying capacity eight feet wide and thirty inches deep. It irrigates about 3,000 acres.

732 Part of the lands lie in Sections 7, 8 and 9, T. 14, R. 75. Then there is Section 17, part of 16, part of North Half of 21, same Township and Range. The ditch was old when I made the survey six or seven years ago. The land was irrigated then and is still irrigated.

Cross-examination by Mr. Delph E. Carpenter:

732 The first ditch of which I spoke is known as Grant's ditch. We always called it the Le Roy Grant ditch. It irrigates about 307 acres. There is supposed to be about 115 to 118 acres on

the Grant place irrigated from Soldier creek. It would be on the east half of Sec. 8, somewhere along there. That was irrigated from a separate ditch on Soldier creek. That ditch is not a continua-
733 tion of Grant's river ditch. This 115 or 118 acres irrigated from Soldier creek lies on the west-side of that creek. Grant's river ditch runs into Soldier creek. Soldier runs off into kind of a slough on the north part and catches any waste water that comes down. The east half of Sec. 8 was irrigated by Charles Connor's home ditch out of Soldier creek. I wouldn't say that this 115 acres irrigated from Soldier creek, of which I spoke, is on the east half of Sec. 8. I don't remember whether Grant's land run over on the east line. I do not know whether or not any portion of 18 is irrigated. There are 40 acres on 18 on the Grant land that is not watered from the Grant ditch. On the Grant place
734 there is a total of 507 acres under irrigation, leaving out that irrigated from Soldier creek, 100 and some odd acres. The whole west part of the Grant land, 160 to 180 acres, was all watered from the Grant ditch on the Big Laramie River. When I speak of the Grant land I refer to Sec. 8. I think Grant owned a big part of Sec. 7.

After the Grant ditch leaves its headgate it runs in a northeasterly direction. It irrigates the bigger part of the land east of the river in Sec. 7, from the ditch to the southwest corner of
735 Sec. 7. I might have been in possession of the Grant land a couple or three months. I simply bought and sold it on speculation. I was dealing for it along in the summer about haying time. There were 286 tons of hay there at the time I was figuring on buying the ranch. That was that year's cutting, from 626 acres, I think. It was native hay. Jim Mead owned Sections 12
736 and 13, Tp. 15, R. 74. There are 40 to 50 acres out of the land that are not irrigated, my recollection is 440 acres altogether. About seven or eight years ago I was out there and did considerable surveying for Grant, running off his lines and such as that.

737 I stated that I made a survey of the Fischer ditch some ten or twelve years ago. The ditch irrigates about 3,000 acres. There is a part of the northwest quarter corner of Sec. 7 that the ditch does not irrigate. I don't think there is anything raised
738 on Sec. 7, there is some hay down there. There is one lateral that runs up pretty well along the west side of Sec. 7 and further up there are two others that I ran out. I don't know whether they ever dug them or not. The idea was to facilitate the irrigation of the land. It was there to irrigate. My recollection is that the greater portion of Sec. 8 was under irrigation. Some of it in alfalfa and the rest of it in native hay. I am almost certain that there is alfalfa on 8. I know there was alfalfa there up to the last year. I don't know how much of Sec. 8 has been plowed in the last five years. Sections 7 and 8 are part of this 3,000 acres irrigated. I can't tell you what portion of Sec. 9 was irrigated. There was
739 some hay cut there one time. In this country we consider anything that will cut half a ton of hay to the acre as hay

land. I think that portion of Sec. 9 which was cut produced a half a ton of hay to the acre. The west half of the section, up to the time Fischer sold it, was producing hay. I stated there was some land irrigated on Sec. 7. I would say all of the section was irrigated. 160 acres, I would judge, south of the road has been used for crops. That is not the field in which I thought the alfalfa was growing. Mr. Grable's new buildings are on Sec. 17. I said about 120 acres were irrigated on Sec. 16. On the south side of the county road, and a little corner over on the north side. There is a little pond in there
north of the road. There are three or four ponds in that
740 vicinity when they are irrigating. The seepage from the
irrigation ditches makes these ponds. I believe that fully 100 acres have been irrigated south of the county road on Sec. 16. That would be in addition to the 3,000 acres I mentioned. Fisher owns a part of 21. That is irrigated from the Fischer ditch. Haven't I got enough land? There is 3,000 acres there all right, it is close onto 3,000 acres. I think I have included everything I want to in this list. I am very positive about this school Sec. 16. I could not possibly be wrong, I went out there with a party that bought the land to look at it. The section has never seen a plow but it has the water. It does not have very extensive laterals. I could not tell you how many miles of laterals there are on that section. There is more than a rod or two of laterals, one goes quite a ways. I could not tell how long it is, but it is more than a rod. There is one little lateral that cuts across from Sec. 17 down near the southeast corner of that section and runs across the southwest corner of Sec. 16 so as to carry water down to Sec. 21. There are some other laterals up north of the center. There is another lateral runs through there. There is a little pond on 16 too. I think I have been a little closer in describing the land irrigated on the Grant land than I have on the Fischer land. I think I am approximately correct, however, on both tracts.

742 Cross-examination by Mr. Fred Farrar:

The past two or three years we have been short of water on the lands near Laramie, Sections 7, 8, 18, Tp. 15, R. 73, and Sections
12 and 13, Tp. 15, R. 74; 1913; this year; in 1911 and 1912.
743 I don't know whether the amount of water flowing in the
stream would be increased or decreased during the distance you have mentioned. I could not say that I know anything outside of the inflow from the Pioneer canal that would increase the flow of the river. The flow of the Laramie river in 1912 might have been normal, I wasn't on the river in 1912 at all. I do not as a matter of fact know that they had no water for irrigation on these lands last year, they were down at the office telling about it. There was no hay put up. I am certain that the shortage in the amount of hay was due to there being no water to irrigate. I was over there
to see if I could fix it for a party in the east. 1911 was not a
744 normal year down here. There wasn't enough water to get
down here. There was some water in the river down here in

1911. There is no permanent dam at the head of the Grant ditch. At one time they had dams in the river but they moved the headgate up stream some three or four years ago. Had there been a dam we could not have diverted the water from the river for irrigation of these lands within the last year or two. In 1911 there was not enough water for June irrigation. It is pretty hard to say whether or not there would have been enough water had there been a dam in the river. There is a doubt whether or not there is enough water in the river during the month of June to irri-
745 gate these lands. There wasn't any more water in July, 1911, than there was in June. There wasn't as much I don't suppose. There was considerable water in May, 1911. There was more water in the latter part of May, 1911, than there was in June, more water in May than there was in July. I could not tell exactly when the highest water occurred but I suppose the latter part of May and the first of June. That is generally our high water. It varies considerably in some years, six week's difference. I could not say as a matter of fact whether our highest water in June was in 1911 or the latter part of June. I do not think there would be any more water just above the mouth of the Little Laramie than there would be here. Unless water were put in artificially there is nothing to increase the stream. There are two or three ditches that take out water. It is probable that there would be more water in the river here or in the vicinity of these five sections than there would be just above the junction of the Big and the Little Laramie rivers. Unless seepage has something to do with it, I should not think that the flow of the stream just above the junction of the Little Laramie would be greater than the flow of the stream in the vicinity of these lands. There is considerable seepage in this country. I have noticed it within the last five years. Since then I don't know whether or not it increased. There is some water returning from seepage into the stream all the time. This will naturally increase as the length of the period of irrigation increases.

N. H. ROACH.

Redirect examination by Mr. John D. Clark:

746 We placed these sacks filled with earth in the river at the headgate of the Grant ditch this spring to get water up in the ditch.

747 We have had trouble in one way and another since 1909 in getting water into the ditches, caused by a lack of water. We put in these sacks about the 10th to the 15th of June this year. The water had pretty near stopped running in the ditch.

Recross-examination by Mr. Fred Farrar:

The bottom of the ditch is about on a level with the bottom of the river. It is on the level unless it fills up with sand or something.

CHARLES BELLAMY, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

748 I have lived at Laramie for over 30 years. Have been civil engineer and surveyor since '78 or '79. Am familiar with the irrigation of lands along the Laramie River, quite familiar with the Boughton ditch. It was first constructed in 1884. I measured its carrying capacity in 1886.

749 Measured officially as Deputy County Surveyor; found the capacity of the ditch 116.97 cubic feet per second. In 1907 I surveyed the lands irrigated from the ditch. It was something over 7,000 acres. Don't remember the exact amount. It was almost all of it under irrigation in 1887 and 1888 but they added a little from year to year. I don't think any has been added since 1907.

750 The headgate was carried up the river in September and October, 1907, Before that they had difficulty in getting water because the dam would sometimes break. The ditch takes its water from the Laramie. I made a re-survey for the reconstruction of the Fischer ditch in 1888. It is located in Ranges 75 and 76, Township 14, and takes its water from the Laramie. About 3,000 acres were irrigated from that ditch.

751 The land was first irrigated in 1887. In 1893 I made preliminary surveys for enlarging the Pioneer Canal. The old flume leaked and I put in a new flume. The ditch as it now stands runs almost identical on my lines. It is now the Lake Hattie Supply Canal. In 1886 Mr. Loback and myself ran a number of lines west of town all over that country. It was a mere reconnaissance. The next year, 1887, Mr. Loback made a survey of the high line. That is almost the same as this continuation from the Lake Hattie Reservoir down over these lands.

752 CHARLES BELLAMY.

Cross-examination by Mr. Fred Farrar:

At that time I used the Colorado formula in arriving at the capacity of the Boughton ditch. I took the area and the fall and constant 15 and multiplied these together and divided by the wet perimeter 9, and took the square root. That would give the velocity and then the constant for friction would be something from .5 to 1, a flume being 1 and a very poor ditch overgrown would only flow half as much. Then you took the area and got the number of cubic feet. It is the same formula that Colorado used. I don't know whether Colorado still uses it, but it was used for a number of years. In order to determine the fall I used to run down about half a mile. I based my calculations on the fall per mile. I used a constant for friction of .65. It might be .85 (witness examines his books). It is so dim I am not sure. In my final conclusion I took the
753 fall as one foot per mile, it came very near that. In working out my capacity, I used the top width at 22, bottom width 9.5 depth 5, wet perimeter as 25.14 and the coefficient of friction as 65. I

think the canal is about 12 miles long. I made the official measurements in 1886. I made a report, I filled out the blanks. They were filed at the court house. The territorial officer was the county clerk. When I handed them over to the county surveyor I knew he paid me for that and said that Boughton had filed it. I never looked out to see.

The 1907 survey was done to determine the amount of land capable of irrigation. It determined the amount of land they were actually irrigating that season. I could not tell whether or
754 not the irrigated land had increased from 1886 to 1907. There was no time between '86 and 1907 that I could give the actual amount of land irrigated. I do not have a blue print showing the land irrigated under this ditch. I do have one under the Fischer ditch. The first dam that was put in the Boughton ditch was just sacks of sand and where the high water came it worked kind of in under it and it settled down and then it pushed it right aside and let the water out. That was in 1885. In 1890 it broke out again and then in 1906 it went out and in 1907 was when I made the survey and superintended the construction up at the new headgate. The old dam was right straight across the river. I think it must have been over 100 feet long. It was up to the bank on one side, which was about 5 or 6 feet, and on the other side it ran out, high enough to keep the water from cutting around the end. The dam must have been 5 or 6 feet above the bed of the river. The sacks were just laid in as though they were rocks and
755 kind of pounded in. They did not seem to be bound or keyed in any way. I suppose they thought the weight of them would hold the water so it would run over without moving them but it was not wide enough and the water got underneath and it slipped out. When the change was made the dam was made of cribs with rock and timber and then filled with sacks of sand and rock and earth and different material. We put in a concrete headgate. There was a wooden headgate at the old place. I do not have a list of the lands irrigated by that ditch, I turned that over to Mr. Boughton. The land that I measured was all between the river and the ditch and then the lake they had for sort of a reservoir. The lake was mostly in Tp. 20, R. 74. It ran down a little into 19. That lake lies right in here somewhere (indicating on map). Probably Sec. 34, Sec. 27 and a portion of Sec. 28. The lake does not have any name. It was used for irrigation. They let it fill up every spring and held
756 it. I know in 1907 they used it. I haven't been there since the summer of 1907. The buildings on the Diamond ranch are a little west of where that lake is. I cannot give you the size and capacity of the lake. The lake was originally a natural depression in the ground and it would be meadow before the ditch was there. Mr. Boughton made a reservoir out of it in 1885 or 1886. The Boughton canal runs up pretty close to Lake Ione. It lies west near the lower end of the canal. I do not know how big the lake was. I should think that it was a little over 100 acres. In 1907 there was about that much water in it. They could not draw all of the water in the lake for irrigation. I think they drew out enough to irrigate

a field of grain of about 100 acres. This survey made by me was made preparatory to Mr. Boughton's selling the ranch. This ditch, for about half its length, runs close to and parallel with the
757 river. From that point on the ditch swings somewhat to the west, while the river runs almost due north. The soil of the land under irrigation is a gravel and some loam, which I call gravel or sandy gravel. In 1907, when I made this survey, the Iron Mountain Cattle Company owned the ranch. There is high land extending north and south and immediately east of the river in or about sections 5, 6, and possibly 17, Tp. 19, R. 74. I did not take that into consideration, that section and some of this (indicating). There is a high ridge there. It is high in Section 5, some in 8, some in 7 and 6 and also in part of 9. This high land was not included in my estimate of 7,000 acres. In my survey I didn't allow anything in 4, 5, 6, 7, 8 and the west half of 9, Tp. 19, R. 74. A considerable portion of Sec. 31, Tp. 30, R. 74 is low, seepage land, that is not good land. I did not go west of that lake at all. There is a lake in there. I suppose that lake will run over and make that poor ground. It is the lake I formerly referred to. There is a draw which
758 runs into the lake. That draw concentrates the water from a considerable area, that is what made that lake, but there was no ditch in wet season. There was always water in there in the spring time before the ditch was built. It would sometimes dry up in the summer, but there was always more or less water. The lake is something over 300 or 400 acres and there might be even as little as 100 acres. That water was the natural water from drainage. This ranch is known as the Bosler ranch, that belongs to the Iron Mountain Cattle Company. It is a cattle ranch. It produces mostly native hay. I don't think they cut on all the 7,000 acres. I know they used to cut over 5 or 6 sections there. The balance was
759 used for pasture. There was about half a section they raised grain on. I know they cut over 2,000 to 3,000 tons of hay there some years. I cannot locate the land upon which they raised grain. They raised oats. They also tried a little barley in the year 1907. I know of their raising it two years. I do not know what success they had with barley. They had very fair success with oats in 1907. I believe the Iron Mountain Cattle Company still owns the ranch.

760 Cross-xamination by Mr. Delph E. Carpenter:

The river takes a bend towards the west in Sec. 27, Tp. 19, R. 74 and runs 4 or 5 miles almost to the west line of that township. It runs due north and south through the west tier of sections and the remainder of Tp. 19, going north, and also Secs. 19, 30 and 31 in Tp. 20, R. 74. There is a hill that begins at Sec. 9 and runs north into 29, Tp. 20, R. 74. That hill throws the river to the west. On the east of the hill, at the north part of the Boughton meadows, waters accumulate, forming a shallow lake during irrigation each year, a waste lake and the drainage from the hills to the east.
761 Some years there would not be much water and then there would be only 100 acres and over 600 acres in very wet years.

I did not include that waste lake of about a section in figuring my irrigated land. I only came to the edge of that. There is meadow land to the east of that lake in the southeast quarter of the township, in 3 or 4 sections. That meadow land extends south to the Diamond ranch buildings. Hay was cut from the buildings north down to the north line of the place.

During this survey I ran the instrument. I cannot give my assistant's name. I done almost all of it by stadia measure-
762 ments. He would go by the Government subdivisions and when he would come to any irrigated land he would give me a signal and I would take the angle and distance, and in order to know where I was I would have him hunt up the corner. Not having a chain man I used that method. In some instances I might have been ascertaining not only the area actually irrigated but also the irrigible area under that ditch, and perhaps there might have been places where they had not irrigated that much.

Cross-examination by Mr. Fred Farrar:

At the time of making the survey in 1888 of the Fischer ditch, I enlarged it and made it deeper from the headgates for about four miles. I made a survey of the lands under that ditch in 1888, lands mostly that were capable of irrigation, because that was the first year he had had water running. I know that out of 3,000 acres of land surveyed in 1888, one half or 1,500 acres of it was irrigated. In 1891 or '92 I went over it with him. The 1,500 acres, or approximately one-half, was not producing. It might have been irrigated but he had not got any crop from it. About ¾ of the 1,500 acres was in hay and about ¼ in alfalfa in the year 1892. He did not plow up hay lands to plant alfalfa. There was natural land, pasture land. Hay lands are, as a rule, bottom lands, naturally wet:—the uplands have to be irrigated to produce anything. They do not naturally raise native hay on the upland. The land he devoted to alfalfa was upland. He cut alfalfa on the land he had in 1892, 4 or 5 years after that. He also cut alfalfa there in 1900. I hand you the plat showing the lands which I found to be suscepti-
765 ble of irrigation under this ditch. It only shows the east half of Sec. 8, Tp. 14, R. 75. I have only this plat, but knowing where the ditch comes up onto the bench and that all that land lays lower, and that he was the owner of Sec. 9, and leased Sec. 16 and the north half of 21 and Sec. 17, and the southeast quarter of 18, and the north half of 20, he irrigated. The north half of 20 was not his own land but he irrigated that. Section 20 belonged to Mr. Mansfield. He would allow Mr. Mansfield to take water onto 20. The north half of Sec. 20, owned by Mr. Mansfield, formed a part of the 3,000 acres which I mentioned as being under the ditch. The whole of Sections 16 and 9, and the east half of 8 and a portion of the southwest quarter of 8, the whole of 17, the east half of 18, nearly the north half of 20 and the north half of 21 constituted a part of the 3,000 acres. These lands are all in Tp. 14, R. 75. That was the total which could be irrigated from this

ditch. I know this east half of 8, a desert filing by his wife, was irrigated. He had me go out there in order to be sure to cover every bit of that, and that is what this map was made for. Relative to the survey of this ditch, I will state that the ditch had been
766 surveyed down to this fork in Sec. 18. That was the old survey and I ran over that and from where the headgate is in Sec. 32, Tp. 14, R. 76, I ran over that to correct it, because it was poorly constructed. I followed the old ditch, cut it deeper, put in a true grade and got onto the bench without making an extra excavation. From Sec. 18 I ran by having my rod man pace 50 or 150 feet at a time and raise the target. I was new from this point. The old ditch to this point would carry water but it was such a poor grade that in Sec. 26, Tp. 14, R. 76, he had to continually bank up the lower bank, which was a hillside, to get water about 4 feet deep to carry it beyond. Prior to my survey he could not get much water on Sec. 18. That was the year before it was reconstructed. The ditch is 11 miles long. In reconstructing we started at the headgate with 8 feet wide on bottom and a grade of 4 feet to the mile to where it went up on the bench in Sec. 19. From that point it was made a foot or two smaller. It was 6 feet wide on bottom about center of 18, and the grade was more than 5 feet to the mile from there on. That was when it was upon bench land.

767 Cross-examination by Mr. Delph E. Carpenter:

The alfalfa planted by Mr. Fischer was located in Sections 16 and 17 and a little in Sec. 9. Most of it was south of the road and between it and the breaks in Sec. 17 where it was a mile long. There was some north of the road in Sec. 9 and a little in Sec. 8.

There are some lakes or ponds in the Fischer tract near the corner of Sections 8, 9, 16 and 17. A pond is formed there by this ditch which never used to be there. After he irrigated, some of this land became native hay land, either from seepage or irrigation. In 1888 there was no land north of the county road which is always moist and would produce native hay. One lake formed after this ditch had been built a year or two.

768 Possibly much alfalfa killed out from excess of water. After 1888 I paid very little attention to the property. I was out there seldom. He would have me come out for some little lateral or something. There would be as much irrigated land now as ever if he still owned it. He disposed of it some 4, 5 or 6 years ago. North half Sec. 21, which he irrigated, is native hay land on bottom. All the rest is bench land. The bench runs close along the north line of 21. The north tier of forties is broken by it. Mr. Mansfield owned that in 1888, now owns it and lives there.

769 Some reconnaissance work was done in 1886 or '87 relative to the Pioneer. They did not proceed with the construction. It was simply to see the possibility of sometime running a ditch there. We started with two buggies and I could get out of one, set up the instrument and send the man ahead where I could take a long sweep and sight with my gradient what the fall for the ditch

would be, allowing it to run nearly straight and then allow a little and then have him hold the rod with the target the same height as the instrument. Then I would ride to him and he would go on. We spent two or three days going over the plains between the two rivers. Mr. Loback did the same in '87, only he staked out a line. No construction was done. The matter was to take a ditch from the Pioneer and run it at higher elevation with a little less fall. The Pioneer there has a very heavy fall, in one place, and we thought by coming out ahead of that and around to see how much more he could take in by making a high line of it and picking up waste fall. I believe that the present High Line ditch at Lake Hattie, for making a Lake Hattie reservoir, provided my stakes could be found, would be identical. I think Mr. Loback's survey was very nearly the same as the present ditches were run. We ran both around and below Lake Hattie. It took quite a ditch to go around. That
770 was in 1893, and I had started to stake this out when the panic came on and everything shut down and they dropped it entirely. They had engaged me to make complete survey and give the cost for all work and determine how large Lake Hattie would be and how much of a reservoir that would make. I was engaged by Mr. Balch of the First National Bank, president of The Wyoming Central Land and Improvement Company, the owners of the Pioneer. I don't think that work was resumed by the Goldsborough people or Mr. Grable and his party until 1908; I am not acquainted with engineers or promotion of later proposition. I am not acquainted with Mr. Wendelkin or Mr. F. C. Grable. The only one of the Laramie Water Company's engineers I know is Mr. Bishop, whom I have met several times. He has been working in this section about 4 years. There was nothing done until Mr.
771 Grable or Mr. Bell took charge of the promotion. I don't know when they began. There were no filings made on my original survey which was incomplete.

Cross-examination by Mr. Fred Farrar:

I believe you might say that flume was the construction done under the surveys made by myself and Mr. Loback in 1893, because so much larger than was necessary, and made on purpose so if they ever did construct the High Line it would not have to be changed, but aside from that there was nothing, no construction work whatever.

The present works are entirely disconnected from my surveys and also the 1886 and '87 surveys by Mr. Loback and me which ended in naught. Lake Hattie was not a reservoir in those days.

Redirect examination by Mr. John D. Clark:

772 In connection with the Boughton ditch, the surveys were attempted to be made so as to show the lands that had been irrigated. I don't know of any lands included that have not been irrigated, but it is possible there might have been small tracts.

772 Recross-examination by Mr. Delph E. Carpenter:

I am Charles Bellamy who has made a series of maps of Albany county and Laramie, Wyoming, from time to time over a period of years. They are from my observations and knowledge of the country and also copied from official plats in the land office and records in the county clerk's and state engineer's offices. While I have been in Laramie I have been engaged in surveying. My son, Benjamin C. Bellamy, was associated with me.

LYMAN E. BISHOP, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

773 I am a civil engineer. Reside in Laramie. Resident Engineer for the Goldsborough Company on the Laramie Water Company's work. Came here July 1, 1910. Been engaged in this work continuously since that time. From July 1, 1910, to January, 1911, I was engaged in final location work in connection with the canals system, mainly on the Little Laramie.

774 In June, 1911, I located the last mile of the Lake Hattie Supply Canal No. 1. August, 1911, I located Lake Hattie Supply No. 2, supplying Lake Hattie Reservoir from the Little Laramie; September 1911, made the final location of Bell Supply Canal No. 2; from March, 1912, to the middle of January 1913, was Resident Engineer in charge of construction work for the Goldsborough Company. During 1912 I did construction work on Stewart Canal, Lake Hattie Supply Canal No. 2, extension of North Canal, Bell Supply Canal No. 2, Lake Hattie dam, South Canal and Pioneer Enlargement. Also made preliminary and final location surveys of Lincoln and Warren ditches and Pioneer High

775 Line. Pioneer Canal enlargement and Lake Hattie Supply Canal No. 1 take water from the Laramie, and Lake Hattie Supply Canal No. 2 from the Little Laramie. These ditches supply Lake Hattie reservoir. Stewart Canal receives water from Lake Hattie Canal No. 2. About 700 stations of Stewart Canal constructed, ninety to ninety-five per cent completed. This constitutes 14 miles of the ditch.

776 When I came, construction work had been done on Pioneer Enlargement, Lake Hattie Supply No. 1, Lake Hattie dam and North Canal and bridges and bifurcations at Sodergreen Lake had been installed. Nothing had been done in the construction of the head works on the Big Laramie at the Pioneer Enlargement. From Lake Hattie to station 985 in the North Canal there was then about ninety-five per cent completed. That was about 19 miles of the upper portion of the canal.

777 From July 1, 1910, to December 1, 1910, the work of various surveys cost about $5,000.00. Prior to December 1, 1910, the Lake Hattie Reservoir & Irrigation Company had expended about $944,000.00 on that system.

778 December 1st, 1910, the project was merged with the Interstate. During 1911 Lake Hattie Supply No. 1 was com-

pleted and water turned in during July. The construction work was likewise in progress on Lake Hattie Supply Canal No. 2 and the head works, and the Pioneer head works were built, and concrete facing on Lake Hattie dam was in progress. In 1912 construction work was in progress on the Stewart Canal and Lake Hattie Supply Canal No. 2, and the extension to the North Canal, Bell Supply Canal No. 2, Lake Hattie dam, South Canal and Pioneer Enlargement. Since the middle of April, 1913, construction work has been in progress on the lateral system under the North Canal extension and structures on Lake Hattie Supply Canal No. 2; completion of the South Canal and structures on the North, South and Stewart Canals and construction work at Lake Hattie dam.

779 The total expended on this irrigation system up to date is about $1,418,000.00. It will take about $34,000.00 to finish the Pioneer Enlargement and Lake Hattie Supply No. 1. Lake Hattie Supply Canal No. 2 and the head works are completed. Lake Hattie dam is completed. They are putting in a drainage system at Lake Hattie Dam that will probably take $2,000.00, yet to complete. The North Canal and the North Canal Extension are completed. It will take about $46,000.00 to complete the Stewart Canal, and about $24,000.00 to complete the lateral system under the North Canal Extension. The South Canal is completed, with probably $200.00 worth of work to be done on the structure at the lower end of it. The Pioneer Enlargement and Lake Hattie Supply No. 1 have been used since July, 1911. 1023 second feet were run in Pioneer Enlargement and Lake Hattie Supply Canal No. 1 for a time last season, 1912. Water was turned into the North Canal from Lake Hattie July this year. It has been carrying water
780 since that time. The carrying capacity of Lake Hattie Supply Canal No. 1 is 1023 second feet. Lake Hattie outlet canal for the first 197 stations has a capacity of 750 second feet. The North Canal has a capacity of 625 second feet to station 448. The capacity increases on down to the end. The capacity of the South Canal is 160 second feet.

781 The total acreage irrigable under the North Canal is about 21,760 acres from station 985 to 1841 and from Lake Hattie station 985 is about 21,340 acres, making a total of 43,100 acres. Under the Pioneer High Line Canal about 31,360 acres; under the Stewart Canal about 37,760 acres. The actual acreage that will finally be irrigated of these estimates after deducting roads, canals, fences, houses and pastures will be 80 to 85 per cent of the gross acreage stated.

782 LYMAN E. BISHOP.

Cross-examination by Mr. Fred Farrar:

Bell Supply Canal No. 2 takes out of Douglas creek about two miles north of Keystone, the canal is 7.8 miles long from headworks to point where water is turned into the Little Laramie river drainage. It is located and partially constructed for a capacity of 350 cubic feet per second. During the fall of 1911 and the year 1912

construction work was done. Douglas creek is a tributary of the North Platte River. It runs in a general southerly direction.

The Bell Supply canal No. 2 will divert water from Douglas Creek, bring it across the divide and empty it into the South Fork of the Little Laramie river. From thence it will be taken through Lake Hattie Supply canal No. 2 into the irrigation system described. There is other proposed development work consisting of Bell Reservoir No. 3, which will be built on the Little Laramie approximately half way between where the Bell Supply canal No. 2 empties into the South Fork of the Little Laramie and the headworks of
783 the Lake Hattie Supply canal No. 2. At the point of diversion of the Bell Supply Canal No. 2, Douglas creek is a stream that will flow as high as 800 cubic feet of water per second late in May or early in June.

The Stewart canals do not divert directly from river now. They take from Lake Hattie Supply Canal No. 2, about 2/5 of a mile from the headworks, and the latter canal from the Little Laramie. Stewart canal is not completed. The south canal ends now on the Big Laramie about the center of Sec. 6, Tp. 14, R. 74 W. About $2,000 worth of construction work was done on Glendevey reservoir, excavation for a cut, for a trench for a dam. That work is part of the final work for the excavation made will be used when the structure is made. There was probably between 300 and 400 feet of
784 test pits cut for the trench. That has been opened up. It averages 10 or 12 feet wide on top and 2 or 3 on bottom varies from 3 to 10 feet deep and was constructed to determine the nature of material immediately underneath and will probably become part of the permanent dam, because the cut off will be placed in that trench. It would be a very small proportion of work of final structure. It was done late in 1910 or early in 1911. That reservoir is on the Laramie river on or about Sec. 36, Tp. 10 N., R. 76 W. in Colorado, about 9 miles below the tunnel of the Laramie-Poudre system.

Sand Creek reservoir has never been constructed. The 21,760 acres which I gave under lower end of north canal covers land which it is proposed to irrigate, probably 90 per cent of the area, the other 10 per cent might now be under irrigation inefficiently. This is true with reference to the 21,340 acres under north canal from Lake Hattie to station 985. Water can be diverted from the
785 Laramie river by means of Lake Hattie Supply Canal No. 2 into Lake Hattie reservoir and then distributed through north and south canal. Water from Little Laramie in Lake Hattie supply canal No. 2 can be diverted at the bifurcation works into Stewart canal. The line of the proposed Pioneer High Line intercepts the Lake Hattie supply canal No. 2.

The Pioneer High Line canal has been finally located. A large percentage of the structures have been designed and plans prepared. Practically no construction work has been done. The headgate will be at the bifurcation works located in Lake Hattie Supply canal No. 1 at about north quearter section corner of Sec. 7, Tp. 14 N., R. 76 W. It will be in Lake Hattie Supply Canal No. 1 at the beginning

of the sluice section or sluice ditch. From that point which it is only necessary to direct water into Lake Hattie, the flow is so great it cuts its channel.

The end of the north canal extension is built and contemplated now to a point about 300 feet east of south quarter corner of Sec. 10, Tp. 16 N., R. 74 W. I have a topographic map of Lake Hattie reservoir site in my official files. It does not give depth. It was made when Lake Hattie was first thought of and there has been no addition made to it since the dam was located and the reservoir built. I have no record of capacity of reservoir at various depths. I took that map once and worked up the total available capacity of the reservoir.

The usable capacity of Lake Hattie reservoir is 68,500 acre feet. At that capacity the depth is 28 feet. The amount of dead water or the capacity not available with present condition of bottom is about 42,000 acre feet. There was a natural lake at the upper end
787 of present reservoir, originally known as Lake Hattie. It held water all the time. Before we can store any available water for use, under our present system, we have to have 42,000 acre feet in this reservoir. From this point my 28 feet is measured, making available 68,500 acre feet. At a depth of 28 feet of available water, we have in the reservoir a total of 110,500 acre feet. A portion of the 42,000 acre feet not now available can be made so by making some cuts between the three different portions of Lake Hattie reservoir. I have no information of depth of water in original Lake Hattie.

Water from the Laramie river was first placed in Lake Hattie early in July, 1911. It was first run into the reservoir from the Little Laramie in April or May, 1912. I haven't any figures to show amount run in reservoir in 1911. During that year we did not put sufficient water into reservoir to make any available. We did not fill the dead water space. There was av-ilable water in Lake Hattie reservoir in June, 1912. By the middle of July, 1912, we had avail-able depth of between 10 and 11 feet. That is the highest we
788 had in 1912. In 1913 we had very nearly 20 feet available depth. I would state approximately 30,000 acre feet of available water in reservoir now, at the depth of 20 feet, above the lowest point at which water can be drawn off in present condition of reservoir. I would give 20,000 acre feet as a very rough estimate of water placed in reservoir in 1912 from Little Laramie. We ran no water from Little Laramie in 1913 because we had under construction two drops and some repairs at headworks of Lake Hattie supply canal No. 2. All water put into reservoir in 1913 came from Big Laramie or from drainage from Sheep mountain.

As originally located and designed Lake Hattie Supply canal No. 2, or the canal from Little Laramie, was for 500 cubic feet of water per second. During the 1912 season we had at one time 583 cubic feet in the canal and still plenty of freeboard, and since then we have built structures and so regulated the grade of the first 24 sections of Lake Hattie Supply Canal No. 2 that now its capacity would be about 750 cubic feet per second. The map prepared by the Irriga-

tion Investigation, United States Department of Agriculture, compiled and drafted by Fred C. Scovey, Irrigation Engineer, does not accurately delineate existing conditions on the system as regards construction. All of the canals as shown on this map have not been constructed in their entirety. Mr. Scovey did not get the information concerning this system from me.

Cross-examination by Mr. Delph E. Carpenter:

The first work on Lake Hattie Supply Canal No. 2 was done by inaugurating the Pioneer location in July, 1910. August 1911 was the first actual construction work on Lake Hattie Supply Canal No. 2. The contract was let for building the canal and we started active work on the head-works and diversion dam by force account. This canal takes its water from the south bank of Little Laramie river. Its head is below the point at which Bell reservoir No. 3 was to be constructed. Bell reservoir No. 3, if constructed, would be a channel reservoir. It would have no inlet ditch and be across the bed and channel of the Little Laramie river. It could be used as a storage and also as an equalizing reservoir. Early in the season a considerable amount of water carried by Bell Supply No. 2, not at that time needed by the Stewart canal, could be held in this reservoir until the demands of the Stewart canal became greater than the supply of Bell Supply Canal No. 2.

Bell Supply Canal No. 2 involves about 7 or 8 miles of very heavy construction work. This is a mountain ditch at an elevation of 9,250 feet. The estimated cost of completing the construction work proper is $158,000 for the entirety. There are no
791 tunnels but four very heavy pieces of side hill flume work of an aggregate length of between 1,400 and 1,500 feet. I will give you the total yardage in the various classifications. 156,000 yards of earth, 48,000 yards of loose rock, 35,000 yards of solid rock. The latter requires blasting, and probably ⅓ of the yardage under the loose rock classification will require the use of black powder under our specifications. The excavation work is on side hill slopes, varying up to 70 per cent slope. The average would be between 30 and 45 per cent transverse side slopes. The ditch completed will have capacity of 350 cubic feet per second. About 15 per cent is now completed, mostly about the center of the 7.8 miles of length.

792 The period for favorable construction work at that altitude is between June 1st and November 1st. Prior to June 1st there was too much snow and the ground is waterlogged and a spring under every rock and in September the winter snows begin. The ditch is situated near the face of the snowy range. Timber line is about 10,500 and this canal is at 9,250, or 1,250 feet below timber line. After the September snows begin the work gradually closes up. From there on up to the tops of these mountains it is the heaviest snow along the mountains of that section. We have had innumberable difficulties in connection with that work. In addition to the climatic conditions that have to be contended with, the coun-

try is hard of access any time of the year. Practically no roads that can be traveled with an ordinary load and team of horses. The contractor in there last year paid 25 cents per hundred for a haul of the last six miles from a shipping point on the Hahns Peak Railroad, station Albany, which is the closest railroad point. The first work I did on this Bell Supply canal No. 2 was in October, 1910. I made extensive surveys to determine the best preliminary line for that canal and I also ran the first preliminary line. In September, 1911, I made the final location, completing in December, 1911. We had snow in September and from September until I left in the first part of December, did not see the surface of the ground except when we got rid of the snow. I wanted to complete that location that year and there was a great many days in October and November when we located it with considerable snow falling and the thermometer sometimes as low as 15 or 20 degrees below zero. By "getting rid of the snow" I mean removing the snow. When I left that year the snow was between 2½ to 3 feet deep. That ditch is located
794 in part of the forest reserve and there is some very good timber in that section. We had to clear a right of way through the timber, some very heavy clearing. The right of way is all cleared at the present time except about one mile.

Since I have been here they have pushed that Douglas creek work along as rapidly as they could except this season. Comparing this work with a system of similar excavations and classifications of material in an open country, if the same kind of construction that is on Douglas creek was done, within 5 miles of the city of Laramie it could be done in about ¼ of the time. Also at very much less expense. Prices are very much higher on Douglas creek on all kinds of work than at Laramie. The contractor that bid on the Bell Supply Canal No. 2 also completed the North Canal for us last year. His earth price on the North Canal was 13 cents, on Douglas Creek it was 19 cents, a very good illustration of the relative cost. The contractor's opportunity for profit is very much less on the
795 Douglas system than on the North Canal, where the unforeseen happens continually up there. We have some rock work on North Canal. It is softer rock than on Douglas canal. The contract price on North Canal is 90 cents and on the Bell Supply Canal No. 2 is $1.25 per cubic yard.

When this Bell Supply Canal No. 2 is completed its waters will be available for distribution to practically any part of the Laramie Water Company's system, through the Stewart canal or taken into Lake Hattie reservoir. If the Pioneer High Line is ever built there is a crossing over the Lake Hattie Supply No. 2 and the Pioneer High Line will be so constructed that Bell Supply No. 2 waters could be run in the Pioneer High Line from that point. There is an acreage of about 3 sections under the Pioneer High Line survey and above the point of intersection with the Lake Hattie Supply Canal No. 2 which enters the reservoir east of John Creek.
796 It follows a natural drainage channel. John creek runs in the spring only. There are a few springs on the east slope of Sheep Mountain in the vicinity of John Creek and Lake Hattie. The

Pioneer High Line survey was made for the purpose of serving land immediately north of Lake Hattie reservoir and all the land in Big Hollow and land on the south limb of Big Hollow, which is above the North Canal, and a portion of the land in Tp. 16 N., R. 74 W, above the North Canal which can be served either by the Pioneer High Line or the lower end of the Stewart canal. The land north of Lake Hattie and in Big Hollow is more sloping than the other land included within the irrigable area under the Stewart or North and South canals.

The Lincoln and Warren ditches are proposed canals in the vicinity of Fox Park, which, if constructed, would divert Lake creek and contributory drainage, Lincoln gulch creek and tributary drainage. Both creeks are tributaries of Douglas creek and Lincoln and Warren ditches collecting these waters would turn them across the divide into Squirrel creek, a tributary of Fox creek which is a tributary of Laramie river, entering between Wood's Landing and Pioneer canal headgate. I made only preliminary surveys of that ditch. Nothing further has been done.

The Interstate Reservoirs and Construction Company controlled the original filings and permits on the Little Laramie system, made, I believe, by Colonel E. J. Bell as applicant. The table of permits appearing on page 116 of the Biennial report of the State Engineer of Wyoming for 1907-8, and particularly permits Nos. 8518 to 8521, inclusive, by E. J. Bell, being for an appropriation from Little Laramie river and two appropriations from Douglas creek and tributaries and a second appropriation from the Little Laramie river, are a portion of the permits that were controlled by the Interstate Reservoirs and Irrigation Company. Permit 8518 covers Bell Supply
798 Canal No. 1, and has been absorbed in the permits for Lake Hattie Supply No. 2 and amended permits for the Stewart canal. The entire relation of these permits will be shown in the amended filings which were made last year for the Pioneer High Line and Lake Hattie High Line canal, which name is used for the Stewart canal, located and built at this time. Permit 8519 is the original permit for Bell Supply Canal No. 2. Permit 8520 is the original permit for Bell Supply canal No. 3. Later permit- No. 8519 and 8520 were amended and absorbed in permit No. 2538, enlargement, which is the last permit for Bell Supply Canal No. 2, obtained in either January or February, 1912. The Interstate Reservoirs and Irrigation Company also had the Bell Reservoir No. 1 and Bell Reservoir No. 2 and made some filings in connection with that and a line to take care of land in Big Hollow, which line derived its supply of water from the Laramie river. Then they had filings on the Bath reservoir and inlet and outlet canals for the Bath. Very few, if any, of these filings, or permits have been discarded. They have all been amended or absorbed by the Laramie Water Company by combining the filings and permits of the two companies. The later
799 filings being taken out in the name of the Laramie Water Company. E. J. Bell was one of the moving elements in this Interstate company. Also R. D. Stewart and F. S. Wendelkin, who is now or recently has been secretary of the Laramie Water Company.

Also, I believe, F. C. Grable. I believe that G. S. Speer was associated prior to the formation of the Lake Hattie Reservoir and Irrigation Company. I think he was part of the ring connected with Trowbridge and Niver of Chicago.

The expenditure prior to December 1, 1910, I referred to, was by the Lake Hattie Reservoir and Irrigation Company. Up to that time the work of the Interstate Company had been primarily promotion and engineering. They had done some construction on the Bell Supply Canal No. 2, and some assessment work on the Stewart canal and Bell Reservoir No. 1 and Bell Canal No. 1. It was mostly
800 assessment work for the purpose of making a showing of tangible figures every year of money spent on construction.

The lower end of the Lake Hattie Supply Canal No. 2 was completed during June and July, 1911, and was done by making a small ditch and turning in the water down the slope through the ditch. The actual expenditure amounted to approximately $3,000 in making the preliminary ditch. That preliminary ditch was about 1/10 of the capacity originally that it is now. In the $34,000 yet to be expended on the Pioneer enlargement and Lake Hattie Supply Canal No. 1 is included repairs to be made to the controlling dykes at the head of the Pioneer enlargement. It is proposed to reconstruct 26 stations near the Sodergreen lake and to line that portion with a concrete lining. That portion runs principally through disintegrated shale. It is a clay formation. There are two concrete drops to be built on this same portion and it is expected to straighten the sluice section of Lake Hattie Supply Canal No. 1 and to put in protection structures in some of the curves that have been developed to prevent future wash in directions not desired. Then there are repairs to be made at the Sodergreen bifurcation works. In con-
801 nection with the head of the sluice section of canal No. 1, it is expected to build bifurcation works which will eventually be needed for the Pioneer High Line and combine the control structure to Lake Hattie Supply Canal No. 1 in this single bifurcation works.

If the lands on the slopes of Big Hollow were irrigated, the return or waste water would find its way down to the bottom of Big Hollow. There are several small lakes in the bottom of Big Hollow, but the size of these lakes is not great and it is probable that some per cent of the water in these lakes is finding its way to the big or Little Laramie rivers. A large portion of this water evaporated. A certain proportion of the return water from the North Canal is collected in depressions from the first 2/5 of the total length of the Canal. From Sections 10 and 11, Tp. 15, R. 74, all the return water would
802 find its way to the Laramie river. The Big Basin, situated between the two rivers and in part of the northwest of Tp. 16, R. 74, contains alkali lakes and has no natural outlet. Probably there exist well defined subterranean passages between this station and Little Laramie river, because the supply of water for these lakes is greater than the rate of evaporation, so the difference must be taken up by seepage from these lakes.

I have not made experiments to ascertain the rate of evaporation. We have plenty of wind. Change of air in contact with the surface

of water accelerates evaporation. The lake in the bottom of Big Basin is about 75 feet lower than either Little Laramie or Big Laramie rivers at their junction. The gradient of the traveling water plane, if any, from the lake in Big Basin, would reach the surface at a point below the junction of the two rivers. In the Little Laramie Valley the water plane is pretty close to the surface, probably 15 or possibly only 10 feet below the surface of the ground close to the stream north and east of the Big Basin on the Big Laramie river.

The Big Basin is where the water is being waste- now out of the end of North Canal. When we were running a large supply in North Canal two weeks ago at the time Mr. Goldsborough was here with a party from Chicago, the water went into Big Basin after it reached the lower end of the North Canal.

Cross-examination (cont'd).

By Mr. Fred Farrar:

The relation between the irrigation system of the Laramie Water Company and the Laramie-Overland Municipal District is that the company is building this system and the district is one of the
804 districts that puts some of this system into use. The Laramie Water Company is merely the company which owns the ditches and rights of way and expects to sell water at some stated price to people in the district or outside the district. The Goldsborough Construction Company a head contractor on this project. Their contract is with the Laramie Water Company which has a contract with the land owners through the district organization. The lands which the Laramie Water Company irrigates are not necessarily lands which they own. I believe the Laramie-Overland Municipal District is bonded, for the purpose of eventually taking over the assets of the Laramie Water Company; and that eventually this system of canals and reservoirs will become the property of
805 the district. The Wyoming-Bell Municipal District lies immediately north of the Laramie-Overland District and its lands are also included in this Lake Hattie system.

The boundaries of the Wyoming-Bell Municipal District are not outlined on the map attached to the answer in this case and termed Exhibit A. The boundaries of the Laramie-Overland Municipal District are not correctly set forth on that map. It contains less acreage than the area shown on this map.

The Bath reservoir is a proposed reservoir. It is not com-
806 pleted. It lies at the upper end of big Basin, in Sections 10, 11, 12, 13, 14 and 15, Tp. 16 N., R. 75 W. and is not shown on said Exhibit A. Representations of small lakes in Sections 13, 14 and 15 in Tp. 16, N., R. 75 W. on Exhibit A indicate the location of the Bath reservoir site. Its superficial area, as planned, would be approximately 2,000 acres. If completed it will obtain its water supply from Little Laramie river and by means of another canal from the Stewart, neither of which are now built. The Stew-
807 art canal would get its water from the Little Laramie river.

OTT. L. BURNS, a witness in behalf of Complainant.

Direct examination by Mr. John D. Clark:

808 I lived 20 years nine miles south of Laramie on Five Mile Creek; in the ranching and cattle business; employed by Red Buttes Live Stock Company as General Manager. Have had charge of the irrigation of their ranch for 20 years. Five Mile 809 Creek is a tributary of the Laramie and flows into the river five miles above the City of Laramie. Willow Creek is a tributary of Five Mile. The ranch is irrigated from Five Mile Creek and Willow Creek. I have never seen any water flowing in the Laramie River from Five Mile Creek. I have been familiar with the point of juncture. The water is used by appropriators for these lands.

810 The Red Buttes Company irrigates about 300 acres. One of the ditches is the Upidee. Have not used it much for two or three years because of scarcity of water. The ditch was built some time in the eighties; about a mile and a half long. There is also the Rice Ditch on that ranch, which was constructed in the seventies. All the ditches on the ranch were built before my time. The Upidee ditch irrigates 40 acres; Rice ditch has rights for 40 acres but 811 don't get that much irrigated. Water has been short a number of years. The Homer Ditch on the ranch irrigates about 100 acres. The Democratic Ditch irrigates about 50 acres. There is irrigation on Five Mile Creek by means of dams in the bed of the stream which spread the water and it runs out and irrigates the land. These dams were there when I went there in 1893.

812 The whole of the irrigation from dams and ditches would not exceed 300 acres including the irrigation from Willow Creek. Sam Collins takes water from Five Mile Creek; also James McGibbon. Mr. Collins irrigates about 50 acres and McGibbon, or Willow Creek Ranch Company, 60 acres.

813 John Cook irrigates some land through a ditch taken from Willow Creek which was taken out ten years or more ago. The Willow Creek Ranch Company has several ditches through which it has irrigated about a section of land since the 70's. There have been years when they could get but a little water. 814 There are a few small tributaries to Five Mile and Willow Creeks but they flow only a small amount of water.

814 OTTO L. BURNS.

Cross-examination by Mr. Fred Farrar:

Five Mile Creek heads in Boulder ridge in Wyoming. I don't think any tributaries head in Colorado. Willow creek heads in Wyoming. These streams head south of Laramie about 20 or 22 miles. The creek which joins Willow creek I have designated Five Mile creek. It is termed Lone Tree creek on the topographic map of the U. S. Geological Survey for the Laramie Quadrangle (Edition of July, 1908). The headwaters of Willow creek are im- 815 mediately north of the Colorado state line. Whether or not Lone Tree creek heads in Colorado, its headwaters are joined

approximately a mile below the state line. These streams run in a general northerly direction. Unless diverted their water would flow into the Laramie river.

Cross-examination by Mr. Delph E. Carpenter:

The home ranch of the Willow Creek Ranch Company is about 3 miles southeast of Red Buttes station. The Red Buttes Land
816 and Live Stock Company owns the Homer ranch. Those ditches which belong to the Red Buttes Company irrigate a part of the Homer ranch. The Red Buttes Company acquired the Lindsey ranch, or the Pap Rice ranch. The Anderson ranch, the Gilmore and Soul ranch. Its central or home ranch is the Homer ranch. The ditches belonging to the Red Buttes Company and also the dams in the creeks used to throw the water out over the meadows, were the ditches and dams belonging to these several ranches. That portion of the Red Buttes ranch now irrigated is used for
817 making wild hay, native hay. These irrigated lands lie near the creek and really constitute a part of the creek bottom. As the water comes down through Willow or Lone Tree creek and strikes any of these diversion dams it is taken out and placed over the meadows. It then flows back into the creek and is taken out again. That is repeated on down through the creek valley. That portion of the creek valley that is irrigated is about half a mile wide at the widest place we were irrigating. It would narrow down to the creek bank at other places. In some places there are no meadows along it.

In ordinary years we cut on the irrigated land of the Red Buttes Company from 200 to 300 tons of hay. It is fed to cattle during the winter.

The Red Buttes Company controls under fence about 14,000 acres of land, I never knew exactly the number of acres. We run our stock altogether in pastures. One year with another we run
818 from 500 to 600 head of cattle during the summer. We run about 60 head of horses during the summer and carry over about 30 head during the winter. We do not run sheep. During the 20 years I have been in charge of this ranch it has been a cattle and horse ranch. Of late years we have been holding everything under fence. In the *yearly* '90's we had more cattle when there was free range and ran the cattle in the summer on the range and under fence in the winter. Since 1900 we have run everything under fence and had to cut the herd down.

Sam Collins on his Brush Creek ranch runs 60 to 100 head of cattle. Brush Creek enters Five Mile creek on Willow creek ranch. Sam Collins cultivates wild or native hay.

The ranch of John Cook is just above the Willow Creek Ranch Company. He runs about 60 head. James Van Buskirk owns a ranch between the Homer ranch and the mouth of the creek at the Laramie river. He irrigates near 50 acres of native hay on Five Mile. A strip of land on both sides of the creek. It is irrigated to native hay. He sells his hay. Willow creek, as well as Five Mile and Lone Tree creek, are all fed by springs. The springs rise at the

heads of the various little tributaries. The creeks flow con-
821 stantly 2 or 3 weeks in the spring. If the snow is heavy in the mountains there is a good deal of water. Other years when there is not much snow the flow is very small. I never followed down the Five Mile creek to see whether or not water entered the Laramie river, but for a great many years in my time there has never been water only a short distance below the Homer house. What little there was was absorbed by the meadows. During the last 2 or 3 years we have been shorter of water than in previous years. The first year of shortage was in 1910, 1911 was short, and there was a little bit more in 1912. 1913 was short the same, that was this year. It has just a fair average run. Van Buskirk's appro-
822 priation is junior to ours. If there is any water left after the Red Buttes Company gets through with it, Van Buskirk gets it. If any passes Van Buskirk that goes on to the river.

Sportsman's Lake is about the south boundary of the big pastures of the Red Buttes Company. That lake is in Sections 1 and 2, Tp. 13 N., R. 74 W. The country south of Sportsman's Lake is used for pasture. The country east from the Homer ranch and toward the Sherman mountains is used for grazing.

R. I. MEEKER.

Direct examination by Mr. John D. Clark:

823 I have two tabulations prepared, asked for at my prior examination, viz., the gauge heights and discharges of Fox Creek for 1912 at its mouth; also the daily mean discharges of the Pioneer Canal Enlargement near Woods, Wyoming, for the year 1912. (The papers handed to counsel for defendants.) I am familiar with Pioneer Canal.

824 I examined lands lying under Pioneer Canal on August 4 and 5 and September 18, 19 and 20, 1913, and ascertained acreage for that year. In securing acreages which were irrigated from Pioneer Canal, a Government topographic sheet was used as a base map. Each section was inspected by driving along the country roads and making side trips on foot across portions of sections to determine various crops and areas irrigated. Lines were located largely by subdivision fences, also by contours, ditches and other cultural features. Different tracts were ascertained where necessary by pacing off distances and widths of various fields and by estimating proportion of a quarter section or the area in question. Total area of land irrigated from Pioneer Canal in 1913 is 11,486 acres.

825 The lands were used for meadow, irrigated pasture, oats, alfalfa and miscellaneous crops, including potatoes, barley, wheat and garden truck. I have been familiar with the Pioneer Canal sixteen months. A considerable area of lands have been irrigated under that canal in prior years, as shown by the tilled soil and laterals. These are not included in the acreage above stated. The irrigated meadow in 1913 is 5,398. Irrigated pasture 2,061 acres;

oats, 2,115 acres; alfalfa 1,740 acres; miscellaneous crops 172 acres.

826 From the North Canal from Lake Hattie Reservoir there were irrigated in 1913, 705 acres, namely oats 48 acres, alfalfa 20 acres, irrigated pasture 637 acres. Examination of same character as of lands under Pioneer Canal and on same days, September 18 and 20. The tables produced by the witness were marked Exhibits 14 and 15.

827 R. I. MEEKER.

Cross-examination by Mr. Fred Farrar:

This examination of the land under the Pioneer canal occupied five days. It was done without an instrument. By inspection, blocking out and pacing off distances to determine boundary lines from cultivated features, ditch lines, etc. The general line of the Pioneer canal is parallel to the river. There is a main traveled highway which is likewise parallel. I traveled over that highway and all the adjoining ones. I was on portions of every section away from the road. I used an auto and where there were roads I drove in and drove over large portions of the lands where they were unirrigated to get at the irrigated portion. Where the car could not go I got out and covered that on foot. I used no instrument. My measurements were made by pacing.

828 I found evidence of other lines than the ones included in my given area which had been previously irrigated, but not now irrigated. I made no determination of these. There was a considerable acreage, more than 2,000 acres. It was in excess of that, but I don't care to state because I don't know. These lands were scattered throughout the irrigated area. That canal is about 30 miles in length. The irrigated area under the canal varies in width from 3 to 3½ miles. I did not make a map showing

829 the summation of this work, I have my field notes. I found 5,398 acres in meadow. It had been cut or was being cut on that area during 1913. In the early part of this examination in August some of the land was uncut at the time but it was land where the hay is cut each year. I worked from the upper end down, starting at Sodergreen Lake. I found 2,061 acres which I classified as irrigated pasture land. I found 2,115 acres of oats, during the latter part of the examination in September most of them were cut. Some of the oats were in each township, more or less scattered throughout the section. Those harvested were cut and

830 shocked. The alfalfa had been harvested on the area which I described, chiefly so. That would be the second cutting. Very little alfalfa remained uncut in September. The uncut part lay on the Heart ranch. They were cutting alfalfa on the Heart ranch on the 18th of September. I saw them cutting other places during September. The alfalfa harvest was generally finished about that time.

Of the 172 acres of miscellaneous crops were included potatoes, barley, wheat and garden truck.

831 There were approximately 20 acres of potatoes. They had not been dug. I think none of the oats which I saw had been threshed. I don't recall any. I did not see any threshing machines working. In August the potato vines were well advanced, in September they had been largely killed by frost. They were in good condition in August. I do not remember of any evidence of frost. There was a heavy frost about the 29th of July. I observed the potatoes on the agricultural experiment station that adjoins Laramie immediaely after the frost. Where they had been irrigated recently they were frosted considerably; where they had not, it did not affect them so much.

832 There was very little wheat in the 172 acres which I classified as miscellaneous. I do not know the reason. Last year there was very much more. There was more barley raised last year than this. There were 42 acres in this total 172 acres

833 that I have given. I do not know the reason for the decrease in the barley area. There were 15 acres of bearded wheat in Sec. 17. There was approximately 5 acres of millet. I made no segregation of the wheat on the University Experiment Farm. There was some wheat grown there for experiment purposes. The University Farm is a general experiment farm.

I will give you the location of the oats: 112 acres, 45 acres, 60 acres, 75 acres, 22 acres and 50 acres, 20 acres, 15 acres, 115 acres 75 acres, 70 acres, 80 acres, 20 acres, 41 acres, 145 acres, 50 acres, 45 acres, 120 acres, 60 acres, 50 acres, 40 acres, 53 acres, 65 acres, 185 acres, 40 acres, 50 acres, 40 acres, 32 acres, 20 acres, 47 acres, 40 acres, 16 acres, 93 acres, 63 acres.

834 On the Experiment Farm the oats and peas had been planted together. They were cut for feed. That includes all the oats under the Pioneer canal. I do not believe that any of this 11,488 acres which I have given are irrigated from any other than the Pioneer canal.

I will give the location of the alfalfa: 9 acres, 5 acres, 15 acres, 40 acres, 25 acres, 68 acres, 52 acres, 87 acres, 20 acres, 104 acres 130 acres, 50 acres, 6 acres, 271 acres, 167 acres, 116 acres, 32 acres, 40 acres, 150 acres, 30 acres, 65 acres, 30 acres, 196 acres in several blocks.

In some instances there were evidences of cereals having been raised upon the lands which I mentioned as not having been

836 irrigated this year. There were large areas of pasture which had been irrigated formerly but which was not irrigated this year, and some meadow. I believe some very small areas of alfalfa. In Sec. 31 I recall a considerable area that had been in alfalfa. Under the north canal I found 637 acres of raw land upon which water had been applied this year. It was just raw prairie land. It was located mostly in Tp. 16, R. 74 W.

837 I consider the irrigation of prairie land an economical use of the water because it is a branch of stock raising in this community. I would not say that the returns are justified in comparison with the returns from cultivated lands. A certain amount of pasturage is essential for fall use before the feeding of the gen-

eral hay crop commences and is customary in this country. I would not say that they would get a greater return from the result of irrigation for pasturage than they would if they raised that much alfalfa, wheat, or oats. I would not care to make the statement that the actual return in value from the irrigation of prairie lands is nominal. I give it as my observation. I state it to be a fact.

At the present time this district is primarily a stock country.

838 Cross-examination (cont'd).

By Mr. Delph E. Carpenter:

In estimating the 5,398 acres of meadow land under the Pioneer canal I included the land that is wet from year to year by seepage from the Pioneer canal, where they cut hay. There are approximately 1,005 acres of seepage hay land under the Pioneer canal.

I found in Sec. 15, Tp. 14, R. 76 90 acres which should be credited to seepage from the Pioneer canal. That would make a total of 1,095 acres irrigated by seepage.

The remaining 4,303 acres of native hay were irrigated directly from the Pioneer canal.

841 160 acres situate in Tp. 15, N., R. 75 W. of the land designated as irrigated pasture land are irrigated by seepage.

Referring to the acreage which had evidently been irrigated at one time and which had been allowed to go without irrigation or cultivation this year, I could not state principally where it is located other than various parts of the entire irrigated stretch from one end to the other. Some years under the Pioneer canal tracts lie idle because the land owners did not buy water for it. My experience with the Pioneer canal and this section has only extended over 18 months. I have given the land by me ascertained as irrigated under the Pioneer canal, whether irrigated directly, by seepage, or overflow, as it appeared when making my observations in August and September, 1913.

The total acreage of irrigable land under the Pioneer canal is much larger than the area which I have given as irrigated. It is more than 2 or 3 times as large as the irrigated area. I do not say that 13,000 acres represent the total development under that canal since its construction. If there were 19,000 acres irrigated in the past, that would make about 7,000 or 8,000 acres that have gone back to unirrigated lands since that time. 11,486 acres represent all of the land irrigated in 1913. There were no more lands than those that I know of. I went over this land in company with

843 E. D. Titus. He is the best posted man in the Laramie river valley as to what lands have been irrigated under this canal. I ascertained the acreage and he assisted me in getting around over the country. He pointed out the areas and gave me the names of the owners. I measured the tracts myself. I determined from inspection whether or not the tracts were irrigated directly from the ditch or by seepage or overflow. The E. D. Titus who accompanied me is the same who has previously testified in this case. I was too

much engrossed with the problem in hand to make any estimate of the area which had returned to aridity.

844 LARAMIE, WYOMING, September 23, 1913.

(By the witness:) Before Mr. Carpenter commences his cross-examination I would like to make one correction, referring to Sec. 18, Tp. 16 N., R. 73 W. I gave 130 acres of irrigated meadow by Ryan Brothers. I wish to change that to 210 acres. That would necessarily modify the totals. The total irrigated meadow in all was given as 5,398 acres and the 80 acres would — it 5,478 acres. This increases the 11,486 by 80 acres, making a total of 11,556 acres.

Cross-examination by Mr. Delph E. Carpenter:

In giving the acreage in alfalfa I included the area in Sec. 1, Tp. 15, R. 74 which was newly seeded. I gave 104 acres in Sec. 11, Tp. 15, R. 74. Newly seeded and not producing sufficient alfalfa for cutting this year. The 130 acres of alfalfa in
845 Sec. 14 is not large. Some of that alfalfa has not received very good attention this year. The southeast quarter is in native meadow of rather poor quality. In irrigated pasture and meadow. Nearly all of the northeast quarter, not including the alfalfa, is in the same condition. It has been irrigated in previous years. Some of that lies under the Walcott Ditch. There
846 was considerable hay cut off the north forties last year. In giving the number of acres on Sec. 31, Tp. 16, R. 73, I included newly seeded ground in my alfalfa acreage, about 30 acres. There is land that I classed irrigation pasture and some that I classed as "no crop." The no crop land is old plowed land. It has stubble on it, and also some alfalfa. In the southeast quarter of the northeast quarter of that section there is a pond. I classified the land surrounding that pond as irrigated pasture. In much of the irrigated pasture land described in other sections there was fox
847 tail. Land is not usually exceedingly wet where fox tail appears. If you get too much water it would kill it. Fox tail appears where the land is damp. Referring to Sec. 19, Tp. 15, R. 74, I gave 80 acres of irrigated meadow land belonging to Mr. Grable. Part of this land that I have classed as irrigated meadow is covered by small ponds. The grass land lies around the ponds. It covers several acres. The 40 acres of irrigated meadow credited to sec. 29, Tp. 15, R. 74 is irrigated land. I class it as poor meadow. Hay was cut from portions this year. On the north side of the county road on that section there is a large lake. I didn't include anything north of county road. Seven Mile lake is like the pond on Sec. 17, filled by waste seepage water. 40 acres of irrigated meadow should be in Sec. 24, Tp. 16, R. 74, instead of Sec. 36. It is situated under the Pioneer canal where the canal loops around a draw and is used for meadow and pasture. I credited 379
849 acres of irrigated meadow to Sec. 17, Tp. 16 N., R. 73 W. I didn't observe any pasture land there. I included the

southwest quarter as irrigated meadow; also practically all south half of northwest quarter; I drove and walked over most of it and don't recall that it is too high to irrigate. There were some portions a little rough and the hay had not been cut this year, but left to be fed. I would not state that a portion would not be strictly hay meadow. Some of it is a little uneven.

850 The lands under the North canal, the north branch of Lake Hattie outlet were brought under cultivation and irrigation first in 1913, the first year water has ever run through the canal. None of the 637 acres under that development would properly be included under the original Pioneer development.

I didn't know that the Laramie Water Company has been running the north canal full of water and wasting it into Big Basin. There has not been a large canal full of water, referring to the discharge. Several dams have been put in the North canal just below spillways, whereby the water was raised sufficiently for forcing it out over the spillways for irrigation.

Some water has been running out at the lower end which has been used for irrigation. Some has been running almost constantly into Big Basin for weeks. No large volume because a large volume has not been turned down the canal. The water running into Big Basin is lost forever for irrigation. That basin is about 100 feet lower than the rivers at their junction. It is distinguished from another large basin lying generally to the south, called Big Hollow.

851 The irrigation of the old Pioneer canal is taken from reports by engineers on that canal and its prpposed extension and enlargement, documents of the Laramie Water Company. I know of the various permits under which the new development of the Laramie Water Company has progressed and which was authorized by Wyoming. The Laramie Water Company is a corporation operating under the laws of Wyoming, formed sometime in 1910. I am unable to affirm that its by-laws were adopted August 24, 1910, or thereabouts. The company was formed as a result of

852 agreement of consolidation between Lake Hattie Reservoir and Irrigation Company and the Interstate Reservoirs Construction Company and the interests of E. J. Bell, F. S. Wendelkin, F. C. Grable and R. D. Stewart. I am not familiar with the agreement. I may have seen the agreement on or about the 5th day of May, 1910, whereby they agreed to form a consolidation, but do not recall having read it. These two corporations and private individuals had various interests which were merged into the Laramie Water Company.

The total acreage irrigable under the Pioneer canal, not that irrigated, is approximately 49,000 acres. That included the Pioneer High Line. I could not give the acreage excluding the Pioneer High Line. I would not state that the High Line Canal is new. The Pioneer High Line canal has not been built yet. Surveys and reports have been made on the Pioneer High Line, dating

853 back as far as 1889, at various times for the Pioneer canal and for the Laramie Water Company. It is more than a

matter of reports and mere lines of survey. Rights of way have been secured for it but I am not able to state very recently. I have no theory that it is an old canal, simply knowledge and observation. I cannot give the acreage under the Pioneer as actually constructed and operated.

Cross-examination by Mr. Fred Farrar:

49,000 acres includes portions of land under North canal and South Canal. The Fischer Ditch, Walcott Ditch and the Last Chance Ditch have since been constructed and cover areas embraced in the total. None of these save perhaps the Walcott ditch,
854 which covers a very small area, are earlier than the Pioneer. The 49,000 acres approximate covers land adjacent to the Pioneer without regard to the present new construction, of the Lake Hattie system. If the new construction did not exist the position and location of the Pioneer is such that by laterals and extensions it would cover that acreage. The irrigation of that acreage does not necessarily pre-suppose a supply of water from Lake Hattie. By enlargement of the Pioneer and construction of laterals it would be rendered capable of serving 40,000 acres. It is not the policy of the Laramie Water Company to prevent construction of ditches or reservoirs by individual land owners or companies which would irrigate the area capable of service from the Pioneer. I know of no instances where they have endeavored to block individual projects or prevent the construction of other projects. The Laramie
855 Water Company is a service company, carrying water for compensation, and supplying water for perpetual water rights. There is an annual charge for those not having a perpetual water right. I do not know about charges to those having perpetual water rights. The construction of a ditch or reservoir designed to irrigate lands under but not irrigated by the Pioneer would deprive the Laramie Water Company of a contemplated source of revenue if priority rights were to go with that construction. It has not been the policy of the Laramie Water Company to monopolize irrigation possibilities upon all lands lying under the canal, and Lake Hattie and its subsidiary projects, but to bring under beneficial irrigation; nor to force small ditches into the organization and the consequent abandonment of their own projects. I do not know of it ever having been done. The president of the Laramie Water Company
856 is not a resident of Wyoming but of Pennsylvania and is the treasurer, G. C. Graeber. The present general manager, Mr. C. C. Schrontz, is from Colorado. The Goldsborough Company, engineers for the Laramie Water Company, have not been connected with the Laramie Water Company since September 15, 1913, and are not now. I cannot give a correct list of companies and
857 individuals that during the last five years have been included in various schemes entering as factors in the present development of the Laramie Water Company; I only know the present company, the Laramie Water Company, the Arnold Company and the Goldsborough Company, both engineers for the Laramie Water

Company; the Goldsborough Construction Company, contracts for the Laramie Company; the Laramie Farms Company and the Goldsborough Land Company. The Interstate Reservoir Company, the Lake Hattie Reservoir Company, Francis C. Grable. F. C. Wendelkin, E. J. Bell, I don't know about Bell Reservoir Company. These have been factors or successors in interest in promotion of various schemes which have been consolidated into the Laramie Water Company. Coupled with those are the two municipal irrigation districts, the Laramie-Overland and the Wyoming-Bell. I have no knowledge whether the Laramie Development Company and the Laramie Realty Company are included in the promotion of these enterprises.

E. D. TITUS.

Direct examination by Mr. Clark:

858 I have been superintendent of the Pioneer Canal for fourteen or fifteen years.

859 Have had entire supervision over the distribution of the water, giving to it all my time through the entire year. The irrigation season under the Pioneer Canal is from some time in April until the latter part of September. During that period the water runs constantly through the canal to its full safe capacity. Became acquainted with the canal in June, 1888, and have been familiar with it ever since. I had a homestead in Section 22, Township 15, Range 74 in 1888 under the Pioneer Canal. I had a knowledge of the canal from '76 until the latter part of '78. They were then starting the construction of what was then called the Crout or Hutton Ditch.

860 I was out of the county from '78 to '88. When I returned in '88 the Pioneer Canal had been completed and is now as it was then with few changes. In Section 24, Township 75, the ditch was changed for about a quarter of a mile in width. There has been no extension of the canal in length. From the head works about ⅔ of the way down to the Sodergreen lake there has been an enlargement. That is about two miles in length and the enlargement was made when the Lake Hattie work was being done. No other enlargement has been made since 1888.

861 Quite a large acreage was being irrigated under the canal in 1888. There were from 50 to 60 people under the canal. Today there are probably 250 people living under the canal, or more.

862 There are seventy different headgates distributing water to users and there are only two or three of these that are partnership laterals. I have kept tab at all times on the amount of water carried in the canal, have a measuring weir about 175 yards below the headgate at the river. Prior to the Lake Hattie enlargement the canal carried over 200 second feet of water, at times as high as 240 or 250 second feet. That would be in the latter part of June and the very first part of July.

863 At times I ran as low as fifty second feet during August, seldom less than that. The water is diverted from the river by means of a dam and headgate. I accompanied Mr. Meeker when he examined the lands under the Pioneer Canal. I know the lands which he ascertained to be irrigated in 1913. Additional lands have been irrigated from the canal in other years, amounting to several sections of land. In 1912 we irrigated 19,000 or 20,000 acres of land under the canal. That is the greatest amount ever irrigated from it. The same amount was irrigated in 1911 and 1910.

864 Ten or twelve years ago I made a map marked Exhibit 7 in the proceeding in the District Court of Laramie County adjudicating the rights of appropriation on the Laramie River. The acreage irrigated then was something like 17,000 or 18,000 acres. The same land was irrigated in every succeeding year up to and including 1912, with the exception of one or two instances where people allowed pieces of land to lie idle on account of seeding to alfalfa and didn't use the water on it.

E. D. TITUS.

865 Cross-examination by Mr. Fred Farrar:

To find the average size of the present ranches irrigated by the Pioneer, strike an average between 160 acres and 8 or 10 sctions. 160 acres would probably be the smallest and about 4 or 5 sections the largest.

Cross-examination by Mr. Delph E. Carpenter:

The total acreage irrigable from the Pioneer is from 35,000 to 50,000 acres. The canal since 1888 is 38 or 39 miles in length. I have had water started in it before the 15th of April and running to the rear end and have run water into December We have been prevented from running until in May in some years. The demand by users regulates the time of beginning. In April they irrigated hay and meadow land. Snow was then still in

866 the ditches at points, at the upper, next to river where there were many willows and trees, and snow had drifted. Sometime[illegible] would turn a small head of water into the ditch and force the through. In these early months we would not run the ditch entirely full, because there wasn't as great a demand as when they were irrigating grain. Late June was when I generally made the heaviest run and early July. They irrigated native hay with cold water in April and May and waited until June and July to irrigate grain, which did not need irrigating. They do not generally irrigate grain until it is large enough to shade the ground, probably 6 inches in height, which it would be then. In May all settlers want water for native hay meadow lands. I shut off irrigating native hay meadows the very last of June but generally they ask to have water shut off from July 15th to 20th. They keep water running

867 on the meadows from the time I turn it on until they shut it off. After that I do not run a large head of water, because

there is no demand, but I keep running water into December for domestic and stock use. Probably half the cattle that were ranging along the ditch that belonged to different people, milch cows and horses and people drank from this same ditch. They prefer the ditch water in the summer time to their well water as there is less alkali.

After they have ceased irrigating I would run as low as 50 second feet or 60, enough to carry through to the lower end,—for watering these cattle and people. Very little water went back to the river or into the numerous lakes. In cases of storm we were protected
868 by two waste ditches to take care of the flood, and I always aimed to control the ditch so very little water went to waste. The people and stock and seepage and evaporation consumed this 50 second feet running constantly. There was quite a considerable loss of revenue from seepage and evaporation. The settlers got the benefit of the seep water. The ditch seeped very badly in places. The seepage water ran out under and irrigated their meadows. Quite an acreage under the canal has been irrigated with a small flow of water from the canal. Of this 50 cubic feet of water per second, there would be hardly 15 per cent lost by seepage and evaporation. Evaporation is much less the latter part and the early part of the season than in summer, seepage is a great deal less in the latter part than in the fore part. These settlers raise 2,000 head of cattle along the ditch which we water. Only one or two consumers
869 paid especially for that service, two or three years when he was running sheep. He leased land there but owned quite a bit of land over in north. He was there a good many years with his sheep but did not continuously lease water for his sheep. We furnished water for the stock to practically all the farmers along the ditch. The rest of the water they used for irrigation during the season. The Laramie Stockyards Company, one of the largest users, are using water at present time and will as long as we have water running in the canal for watering stock that passes through here in shipment. The pasture is across the river in Sections 19, 20 and 30, and none of the land is more than a mile and a half from the river. There was quite a considerable "holler" the other day because
870 I had to shut down the canal for repairs. The river is not a safe place to water sheep when they are just unloading. They crowd in and drown. There is not quite a flow of water in the river in August and September, this time of the year there is not as much as there is at this present time generally. 50 cubic feet of water, running constantly, would fill quite a lake in a short time. This 50 feet evaporates, seeps and is used, because I have never allowed until now over 2 second feet to go down at the lower end waste ditch, and I always keep waste ditch No. 1 gates shut, except in case of storm, or where I get a little too much water in, and I telephone them to shut off so much and open the gate in the meantime, and in about 12 or 15 hours the flow goes down and the gate goes down. Hard to say how much water cattle and people consume. We don't keep tab or charge for domestic use only in a few instances. Water is turned out only in laterals where people live away from the ditch,

enough to reach their buildings, or where they wished to use this water. There are more than a half dozen of them. The Stockyards Company run out their water into laterals for watering sheep but the sheep do not consume it all. What is not being used by the sheep is going back into the river. I never saw water cease flowing in the river near where these sheep are all the time. This flow of 50 feet through August and September, and sometimes as late as December, is largely for accommodation, supplying water to Pioneer patrons for domestic use. A portion seeps away and soaks in the ground along the Pioneer and the lands thereunder. Many are irrigating their alfalfa after they cut the last crop, the last two or three years, and find it very beneficial. That is in September, just before the ground freezes. It was demonstrated many years ago at the Univer-
872 sity farm that alfalfa could be grown successfully. The first alfalfa I ever saw growing was in Sec. 1 of the University farm, in this section of the country.

There are around 250 or a few more people, men, women and children, living under the Pioneer canal. That population would be distributed among more than 50 ranches.

I have to keep track of this water flowing into my canal all the time in order to properly operate the canal. I kept a record
873 in 1906 or 1907, but I keep no record now.

Cross-examination (cont'd).

By Mr. Fred Farrar:

I devoted all my time to work as superintendent of the Pioneer canal. I am also president of the Laramie-Overland Municipal District and have been since organization, about three years ago. A portion of my time has been devoted to that.

The Pioneer canal is now owned by the Shamokin people. They are known as the Laramie Water Company. The business of the Pioneer is kept separate from the Laramie Water Company accounts. I don't know whether the Laramie Water Company has a 99 year lease on the Pioneer. I understood it was purchased outright. The Pioneer canal was owned by the corporation called The
874 Pioneer Canal Company. I could not tell where the stock of that corporation is held now. The Laramie Water Company owns Lake Hattie, through the Lake Hattie Reservoirs and Irrigation Company and not directly. I am in no way connected with the Wyoming-Bell Municipal District. Mr. Bath or Mr. Spaulding is the president of that district. The Laramie-Overland Municipal District was organized for the purpose of getting the lands under irrigation in the district by water furnished by the Reservoir Company. There is no connection between the Laramie-Overland Municipal District and the Pioneer Canal, apart from Lake Hattie. The relationship exists between the Laramie-Overland District through the Laramie Water Company with Lake Hattie and the Lake Hattie project. The Laramie Water Company owns the North and South canals leading from Lake Hattie.

875 The lands were petitioned into the district and a water right granted for whatever amount of land they put into the district. These lands are bonded and the owner owns that much stock in the water company. That covers his land. He is not then required to pay an annual toll or any other tax or assessment for water, he is only required to pay a certain amount for operation and maintenance charges. There are lands within the exterior boundaries of the district which do not form a part of the district. The Laramie Water Company furnishes water to the Pioneer Canal for all the lands under it, and it has furnished water this year for some land under the North canal. The lands under the Pioneer pay a yearly stipulated price for the water which they get from the Laramie Water Company. That price is supposed to be on the amount of land irrigated. Those contracts are just for one irrigation season. They furnish not less than one cubic foot of water per second of time for 70 acres for one dollar per acre. If they get more it is simply turned out to them. Some few in times past have gotten a good deal more than they paid for. I don't think any have received more for that amount for the year 1913, because we have not had the water to deliver when it was called for. Some received more in 1912 and '11. In the fore part of 1910 they did but in the after part of the season they did not. Nearly all of the ranches received more water than one cubic foot for every 70 acres during the irrigation season which they paid for.

876 I have studied perpetual rights under the Pioneer system and I haven't made up my mind whether or not we have such rights. We have sold shares in the Pioneer canal to
877 different ones which makes them a part of the Pioneer canal company. The matter of perpetual rights is tied up in a pretty complicated shape. I would consider a perpetual right would be where a man would have a perpetual right to water without any further charge. Some of the small users in Sec. 31, Tp. 16, R. 74 claim they have, but we have never acknowledged anything of the kind. I cannot figure upon what they base
878 their claims. They were rights sold to purchase water and then there were rights sold which would make them a stockholder of the company, just the same as if you or I would purchase stock in a company. They claimed they were perpetual water rights and they didn't have to pay anything more. It is a contention based upon the legal status rather than upon the physical. We have three classes of irrigators within the outer boundaries of the Laramie-Overland Municipal District: First, the appropriators under the original Pioneer canal, second, the owners of land forming a part of the district and receiving water from Lake Hattie and its projects; and a third, owners of land who are dependent entirely upon the purchase of water from year to year. In addition we have
879 one or more persons asserting that they have a free perpetual water right. Nearly all the old appropriators under the Pioneer may also be in the district. Whether in or out, if necessary to furnish them with water from Lake Hattie it is furnished. If they are out they have to buy it.

The contract between the Laramie Water Company and the Laramie-Overland Municipal District, of which I am president, is a contract to furnish water from their system of ditches for all time. The last lands signed into the district went in at $25 per acre. Any payment made is not made by the district as
880 a whole but by the individual owner. The corporation has paid for water rights or physical property. There has been a payment in the Bell District with bonds for the district. The water company receives these bonds at 95 per cent of their face value in payment for water rights. These bonds are figured on an acreage basis throughout the district. There has been one payment of bonds made in the Wyoming-Bell Municipal District. The payment for water rights by the bonds of the Laramie-Overland District was taken up at our last meeting, but whether it has gone through I will not know until after we have another meeting. If it does go through, for a certain number of years this reservoir and ditches will remain in the company and after that will pass to owners of the land. If the Laramie Water Company does not receive these bonds
881 the reservoir and ditches will still be property of Water Company. There is an agreement for them to pass to district. Land that is petitioned into district and accepted becomes part of the district, and is bonded, and there is an agreement between the company and the district that they are to receive these bonds, charging a certain price for the water. After 50 or 49 years the Physical properties pass to the district. During this period a certain revenue is derived by the company from the lands in the district in addition to the interest and principal on the bonds, until the principal becomes due. That constitutes the profit which the company makes in the transaction above the difference between cost of building, payment for physical properties and expense of operation and maintenance.

882 The agreement between company and district is reduced to one contract. I think the secretary has one.

The general situation between the two districts and the Water Company is the same, but the Pioneer is different from the district. The original Pioneer ditch has practically the same status in both districts and the appropriators under it have practically the same. I have been superintendent of the Pioneer canal company ever since I have been in their employ. I don't know who is president of that company now but think he is an officer of the Laramie Water
883 Company. Mr. Schrontz is general manager of the interests of the Water Company and the Pioneer Company. My relationship is somewhat intermediary. I am an officer of the Pioneer canal company, which company is under the control of the Laramie Water Company, and I am also president of the Laramie-Overland District, which is in contractual relations with the Laramie Water Company.

The town of Laramie receives its water supply from springs to the east of the town.

Cross-examination.

By Mr. Delph E. Carpenter:

The Pioneer canal company owned the Pioneer canal in 1888. Some water users were owners of stock, but the majority were not.

884 Under the territorial laws they asked for an appropriation to cover these lands lying under the Pioneer canal. The corporation got the appropriation. The land owners paid so much per acre per year to receive water. In years gone past it was 50 cents. A year ago last December notices were sent out of an increase to one dollar per acre per year. I do not know whether that was under the new organization or the Lake Hattie and kindred promotions. I got my instructions from the Assistant General Manager and sent out the notices. During the '90's, when I was running this canal for the corporation, the land owner who wanted water paid 50 cents an acre to us. At the time I took charge of the Pioneer canal in the '90s, the gross receipts was $410 a year. The president of the company told me "make this canal pay expenses if you can't do any better." I had nothing to do with operation of canal in the '80's. So I proceeded to deliver water to the different users. Some of them were poor people just settled on their land. For instance, a man would pay for water sufficient to irrigate 30 acres, a cubic foot per second of time for 80 acres, and I would turn out to him double and sometimes treble that amount of water, and he had no money to pay for it, but had land to put it on. In that way I put them on their feet so that in after years they could come a whole lot nearer paying for the water they had used. I more than doubled the $410 the next year after I took charge, I was told that in several years prior to my taking hold of it the consumers did not pay enough money to run the canal. The third year after I took charge the receipts took care of operating, but the ditch was in very bad shape at the lower e ,ndand the company had to put up its own money to repair it. The sixth year it a little more than paid operation and maintenance expenses. My theory of making the

886 canal pay its operation on maintenance expenses was to irrigate the lands regardless of whether the parties paid for the amount of land they irrigated or not, for the reason that if land was irrigated for a couple of years they could put up a fair crop of native hay. Some of them put up hay the second year. The canal did not ever pay cash dividends to its stockholders prior to the initiation and promotion of the Lake Hattie scheme. It was always a problem for me to make maintenance and operation come within revenue derived from charges to water consumers. Since the organization of the Laramie-Overland District there are two different propositions whereby the water may be delivered to the land owners. No part of the Pioneer has been petitioned into the district.

887 When I was superintendent I did not keep a weir at the head of the canal all of the time. I placed the weir in there and it was used as a gauge until the Pioneer was enlarged and we have gauged since with a meter. That enlargement has taken place in very recent years. From time to time prior to the enlargement I com-

puted the amount of water passing over the weir by what is known as the California weir measurement rule. It was a drop weir having 3 feet. The weir crest was 3 feet above the bottom of the ditch. When we were drawing as high as 200 second feet it always showed
888 an air bubble along the crest of the weir so it showed it was running free. The water was decreased or increased in depth as I ordered. There was no official except myself in charge.

During these years, until the last couple of years, our diversion was never interfered with by the water commissioner, the state engineer or officials of the state. The interference has been since the enlargement of the canal and the beginning of storage of water in Lake Hattie.

JAMES HARDMAN, a witness in behalf of Complainant.

Direct examination by Mr. Clark:

889 My name is James Hardman. I reside in Laramie City. Was engaged in ranching on Sand Creek, Section 2, Township 13, Range 75, for thirty years, commencing in 1877. Knew the ranches on Sand Creek and the irrigation from that stream. It is a tributary to Hutton Lake. Prior to irrigation on that stream some years the water would run into the Laramie river and some years it would not. That was true when I first commenced ranching there.

890 It has been the same way since. In 1878, 1881, 1887, 1903 and 1908 or 1909, were the only years that any water flowed from Sand Creek into the river. I had two ditches taking water from Sand Creek. Other ranchmen irrigating on that stream were Mr. Collins, Mr. Lindquist, Mr. Goetz, Davis Brothers, Hoge, Cunningham and Wyoming Central Land and Improvement Company. I had Davis Ditch No. 2 which was built in 1878. It irrigated about 170 acres.

891 In the eighties I built the Alice Hardman Ditch, which was enlarged in the nineties. 400 acres were irrigated from that ditch, 300 acres of it prior to 1900. From Davis Brothers No. 2 Ditch 200 acres were irrigated. The Fred Collins Ditch was built in the eighties; 75 to 80 acres irrigated from it. Mr. Lundquist's ditch was the Konold ditch, built in 1881; 420 acres irrigated from it. Mr. Hogue had five or six ditches. Some were built in 1880.

892 The amount of irrigation under them in 1900 was more than two and one-half sections. Peter Cunningham Ditch called the Le Roy Ditch, was built in 1881 or 1882, and covers almost a section of land. Half a section was irrigated from the Cook Ditch. John Goetz had the Lone Tree ditch, built in 1885 and irrigated 360 to 400 acres. Davis Brothers No. 1 was built in 1885 or 1886.

893 It irrigated 360 acres at least. The tributaries of Sand Creek are very small and there was irrigation there. Shell Creek had land irrigated from it through Steamboat Lake, which overflowed in 1887. I irrigated 70 to 100 acres from Spring Creek

and Rice irrigated some and that took all the water of that creek. Andrew Johnson took all the water of Antelope Creek which emptied into Hutton and Creighton Lakes. The headgate of the Hogue & Haley ditch is on the Laramie River above Le Roy Bridge, about the middle of Township 14, North, Range 75. That was
894 built twelve or thirteen years ago by Mr. Hogue. About 1,800 acres were irrigated from it.

894 Cross-examination by Mr. Fred Farrar:

There were not less than 16,000 or 17,000 acres of land irrigated from Sand Creek and its tributaries. Sand Creek is naturally a tributary of the Laramie River and then is not. For quite a number of years, unless the water is very high it will not run into the Laramie River. It would run into Hutton's Lake, Lake Creighton and Lake Hutton, and fill those lakes up. It ran into Lake Hutton naturally. It always flowed in there until they got full, and then it would run into the Laramie river. If the creek flows heavily, after Lake Hutton is filled the water runs into the Laramie river. That was the condition when I first located on Sand Creek. It always has been the case so far as I know. The water which flows into Lake Hutton evaporates and seeps away. It has not been used for irrigation so far. Hutton and Sreighton lakes cover probably a section and a half. If you were to follow the channel of Sand Creek to Laramie river it would have no channel. If water overflowed the Hutton lakes and passed on down to the Laramie river, it
896 would join the Laramie river on about Sec. 6, Tp. 14, R. 74.

Sand Creek rises over in Colorado. Its general course is northerly and a little westerly in some places. Shell and Antelope creeks rise in Colorado. These streams irrigate possibly 16,000 acres.

The statement that Hoge and Haley ditch irrigated 1,800 acres is a general estimate from the course it takes. I have been over the Gullihan ditch.

If the water of Sand Creek were not permitted to flow into these lakes it would naturally run down here and spread over the land; there is really no water course only about half a mile below the lakes.

LARAMIE, WYOMING, September 24, 1913.

JAMES HARDMAN.

Cross-examination (cont'd).

By Mr. Fred Farrar:

897 When I estimated that 18,000 acres of land were irrigated from Sand Creek and its tributaries, I made a mistake and I desire to correct that. I find in looking over my figures that were given before, a total of 6,276 acres were irrigated from Sand Creek and its tributaries. Then from that we will have to make a little deduction. Included in that is the Caldwell and Gardiner ditch,

which was afterwards thrown, and on the Boyd Rice place
898 there is a claim for some amount of water for a reservoir and from that I deducted 300 acres. That left net 5,628 acres. Then besides that from Antelope creek, which had slipped my memory altogether, there is a record of 270 acres that is used in it when there is water. That is to be added. Making a total of 5,898 acres.

The land under the Caldwell and Gardiner ditch was deducted because they allowed it to go by default. The same land is now irrigated by the Cook ditch. The Cook ditch takes water from Sand creek and was filed on in 1901. The amount of land irrigated at this time would be 5,898 acres.

899 My deduction of 300 acres from the Boyd Rice place was made because he only has a right to fill up that reservoir when the water is not being used for irrigation. If he has water for his reservoir he irrigates 300 acres. That would be added to my total of 5,398. I deducted 348 acres under the Caldwell and Gardiner ditch, because in my sum total I added the 360 acres of the Cook ditch. There is a half section of land that is included in the Caldwell and Gardiner tracts, but there is only 260 acres irrigated.

Cross-examination by Mr. Delph E. Carpenter:

The Hutton Meadows were large and irrigated from Sand Creek and some from the Laramie river. They had two ditches
900 from the Laramie river, the Dowling and Bilderback ditches, but those are further this way. There were a number of ditches from Sand Creek.

The lands irrigated on Sand Creek are meadows, native hay principally. There was always irrigated pasture amongst it. In the acreage given I have included that land irrigated to meadow and also for pasture. The Hoge and Haley ditch takes its water from the Big Laramie river. I stated that the Hoge and Haley ditch irrigated what I thought would be about 1,800 acres. I did not
901 include in that 1,800 acres the land irrigated by the Caldwell and Gardiner ditch, but I did include that irrigated by the Bush and Holliday ditch. The Bush and Holliday ditch irrigates somewhat the same lands I gave as irrigated by the Hoge and Haley ditch. The 1,800 acre- estimated includes lands irrigated by both the Bush and Holliday and the Hoge and Haley ditches. It is principally native hay and pasture land, some of it has been plowed at times. Whenever plowed it has usually gone back to native hay, they let it go back, most of them, in two or three years.

The best results are obtained from raising native hay. Out of this 5,898 acres irrigated, 522 acres were irrigated from my ditches. That was mostly hay land, 95 per cent hay. Mr. Cunningham owned the Le Roy ditch. Both of these ranches and the water rights were later sold by me and Mr. Cunningham to Mr. Bruce G. Eaton. He is one of the owners of the Divide ditch, taking water from Sand Creek into the Cache la Poudre river.

902 Cross-examination by Mr. Fred Farrar:

I stated that I would look up the dates upon which these ditches were constructed. Some of the testimony yesterday was wrong. The ditches and the date of construction are: James Hardman, No. 2 ditch, 1878; Hardman No. 1, 1877; Le Roy, 1885; Caldwell and Gardiner, 1885; Gullihan, known as the Gullihan No. 2, 1880; Gullihan No. 1, 1880; Red ditch, 1880; Guillihan No. 21, 1882; Red ditch, 1882; Braden ditch, 1880; Nedart, 1880; Davis Brothers No. 1, 1881; Konold, 1885; that latter ditch is under the name of Lundquist and Konold. Lone Tree, 1890; Collins, 1887; Collins, 1890; Richards, 1886; Richards, 1888; Davis Brothers No. 2, and Alice Hardman, 1891; Lone Tree and A-telope, 1894; Bush, 1897; Davis Brothers, 1894; Lundquist, 1900; E. J. Boyd, 1889; E. J. Boyd, 1903; Jackson Brown, 1877; Payne, 1885; Diana Brown, 1876; Cook, 1901. These are ditches out of Sand Creek and its tributaries.

JOHN BIDDICK, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

903 I lived on a ranch in Albany County in Section 4, Township 17, Range 74, for more than twenty years. I built the Biddick ditch in 1897.

904 It has irrigated 578 acres ever since I took out my ditch. Raised hay and some oats. I know the Oasis Ditch. It passes through part of my land. The land under that ditch has been irrigated over twenty years to my knowledge.

905 The land between the ditch and the river has been irrigated as long as I have known the ditch.

905 Cross-examination by Mr. Fred Farrar:

I own Sec. 4, Tp. 17 N., R. 74 W. and I own a quarter section in Sec. 10, the same township and range. All of Sec. 4 west or south of the river is irrigated from the Biddick ditch. It irrigates about 235 acres in Sec. 10. I own the northwest quarter and irrigate probably 75 acres. It was not irrigated this year, there wasn't any water in the ditch this year. They took it all from us. The river wasn't high enough to irrigate any. There was irrigation under the ditch last year. The lands owned by others were also irrigated last year. In Sec. 11 there are 120 acres irrigated by this ditch. There was irrigation under the ditch in 1911. During 1910 I was irrigating my land. My land was irrigated in 1910, '11 and '12, but

907 the others, I could not say much about. They had a little water in Sec. 4 and this quarter I had. I had water on that but the other I didn't turn any water on. The Oasis ranch is on Sec. 11, a part of which was irrigated from this ditch. No one is living on Sec. 10. In 1911 Dutton irrigated lands on Sec. 11 from the Biddick ditch. Those lands were not irrigated in 1912.

I have 10 or 12 acres in my field, I cut hay on. The other parties

under this ditch didn't cut any hay, they used it for pasture. No oats were raised under this ditch this year, or in 1912. In 1911 I had about 60 acres.

Most of the 578 acres under the Biddick ditch is not cultivated, it is irrigated for pasture. I cut hay on part of mine, had the 60 acres in oats and what was outside of that in pasture. I didn't raise anything in 1913.

I am in the stock business. My cattle range between the Big Laramie and the Little Laramie rivers. I have got quite a bunch of cattle. I have horses. I cut hay this year but not on this
909 place. We cut a little hay in 1911, just 5 or 6 acres. My land is largely pasture and has been during the past few years, we have been short of water, that is the reason.

Cross-examination by Mr. Delph E. Carpenter:

I don't know who took my water this summer. In 1912 there wasn't any water then worth mentioning. In 1911 we had a
910 little water. The headgate of my ditch is 4 or 5 miles above the junction of the Big and the Little Laramie rivers. No water comes into Big Laramie between my headgate and mouth of Little Laramie. My ditch is about 5 feet wide. It carries water from 2 to 3 feet deep. I have a rock dam.

I cannot take water through my ditch when the water is as low as it was in 1913. In 1912 it was pretty low. I have the principal use for this water in the Spring as early as possible. That is the time to irrigate meadows. For grain we don't need it until later. If I have water in June and the latter part of May I can get along and get a pretty fair hay crop. That is not early enough to irrigate for hay. No ditches take water between me and mouth of Little Laramie river.

911 It is surprising that I could not get water when the State Engineer's records of Wyoming show that in 1911 there was as high as 500 to 700 cubic feet passing my gate during June and in 1912 as high as 1,287 cubic feet. I have been devoting most of my time to looking after my cattle.

I don't know that I have found farming a failure. If I have got to be plain with it I don't think much of the country in this part as farming country. I have seen better stock countries than this, but it is pretty fair. I cannot tell you why this is not a farming country. I went there in 1893 and took the ditch out in 1897. I was handling cattle then. I have been in that business ever since. I got the first water in my ditch in 1898 and had plenty of it too. I have been irrigating ever since, when I could get water.
912 If I had a dam so I could take all the water that came down I could irrigate every year, but we can't take it all. We have to divide it up.

The Haley lands in Sections 10 and 11 irrigated from my ditch, I gave them half for allowing me to go through their land. I suppose I only own a half interest in the ditch. Since I have
913 been down there I have seen one stack of hay on the Haley place at different times, a good sized stack. Outside of the little land that Haley cut over the rest has been used for pasture.

I lease land on the other side of the river for my cattle. I refer to the Talmadge-Buntin Company, lands they sold to eastern people. I have not been over each quarter section under the Oasis ditch. I have seen the water running over the land. I have seen the water turned out of the Oasis ditch and running over toward the river, the land was pretty near all under water wherever it could, a foot deep. There was a whole lot of flat land that runs right over towards the river. Over around the bend, north of the hill, on what
914 we call the north valley in Tp. 18, there is a flat there covering a good many sections, I suppose, that flat was quite a good smooth piece of land in there to be irrigated. The ditch runs along the east edge. They raise lots of hay by this irrigation. Quite a lot of hay was cut along the ditch and along the river. Of course they haven't been irrigating it very strong the last year or two, but Haley put up a pile of hay when he had the land. I could not tell you whether he irrigated all the land, but it was supposed to be all under water. I rode through that bottom different times in several springs and it was just flooded. There was a pile
915 of hay as far down as the railroad.

The Biddick ditch is about 3 miles long.

S. C. DOWNEY, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

I am a little past forty years of age and was born in Laramie, Albany County. Stephen W. Downey was my father. He was one of the organizers and was a director of Pioneer Canal until
916 his death. The most of the time Secretary. Pioneer Canal was organized in 1878 and constructed in the fall of 1878 and the spring of 1879. Then it was enlarged in the fall of 1884 and spring of 1885. In 1909 or 1910 it was again enlarged from the headgate down to the Sodergreen Reservoir. The last enlargement was part of Lake Hattie system and afterwards the Laramie Water Company. The capacity of the canal has not been enlarged at any time except by the enlargement made in '84 and '85 and the enlargement spoken of in 1909.

917 The ditch as originally constructed in 1878 carried more than one-third the capacity of the present Pioneer Canal. The original capacity was 140 cubic feet to the second. Pioneer Canal has been used for irrigation of lands under it from 1879 to the present time. After my father's death I was Secretary of the Canal Company and one of the directors and a member of the Executive Committee until May, 1909. My father died in August, 1902. After the enlargement in '84 a survey was made at once by by Mr. George A. d'Hemecourt. In the summer of '85 George G. Anderson, a civil engineer, went over the work and made a report on the High Line Canal and various reservoir sites. After that Mr. Loback in 1889 made surveys and maps; after that, in 1890, '91, '92 and '93 W. O. Owen, a civil engineer, and Charles Bellamy made a number of surveys.

918 The company was in financial difficulties and rather at a stand-still until 1906, '07 and '08, when Mr. H. N. Roach and R. D. Stewart made surveys and maps. The final surveys of Roach and Stewart were made in the fall of 1908. The stock was transferred in May, 1908, and the construction started on the present system. These surveys, examinations and reports covered in a general way, with small variations, just about what is known as the Lake Hattie or Laramie Water Company's irrigation system at the present time. One survey covered the present line of the North Canal of the Laramie Water Company, another came down through the canal as they have it constructed now, another one came out of the Sodergreen Reservoir and ran south practically taking the place of the South Canal, using another reservoir. The idea always was to use Lake Hattie for a reservoir as they have at the present time. One of these surveys followed the present Pioneer Canal High Line. The Wyoming Central Land & Improvement Company in 1884 purchased the stock of the Pioneer Canal Company.

919 The Wyoming Central owned the railroad land lying on the Laramie Plains between the river and other tracts and they undertook to construct the reservoirs and ditches as I have indicated. They sold the land to different purchasers from their incorporation until about 1891 or '92, when the hard times threw the land back onto their hands and the company was unable to keep up payments to the railroad, and in the fall of '94 the Union Pacific went into the hands of Receivers and suits were commenced against the Wyoming Central and the property was tied up in litigation until the spring of '99, when it was settled and adjusted, the Railroad Company taking back the title to most of the lands and afterwards selling them out to various people up till 1907.

920 The stock of the Pioneer Canal Company was sold to Mr. Mullin and Mr. Ryan. The same people were the owners of The Laramie Water Company system. The Pioneer Canal was then merged into the Lake Hattie system and all these interests have been united in the one company, the Laramie Water Company.

S. C. DOWNEY.

Cross-examination by Mr. Fred Farrar:

920 Born in Laramie, Wyoming. Forty years of age. Was 5 years of age when Pioneer canal company was organized in 1878. When I testified to the construction of the canal in 1878 or '79 I was not testifying from my own knowledge. When I testified concerning the enlargement made in '84 or '85 was testifying partly from my own knowledge. Was around the office and out on the work with my uncle. The evidence given up to the time
921 of my own personal knowledge is from old records and minute books of the Wyoming Central Land and Improvement Company and The Pioneer Canal Company, original contracts, original reports, original maps, and some of it from conversations with people who were there. Mr. Corthell has those things, I turned them over to him. I am a member of the bar. The testimony which

I gave relative to various examinations and surveys is based some on knowledge and some on the files of the company. I know personally that Mr. d'Hemecourt was doing that work out on the Pioneer canal. I also know of the surveys of Loback, that he was making those surveys and also the surveys of Owen and Ballamy. Of course the latter surveys of Roach and Stewart I personally know about because I had the work done.

The Roach and Stewart surveys were made in 1906, '7 and '8. Stewart was consulting engineer with Roach. I don't believe he did any actual field work. Stewart went over the work with Roach and Roach ran the levels and the lines and Stewart would assist in picking out the best lines.

922 The sale of stock of the Pioneer Canal Company that I mentioned as having been made to the same parties that constitute the Laramie Water Company, was not to the Laramie Water Company. The Laramie Water Company was not organized then. That sale was in May, 1909. While I say it was sold to the people who represented the Laramie Water Company, they were promoters of the Lake Hattie Company and the Laramie Water Company, and I suppose they are the owners. At any rate they were the people promoting the present scheme. Mr. H. N. Roach was formerly county surveyor.

Financial difficulties of the Wyoming Central Land and Improvement Company and trouble with the Union Pacific Railroad Company prevented them from completing their scheme. Part of the lands included in their project reverted to the Railroad Company. Most of the land lying under the Pioneer Canal, or a good part of it, did not revert. Practically all of the land that lays above

923 the Pioneer Canal, until you come to the land that is irrigated from the Little Laramie river, reverted to the Railroad Company. Those are part of the lands that are now included in the Laramie Water Company's system, with a good deal more land. These lands were later sold by the railroad to various persons. The most of it was sold before 1908 to different purchasers. It was sold to a great number of purchasers, from one section up to a township, that is, the railroad land in a township, 18 sections.

I have no personal knowledge of original capacity of Pioneer canal, except from the original contracts for the constr-ction of the canal. I was secretary of the canal after the death of my father in 1902, until the transfer of the stock. The only connection I had with the company prior, was that I was in my father's office from 1895 and attended practically to work of the canal and also of the Wyoming Central Land and Improvement Company.

I know Mr. Sevison. I know he worked for the Arnold Engineering Company, but I thought it was after the original surveys were completed. I know Lyman Bishop. From the time that I was secretary of the company in 1909, I am not familiar with who did their work or what contracts were entered into. The Wyoming Central Land and Improvement Company contracted to purchase from the Union Pacific Railroad about 600,000 acres in Albany county and the east part of Carbon county inside the railroad limits. That is

within the grant made to the Union Pacific by the Govern-
925 ment. The grant was for every other section for a distance of 20 miles on each side of the railroad. There were two other large purchases of railroad lands besides that of the Wyoming Central Land and Improvement Company. They were the Two-Bar or Swan Land and Cattle Company and what is known as the Gilchrist-Plunket, afterwards known as the Boughton or Iron Mountain ranch. The Wyoming Central contract included the railroad lands to the south of the city of Laramie and down to the Colorado line. It extended in an irregular shape north of Laramie on the east side of the river to the line betwen townships 20 and 21, then north and west to 20 and 22 and over into Carbon county. It was about 60 miles long north and south. When the Wyoming Central
926 Company settled with the Union Pacific Railroad in 1899 these lands with small exceptions reverted to the railroad. About half of the land reverted. The other half had been sold to settlers before the law suit with the Railroad Company. In a few instances the Railroad Company assumed the contracts or rather issued now contracts to the people that had applications into the company, but it was only to a very small extent. The lands that reverted were scattered east of Laramie in small holdings, some in the south part of Albany county, and a strip along the Big Laramie River from Laramie up. A part of those lands were under the canal as then constructed. A large block of land including down the Big Laramie and up the Little Laramie and from the Little Laramie over toward Rock Creek. Quite a number of contracts were still standing that had been partly paid. The company kept those. We paid the Railroad Company and got a deed for those lands in the settle-
927 ment. All the lands between the Pioneer canal and the Little Laramie Valley, except a strip along the Little Laramie and Big Laramie and under the Pioneer canal and also a few sections of land known as the Bufort land, which lay practically west of Laramie, reverted. The Buford lands had been a military reservation. They joined on the west. After the enlargment of the Pioneer canal in 1884 and 1885 it was the same length, practically, as the old canal. The enlargement of 1884 and 1885 consisted of putting in a larger headgate and increasing the width and depth of the canal. I have not been able to find the map which I mentioned had been prepared by d'Hemecourt in 1884. It is on file in the United States Land Offices at Cheyenne and Washington.

The records of the company show it was a complete survey. It consisted of a line running over to the reservoir near Lake Hattie, what was then known as the High Line canal on the north side of the Laramie, Big Basin and laterals down through the Basin. I don't know which survey Mr. d'Hemecourt used. There were two surveys made, one coming out a mile or so above the present headgate of the Pioneer canal and running practically due northwest to Lake Hattie and dropping into Lake Hattie and extending on around on the rim of the basin were laterals coming out of Lake Hattie. There was another survey made that comes out of the Pioneer canal and Sodergreen reservoir and practically follows the same line, not so high, at

least not as high as Lake Hattie The survey was completed as to grades.

The ditch was not built on that survey. It was used more or less with other surveys made afterwards. The Pioneer Canal Company, through their agent, the Wyoming Central, made the other
929 survey. The Wyoming Central Land and Improvement Company made this survey for the Pioneer canal. The companies were practically the same. The Wyoming Central acquired the Pioneer Canal in 1884. At that time 803 shares of the stock of the Pioneer Canal Company had been issued. Out of a total of 1,000 shares. The total capitalization of the company was $10,000. The Wyoming Central paid par for this stock. The Pioneer canal paid a portion of its indebtedness by stock. I don't know whether or not the stock went in on that account at 50 per cent of its par value. After looking up my records I find that the survey which I mentioned as having been made by George G. Anderson must have been made in 1890, instead of 1885. That survey was independent from the survey made by d'Hemecourt, he used the d'Hemecourt survey though. I am not able to produce a plat of the survey made by Mr. Anderson, I don't believe one was ever made. I am unable to produce a plat of the survey made by Mr. Loback. The Anderson and Loback surveys were never filed for record to my knowledge. The Anderson
930 and Loback surveys were also for the general system termed the High Line.

The ditch was not constructed under the Anderson survey or the Loback survey. The Owen survey was made in 1890 and the Bellamy survey somewhere between 1890 and 1893. Owen's survey was in December, 1891, and Mr. Bellamy's was in 1892 or '3. I was able to find a plat of the Owen survey.

(Plat marked defendants' exhibit 16.)

Defendants' exhibit 16 is the map of the Owen survey.

I now hand you a plat of the Bellamy survey.

(Plat marked defendants' exhibit 17.)

Defendants' exhibit 17 is the map of the Bellamy survey. It was made by Charles Bellamy.

931 Admitted by counsel for Wyoming, Mr. Corthell, that Mr. Bellamy is the same man who testified in this case.

The ditch was not constructed under the Owen survey. It was not constructed under the Bellamy survey. The Wyoming Central Land and Improvement Company authorized the Owen survey for the Pioneer canal. The same people authorized the Bellamy survey. This company had four distinct surveys made at different times in this proposed project. The last of these four was the Bellamy survey in 1893. The next surveys were made by H. N. Roach and R. D. Stewart in 1906, '7 and '8. In 1909 surveys were made. The
932 Roach and Stewart surveys were made for the Pioneer Canal Company. These surveys were for a line similar to the Bellamy survey, figuring a High Line canal using different reservoirs

and the south line. They were separate and distinct surveys. They were working in the field at different times during the three years on that work, not continually. These surveys were for what each surveyor termed a high line canal. Part of the canal has been constructed, the part from the river to Lake Hattie reservoir, and from Lake Hattie reservoir on east, they call the Stewart canal the North canal. It runs out of Lake Hattie and along the north part of the Big Hollow, down towards the northeast, toward the Laramie river. In a very general way I am familiar with the lines of this canal. Mr. Roach ran a line out of Lake Hattie down in that direction. I don't know who made any surveys after 1909.

933 The ditch was not built in 1909. Comparing the maps showing the Owen survey, marked Defendants' Exhibit 16, and the Bellamy survey, marked Exhibit 17, and eliminating the Pioneer canal then constructed, the headgate of the proposed High Line canal, was considerably further up the river than the headgate marked on the Bellamy map. The ditch was never constructed from head of this proposed canal as shown by Owen survey. The head of proposed canal, according to the Owen survey, is on the west bank of the Laramie river on the south line of Sec. 2, Tp. 13 N., R. 77 W. The head of the proposed canal under the Bellamy survey was on the west bank of the Laramie river near the quarter corner of Sec. 35, Tp. 14, N., R. 77 W. The line of the Owen survey runs through the east tier of sections in Tp. 14 R. 77. The Bellamy ditch runs through three south sections and then swings east around a hog back. On the map of the Owen survey Lake Hattie is located on the wrong section. The survey shows that both of them

934 would run to the west of Lake Hattie. Assuming that the Lake Hattie location is differently shown upon the two maps, there being approximately a mile difference in location, from Lake Hattie, on the Owen map the line runs through Sections 13, 14, 15, 16, 17 and 18, Tp. 15, R. 76, while in the Bellamy map it runs through about a mile north of that line, ending in Sec. 14, Tp. 15, R. 76, laterals run from Lake Hattie. The Bellamy map showing no laterals running east from Lake Hattie, while the Owen map shows two. The Owen line of the proposed canal continues on in a northeasterly direction until it lands down to within about four miles of Laramie, and there was a branch from that lateral on the township line between Tp. 15, R. 75 and 76, which ran north for 2 miles and northeast for a distance of from 6¾ to 7 miles.

The two lines do not coincide at every point unless it be immediately west of Lake Hattie. On the Bellamy map the proposed line of this canal is in ink. There appears what is apparently the line shown by the Owen survey traced in *in* a lead-pencil. The lead-pencil marks practically coincide with the Owen map. The proposed line as shown by the Bellamy survey is shown by a dotted ink line marked "High Line ditch in course of construction." There are no designations on the leadpencil line at all.

935 The Murphy-Collins ditch was taken out of the Big Laramie River on the west bank, the location of the headgate being

about a mile above the headgate of the present Pioneer canal. That Murphy-Collins ditch is now owned by Oscar Sodergreen. I understand that part of the Murphy-Collins ditch is the same as the Sodergreen.

The line of the proposed High Line ditch as shown by the Owen survey, Exhibit 16, was at or near Wood's Landing.

The present canal leading to Lake Hattie Reservoir does not follow the line of the survey as shown by these two exhibits, that is, the Bellamy or the Owen survey. I should say that some of the lines run very close together. The topography of the country would naturally throw them somewhat in the same location.

936 LARAMIE, WYOMING, September 25, 1913.

S. C. DOWNEY, examination cont'd.

Cross-examination (cont'd) by Mr. Fred Farrar:

I do not have any map of the Roach or Stewart surveys. I have no record of these surveys, Mr. Roach has them. I think, however, they generally follow the line of the Bellamy and Owen surveys.

I found a report made by Mr. G. A. d'Hemecourt. That
937 is the only report made on the d'Hemecourt survey that I know of. As to whether or not the d'Hemecourt survey was a preliminary one, the only thing I could find was a survey which was ordered completed sufficiently to hold the right of way over Government land. I understood it was a completed survey as the ditches were to be constructed after the cross-sectioning.

938 I can give the reason why the company did not build the High Line canal under the d'Hemecourt survey. The company was local and had invested all the money which could be raised locally. About 1888 times began to tighten and lots of people interested, particularly large holders consisting of Englishmen, were not able to pay out on their stock. Continually from the time of the organization of the company in 1885 the company tried to raise some money to build a system and was not able to finance the project either locally or through capital in England, France, Colorado or Kansas, and numerous other people. At different times there were probably some 10 or 12 different options, but no one was able to carry out any of these deals. When the Union Pacific Railroad company went into the hands of receivers it caused new complications, as they would not deed the land to the Wyoming Central on the old terms. Finally suit was started in the fall of 1894 by the railroad company to foreclose the vendors' lien. From then until the settlement of the suit in 1899 it was a practical impossibility to do anything. In 1899 a large part of the land reverted to the railroad company, which they sold out in small tracts and the company were not able to finance the proposition, until finally the Wyoming Central sold the stock of the Pioneer Canal Company to the present owners and the system was constructed. The hard times began to be felt here about 1888, but before that they were having these surveys made and trying to get in touch with capital. As I stated

before, the company was a local corporation and had invested all the money that could be raised here and could not assume any further liabilities than the purchase payments due on the land. Fifty per cent of the lands lying between the two rivers were Government, state and school lands. They were not in any wise affected by the contract between the Wyoming Central and the Union Pacific. I have produced what purports to be a report made by each of four surveyors, d'Hemecourt, Loback, Anderson and Owen. Each of these was an individual attempt to promote the scheme which
939 I have outlined. Each report is an engineer's prospectus, rather than a report on a definite survey basis. By that I would say it is a general report rather than a detailed report of the survey. By preliminary line I mean that they show a preliminary line in a general way, not reduced to detail and the general condition surrounding the whole situation. In each of these reports the High Line Canal is quite evidently located at different places and in each instance is a mere open canal without any difficulties of
940 construction. The High Line ditches, in any event, in order to irrigate lands situated at the higher levels than those irrigated by the Pioneer canal, would of necessity be limited in their location between the base of Sheep Mountain and Sodergreen Lake on the Pioneer canal, between the river and Sodergreen Lake. The western limitation of that land would be the base of Sheep Mountain. Right at the immediate toe of Sheep Mountain there is some broken land. Any competent engineer, in running any line for the irrigation by a higher line of ditch than the Pioneer canal, would be forced to place his line through the vicinity we have named, between Sodergreen Lake and the base of Sheep Mountain. The present inlet to Lake Hattie commences at Sodergreen Lake. The Murphy-Collins ditch was above the Pioneer. It has been abandoned for a number of years. The natural topography of the country around Lake Hattie is rather steep and broken.
941

On the topographic sheet for the Albany County Laramie quadrangle of the United States Geological Survey, edition of July, 1908, and particularly as to Tp. 14, R. 74, Creighton Lake and Hutton Lake are differently located than on the Wyoming Central Land and Improvement Company map. On the Wyoming Central map Hutton Lake is given as the more northerly of the two, Creighton being the southerly. On the U. S. Geological Survey Quadrangle mape Creighton Lake is given as the northerly lake and Hutton as the southerly. Hutton Lake is the more northerly one and is correctly set forth on the Wyoming Central map. Creighton lake is the southerly one. Those lakes, taken together, are generally known as Hutton Lakes.

Only $8,030 of the original $10,000 capital stock of the Pioneer Canal Company was paid for in full, 803 shares were issued. Some of the stock was paid for in cash and some in work and supplies. The stock was issued in payment of indebtedness. The original canal was not built out of that capital, there was $964.09 owed on the canal at the time the stock was purchased by the Wyoming Central Land and Improvement Company, which was paid by the company.

The Pioneer Canal Company was not a mutual company in the sense that the users of the water were the stockholders. At the time the company was taken over by the Wyoming Central there were 25 stockholders. Very few of these stockholders were users of water. The 25 include the stockholders whose stock stood in one man's name as trustee. I think there were not users of water other than the stockholders. When the transfer of the canal and properties
943 was made to the Wyoming Central Company all of the capital stock of the canal Company passed to the Wyoming Central, except 7 shares, which were held by different individuals so they could be trustees in the Pioneer Company. In 1885, '86 and '87 water was donated to different users under the canal free of charge. From that on 50 cents an acre was charged per year for water until the year 1910. It was raised either in 1910 or '11 to one dollar an acre, the present charge. There were a few contracts called water deeds issued to some six water users of the canal so they could prove up on desert claims, which provided that they had a right to purchase water at not to exceed a dollar an acre, as fixed by the Board of County Commissioners. But the same became forfeited by non-user for two years. I find a record that Mr. Stewart was paid $250 Jan. 6, 1906, and I think he was paid some in addition to that. Mr. Roach was paid $750 in one warrant April, 1906. The min-
944 utes of the meeting of the board of trustees of the Wyoming Central Land and Improvement Company of October 11, 1892, show this statement: "The matter of enlarging the Pioneer canal from the headgate to where the proposed high line extension is to be taken out was discussed, and it was the sense of the meeting that nothing be done in the matter at present." The minutes do not show any other minute of an action on this project subsequent to that date, except those which I have just mentioned, that is, the payment to Stewart and the order given to Roach, except in relation to the sale of the canal, and by that means finance another company to construct the same. From 1892 until 1899 the company was involved in litigation and was not able to do anything. Numerous attempts were made to sell the Pioneer canal. These were continued from about 1886 until the sale was made in May, 1909. The canal was not a financial success from the stockholders' standpoint. According to the financial statement for the year, beginning July 31, 1897, to July 31, 1898, the total amount received for the use of water from the canal was $365.70, the reason for that was at that time we were having the suit with the Railroad Company and did not dare to enter into any contracts for water. The people wanted contracts for the water to prove upon Government land and they were afraid to execute any more. The people wanted water deeds or water certificates. Practically the only source of revenue from the canal was from the rent of water. The canal as an entity had no other source of revenue than the sale or rent of water. From about 1900 the water rent increased very materially. From 1897 the revenues of the canal from the rent of water were very small. The revenues were small during the years of 1898 and 1899, but as soon as the suit with the Railroad Company was settled the rents increased materially.

The receipts for the year 1908 were $1,938.25. That was
946 obtained from water rents, but did not include a large amount of water which was used by the Wyoming Central Land and Improvement Company, for which no credit was taken, amounting to about $1,500 more.

Cross-examination by Mr. Delph E. Carpenter:

The Wyoming Central Land and Improvement Company reserved from sale, during the eighties the land within 2 to 5 miles of Laramie, on account of competitions over the Ft. Buford reservation. That was not the same as the Fort Sanders reservation. There were three reservations. It was first known as the Fort Buford reservation, then as Fort Sanders and then cut down again and known as Fort Sanders reservation. The later Fort Sanders reservation was a smaller area than originally included in the Fort Buford reservation. When the company first organized for the first two or three years this land was sold. The Government then refused to pass title, claiming the railroad had none and it was 4 or 5 years after that before the Government passed the title. The Government conveyed directly to the company on payment of $2.50 an acre. After 1885 the
947 company offered water from the Pioneer canal free for the first year to anyone that would use the water and then afterwards purchase it, and it was given free during the years 1885, '86 and '87 to all users. After that it was the practice of the company to allow free use of the water for the first year to encourage settlers. Any settler under the canal on land purchased from the railroad or Government had the benefit of this policy. It held up until some time about 1895 or '96.

S. C. DOWNEY, a witness in behalf of the Complainant.

Redirect examination by Mr. Clark:

947 After the sale of lands that could be sold to different purchasers the Wyoming Central tried to sell the lands in large blocks with the pioneer Canal, especially the lands lying between the two Laramies. Numerous options were given, one to John W. Hoyt, Ex-Governor of Wyoming, in 1885; in 1885 and '86 one to Robert Marsh, through English capital; one in July, 1889 to J. Douglas-Willan; one in January, 1890 to John Hess and John H. Poole; one in June, 1890, to John H. Poole and Samuel Lessen; two options to E. H. Salltiel and F. J. Stanton in 1895 and 1896; one to Carter-Adams in 1886; one to A. A. Johnson in 1892 and 1893; one to C. E. Wantland, and a man named Blitz and N. O. Bryant, in 1887.

948 The proposed High Line of the Pioneer Canal Company takes the place practically of the Stewart Canal. The South Canal takes the place of two canals running out of Lake Hattie, as shown on the W. O. Owen map, Defendant's Exhibit 16. I furnished all these records, reports and maps to counsel for defendants upon

their request and went over them with them at considerable length.

949 Work was started on the system and a lot of work done in 1909, when the stock was transferred to the new purchaser and the contract was let and the work continued.

949 Recross-examination by Mr. Fred Farrar:

An option was granted August 7, 1886 to J. M. Munford and George A. Starbird, of Longmont, Colorado, in which the land was offered between the Laramies for $4.25 an acre with the canal, and $3.50 without the canal. January 7, 1893, an option was given to A. A. Johnson for $3.50 per acre to include the canal. That option covered all the land between the two rivers, subject to the reservation by the company selling any small tracts. I think there were no options given as low as $2 an acre, except back early in 1885 or 1886, they might have given some for $2. None of these options were exercised by the person or persons to whom they were given. In no event was the option fulfilled by a sale.

950 I stated that in my testimony I confused the north canal of Lake Hattie system with the line of the proposed Stewart canal. The Stewart canal was never built. If built it would take water from the Little Laramie as well as from Lake Hattie.

An option was given by The Wyoming Central Company June 23, 1890, at $3.50 an acre, 1/5 cash and the balance in 4 equal payments, with interest at 6 per cent. That option was given on the lands between the Big and Little Laramie rivers, comprising about 65,000 acres, and included the canal.

Recross-examination by Mr. Delph E. Carpenter:

Ayres of New York published a number of ads for the sale of land in small tracts. The company has prospectuses published and mailed all over the country, but it did not accomplish anything.

THORNTON BIGGS, a witness in behalf of Complainant.

Direct examination by Mr. Corthell:

951 Have lived in Albany County about sixteen years. Live on the old Milbrook Ranch. Know the Oasis Ditch on the Laramie River which formerly belonged to Haley Live Stock Company. I was employed by that company 15 or 16 years. Left the ranch six years ago.

952 Had knowledge of the irrigation under the Oasis Ditch. All the irrigated land under that ditch was irrigated during the time I worked there. That includes all the land under the ditch, all the meadow part. I cut hay there every year off and on for six years. Every foot of the land lying between the ditch and the river down to the Ghost Ranch was irrigated for hay and pasture. The company run 5,000 or 6,000 head of cattle. That continued for 15 or 16 years that I worked there.

953 I was foreman of this cattle and the irrigation during that time. Rankin was head foreman on the ranch.

953 THORNTON BIGGS.

Cross-examination by Mr. Delph E. Carpenter:

They probably put up on the whole land there 1,500 or 1,600 tons of hay. We never measured any only what we baled. They fed most of it to stock.

We did not run cattle on this ranch during the summer. We ran the big part of them northwest of the ranch and they ran quite a number of them in about Muddy Springs. We sorted these cattle and fed hay to the weak during the winter. We weaned the calves towards the first of the year and fed them. The cows were sorted and the strong allowed to rustle, while we fed hay to the weak.

954 Fat cattle we ran separately. We kept them on pasture and maybe along toward spring we would give them all a little hay. Some years we did not cut quite as much hay as I have mentioned. A considerable part of this land under the Oasis ditch was not cut over. Take it in one of these valleys there might be 15 or 20 acres under that ditch we didn't cut, cut around. We just cut the heaviest hay. I could not tell how many thousand acres we cut to get this amount of hay, quite a number. Together with myself, we ran 4 or 5 men when irrigating.

955 Cross-examination by Mr. Fred Farrar:

When the men were not irrigating or putting up the hay they were fixing fences that were down and doing a little cropping. There were certain times in the spring when it took probably 7 or 8 men to handle these cattle, then we would get the cattle located and they dropped out and we cut down on these riders to do the irrigating and fencing and one thing and another. We cowboys had to be ranch hands as well as cow men. We took them all out of the saddle and put them in the hay fields for maybe two or three weeks.

Cross-examination by Mr. Delph E. Carpenter:

We commenced haying along in July and August, and finished up in September. We turned the water off of the meadow right after July 4. That was the usual custom.

THORNTON BIGGS.

Redirect examination by Mr. N. E. Corthell:

956 I think this Haley Live Stock Ranch has been cut up into small tracts and sold. It was a very large ranch, consisting of many thousands of acres.

WILLIAM J. COWAN, a witness in behalf of complainant.

Direct examination by Mr. N. E. Corthell:

956 I have lived on the Little Laramie since 1878; engaged in the ranching business.

957 I know the Haley Live Stock lands on the Laramie and the Oasis Ditch. I was employed on that property in 1900 or 1901, irrigating and looking after the stock. Was foreman of the ranch from the first of April until the following November. We tried to get water over nearly all the lands between the Oasis Ditch and the Laramie River. There would be a few high places that the water would run around. I suppose these places were sub-irrigated to some extent by the water running around. There wouldn't be a good deal of land in these high places.

958 Probably 40 to 50 acres out of a section. Mr. Bellamy laid out laterals and I helped build them, to distribute the water. We raised oats, barley, potatoes and native hay. It was a stock ranch.

958 WILLIAM J. COWAN.

Cross-examination by Mr. Delph E. Carpenter:

We had 50 or 60 acres of oats that year. They were located on the Little Laramie at the Home ranch, the old Wyoming ranch. After they put in the new road they abandoned that ranch.

959 The oats were irrigated from the Little Laramie. They were not under the Oasis ditch. The barley was right adjoining. That was irrigated from the Little Laramie too. I would say there were 6 or 8 acres. We cut the oats. I think they yielded about 800 bushels. I don't remember how much barley there was. The potatoes were raised adjoining the barley. They were irrigated from the Little Laramie. About 3 acres. I do not remember the yield, a very good crop. During the year that I was there there was nothing but native hay raised under the Oasis ditch. We had

960 a good crop, but we didn't measure the hay. Mr. Haley fed it to his own stock. We started at upper end of Oasis ranch and put up hay to the Diamond ranch. Below the Oasis was the Waters ranch, then the Red or McGibbons ranch and then the Ghost ranch. We cut hay here and there under the canal from the head to the lower end down near the Ghost ranch, and below the Ghost ranch. The Ghost Ranch cut 500 or 600 tons. The Ghost ranch was irrigated from the Oasis ditch, all on the east side of the river was certainly irrigated by that ditch. It belonged to Mr. Haley. I notice

961 that on the map attached to the answer of the defendants in this case showing the Oasis ditch and the Little and the Big Laramie rivers at their junction in Tp. 17 N., R. 74 W., that the Oasis ditch runs almost north until it gets pretty close to where Wyoming station appears on the map and then swings abruptly to the west and runs 5 or 6 miles. The Oasis ranch included that land under the ditch, from its head down not quite to the junction of the

Two Rivers, there is another small ranch that runs across the ditch,—the Biddick ranch. Mr. Biddick owns land on the north side of the river. Mr. Biddick's ranch was the west boundary of the Oasis ranch proper. The lands in Tp. 18, R. 74, on the
962 north side of this hill, were very good, but it was not such a body of it together. It was not spotted, but it was a longer distance. The meadows at this time extend from the ditch almost to the river. The water from the canal, these laterals I spoke of about a moment ago, were taken out to distribute the water. There is more meadow on that tract of land now than in 1901. It increases from year to year. We had a camp on the Waters place. That
963 belonged to Haley. Then we moved to the Ghost ranch and finished haying at that place, and we cut considerable hay all the way down. Some of the hay would go half a ton and some considerable more, better than a ton. It would go from a ton down to grass that wasn't worth cutting over the meadows. We considered real good that hay which would run from half a ton to a ton and a quarter or ton and a half was very good.

The cattle of which I spoke were run partly in the Black Hills region west of the Laramie River, partly toward James Lake and some would run in pastures on the west side of the river, in two large pastures and then what we called the north pasture, we had some cattle in there. On the east side of the ranch above the canal on the grazing land we had some cattle in the summer time. We used this hay in winter to take care of the milch cows, weaning calves and stock that we were obliged to feed. I was there with Mr. Haley several times, visited there. They baled quite an amount of
964 this hay and shipped it. The water had been distributed there before the laterals were run, but they took out these laterals. This work was done to bring more land under irrigation and to distribute the water.

Cross-examination by Mr. Fred Farrar:

I worked there from April to along in November. The Ghost ranch is still kept up, also the Oasis ranch. All of the ranches have been kept up to the best of my knowledge, or were at that time.
965 I would say the other ranches have been kept up as well as the Ghost ranch. They are farming the Ghost ranch.

WILLIAM J. COWAN.

Redirect examination by Mr. Corthell:

965 The Cooper Lake Ranch on the west side of the river was irrigated from the Big dam on the river and we cut hay there.

Recross-examination by Mr. Delph E. Carpenter:

We cut hay under the Cooper Lake ditch, 300 tons, perhaps more. I put up hay there with Mr. Haley's force, the land was under my jurisdiction the same as the land under the Oasis ditch. The hay I cut that year under the Cooper Lake ditch was all that was cut there by anybody. That was all native hay.

H. N. ROACH, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

966 I know the location of the projected canal of the Laramie Water Company known as the Pioneer High Line. I helped make a survey for a ditch corresponding to that canal in 1897 and 1898. W. O. Owen was the engineer in charge of that survey.

967 In 1908 I next made a survey there. The lines of the ditch surveyed on these two occasions were very close to the same lines as the present location of the projected Pioneer High Line. My surveys were made for the Wyoming Central. I know the location of the North Canal of the Laramie Water Company. In 1906 I made a survey for a canal along that route.

968 We started August 9, 1906. I made that survey for the Wyoming Central. Started from the Pioneer Canal and extended the survey 15 to 18 miles. The survey left the Pioneer Canal in Section 31, Township 15, Range 75.

968 H. N. ROACH.

Cross-examination by Mr. Fred Farrar:

I assisted Mr. Owen in running the line in 1897 or '98 for the proposed High Line. There is a map in existence. Mr. Owen made a plat of the proposed high line previously. We started along

969 for the first mile and a half, maybe two miles, and followed the old original survey. We diverted from it at certain places. My recollection is there were a few cuts and fills they were trying to cut out. There were stakes set on the original Owen line. It is not a preliminary survey. I left the Pioneer canal with my line in 1897 and '8. My recollection is they come out along above what we call the Sodergreen lake now. I think the second Owen survey was made to change the expense of the original survey.

970 We followed the original line very close outside of a few places where there was a heavy cut or a fill. I would say our second survey was really a more detailed survey of the original. I could not tell you whether the situation was improved.

I ran a line of my own in September, 1908. That was also for a high line. I have a plat of the survey. I have made contours every 5 feet on that line up there and made a map of it. I left the canal in Sec. 30, Tp. 14, R. 76. I made two or three surveys. One to start out at the river and run on the west side of the hill that lays between that and Sodergreen Lake, and then I started from the lake and ran around. That survey was made for the Wyoming Central Land and Improvement Company. I think at that time R. G. Stewart

971 was consulting engineer for the Wyoming Central Land and Improvement Company and I had orders, either from him or Mr. Corthell to go out there and start at one or two places and run a line.

I ran a line independent of any other survey. Mr. Stewart was consulting engineer and co-operated with me to a certain extent. He

made a survey out there. I did not run across any surveys
972 being made at that time by the Arnold Company or their representatives. Neither by the Goldsborough Companies to my knowledge. I consumed about six days in the field in making this survey in 1908. Mr. Corthell and I had a dispute as to who got the map or plat of this survey. I do not know what became of it. I still have the field notes. My survey of what I call the Peggy Askins ditch was taken out of the line of Pioneer canal somewhere close to 6 miles below the Sodergreen Lake. I do not have a map of
973 that survey or a sketch of it. I did not make one. I have my field notes. That was also made for the Wyoming Central Land and Improvement Company.

I am not able at this time to give, except in a general way, the line of my survey. I know it followed practically the same line as the present north canal. I have not been able to give a definite location of my old High Line survey. I ran 3 or 4 miles out of the Pioneer canal. I then passed in a general northeasterly direction around to the west of the natural basin known as Lake Hattie. Then I swung off to the east. No canal has been built following the line of that survey.

974 If the Lake Hattie supply canal is correctly shown upon the map attached to the defendant's answer, then my line was different. We started at several places from the Pioneer
975 canal. I did not tie to anything there, everything was done with angles. I tied to section corner in 36. The present Lake Hattie Supply canal was built very close to one of my surveys. It was not built from my survey.

I ran along the line of the old Collins-Murphy ditch in a preliminary way. I found it impracticable, the cost was too great. Construction work was done at one time upon the Murphy-Collins ditch. When I got over with it I was sick and disgusted with it. There was never any irrigation from the old Collins-Murphy ditch.

976 Cross-examination by Mr. Delph E. Carpenter:

The difference between the North Canal of the Laramie Water Company and the Peggy Askins Ditch, that I surveyed, is that the North canal comes out of the reservoir. The Peggy Askins ditch came out of the Pioneer canal. The north canal was built and the Peggy Askins was not.

R. D. Stewart, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

977 I am a civil engineer, residing at Laramie, Wyoming, since April, 1902. I know the location of the Robertson-McConnell Reservoir on the Colorado-Wyoming line on the Laramie River.

I made a survey in a way for a reservoir on that site and located a site for a dam. There is a canon at the lower end of the reservoir and the proposed dam was to be located at the upper end. Above that the valley widens out from a half to three-fourths of a mile and

extending for 5 or 6 miles, crossing the Colorado-Wyoming line. I made my report December 15, 1905. The survey and observations were made three weeks to a month before that time. The survey was made for the Laramie Commercial Club.

978 In a general way I know the North Canal of the Laramie Water Company. At one time I made a survey for a ditch along approximately the same line as that occupied by the North Canal. Was consulting engineer of Mr. Roach of the Pioneer Canal Company. From the Sodergreen Lake to where their North Canal empties into Lake Hattie my survey was on virtually the same line as the Supply Canal. The survey leading out of Sodergreen Lake and over the present Supply Canal was made during the summer of 1906.

979 R. D. STEWART.

Cross-examination by Mr. Delph E. Carpenter:

The Robertson-McConnell Reservoir has never been constructed.

NELLIS E. CORTHELL, a witness in behalf of Complainant.

Direct examination:

979 I was chairman of the committee of the Laramie Commercial Club in 1905 which procured Mr. Stewart to make the survey of the reservoir site designated as the Robertson-McConnell reservoir, which was then known as the Boswell reservoir. When Mr. Stewart's report was received I kept it on file for a time, and as soon as I learned of the work the promoters of the Lake Hattie or Laramie Water Company project were doing included the Robertson-McConnell site I turned over to them this report and all the data the committee had for such use as they might be able to make of it.

980 Mr. NELLIS E. CORTHELL.

Cross-examination by Mr. Delph E. Carpenter:

I turned this over to these other people I think some time in the year 1908. I delivered it either to Mr. Talmadge or Mr. Buntin. It may have been to Colonel F. W. Bowen. I think the Commercial Club paid Mr. Stewart in the neighborhood of $200 for this one piece of work. That was the only work he did for the Commercial Club.

(End of Transcript Vol. 2, Complainant.)

R. I. MEEKER.

Direct examination by Mr. N. E. Corthell:

982 I examined in the field the total area irrigated from the Little Laramie River from the head of the valley down to Two Rivers, including the irrigation from Seven Mile Creek and from Four Mile Creek. Four Mile is a tributary of the Laramie

River and Seven Mile is a tributary of James Lake. The
983 outlet from James Lake is an artificial canal, and from that into the distributing system. In 1913 45,899 acres were irrigated from the Little Laramie River, 1,527 acres from Seven Mile Creek and 918 acres from Four Mile Creek, aggregating, the three sources, 48,344.

The drainage basin of Seven Mile Creek is within the General drainage area of the Laramie River shown on Exhibit A attached to the Bill of Complaint. The chief crop on these irrigated lands is native hay, a considerable acreage of oats, some alfalfa, a little barley, a little flax and some garden truck. There is a large acreage of irrigated pasture. The irrigation on the Little Laramie alone is 25,104 acres meadow, 18,550 acres pasture, 1,925 acres oats, 300 acres alfalfa, 20 acres flax.

984 The irrigation on Seven Mile is 1,237 acres meadow and 290 acres pasture; on Four Mile, 501 acres meadow, 417 acres pasture. All the irrigation of which I have spoken appears to be of long standing. I found evidence of additional lands irrigated in previous years, and not irrigated in 1913. The hay crop on these areas was very good, the oat crop good, and the pasture very good generally.

I know the location of the gauging station on the Little Laramie called Two-Rivers. It is below these lands at the lower end of them.

985 Cross-examination by Mr. Delph E. Carpenter:

I stated that Seven Mile Creek is not a natural tributary of the Laramie River. I have been informed that the water never ran over the embankment of the natural depression of James Lake. The water that used to go into Lake James evaporated and probably some of it seeped away. Most of it evidently evaporated. All it required to make use of the water that had previously wasted away was the cutting of an aperture through the natural embankment. The cut was approximately 17 or 18 feet in depth below the deepest point in the natural rim, and it gradually tapered out. It was about 1,300 or 1,400 feet in length [illegible], the construction of this cut the waters from Seven Mile Creek, which had previously been allowed to evaporate or go to waste, were utilized for the reclamation of lands. If the reservoir outlet apparatus or gates were left open the making of this cut would so connect Seven Mile creek with Four Mile creek as to make Seven Mile creek a tributary of Four Mile creek and therefore of the Laramie river. So far as any irrigation
in the Laramie Valley is concerned, the waters that come from
986 this lake are added to the waters already obtained from other sources.

I would say that roughly 6 feet in depth over the entire exposed area would annually evaporate, from year to year, from James Lake as it stood in its natural condition. The James Lake I refer to is the same body of water noted on the map attached to defendants' answer as Lake James and appearing in townships 17 and 18, R. 76 W. It is the same body of water now utilized as a storage

reservoir by what is called the Talmadge-Buntin project. The 1,237 acres of irrigated meadow and 290 acres irrigated pasture which I gave as irrigated from Seven Mile creek are all located above James Lake. I did not include any waters which are discharged from Seven Mile creek into James Lake. On Four Mile Creek the irrigated area extended both above and below the lake. Four
987 Mile creek is naturally a tributary of the river. My knowledge of this irrigated area on these streams is confined to my observation made during these days in October of this year and some small knowledge from previous observations during 1912 and '13. I knew nothing of the valley prior to that time. The land from which native hay had been cut was classified as irrigated meadows, and those irrigated lands with native hay which had not been cut were classified as irrigated pasture. I made no measurements to ascertain the tonnage of hay cut on the 501 acres on Four Mile creek. I made no observations as to the tonnage of hay cut on any of this meadow land, I asked several of the ranchmen with reference to the production. I made no measurement of the hay in stacks.

988 My gauging station on the Little Laramie River is located one mile below Fillmore post office. I have a station near Fillmore. Lower station is first one above station at Two Rivers. Can give total acreages, by sections and townships, irrigated above Fillmore and below Fillmore on Little Laramie. In ascertaining these acreages I took topographic sheets of Laramie and Medicine Bow Quadrangles into field and platted in colors various areas under irrigation, using cultural features such as fences, location of houses, topography, canals, and so forth, to block out areas, driving over portions of each section. Used speedometer on automobile at times, to ascertain mileage and fractions of miles. Consider that, while there was no great refinement used in making estimates, total area of lands irrigated from Little Laramie river should come within 2 per cent and in special instances of smaller acreages with 5 per cent of correct area. These areas could have been determined by detailed survey but not in time for this testimony. Even in these meadows there are areas sometimes including several acres, not cut at all. Are also spots and small tracts of waste and uncultivated lands. These areas eliminated from areas in each section by percentage basis; correction made for areas around ranch buildings, river bed, embracing sloughs and draws and areas for roads, etc., were applied to each section based on the observation. Simply went upon ground and looked around, going over the meadows and observing with eye, making what seemed proper deductions of various tracts not cultivated, or waste. Had time been taken to survey tracts with instruments, observations would have been more accurate. Irrigated meadows were lands on which native hay is raised and cut at time of observation and areas of high ground or grease wood, sloughs or draws or river bottom were excluded, after observations made
990 in manner stated. Irrigated pasture consists of meadow lands from which no hay was cut this year, also higher bench lands under ditch, irrigated in 1913. Includes all lands under

ditches not cut for hay upon which was a forced growth of grass, better than natural. Some areas along Little Laramie river some years cut hay, other years not cut, are meadow lands, but used for pasture that year. Considerable portion of total 18,550 acres irrigated pasture on Little Laramie of that class. In some places rough to cut, in others sufficient hay produced in meadows portions were left to be pastured during fall and winter. Considerable amount is where hay production is heavy. Difficult to estimate acreage of this class, had other matters to work out, made no note of it,
991 could not give figures. Some land under these canals is absolutely waste land in so far as irrigation is concerned. Considerable areas in places tilled and irrigated in former years were not included in totals given because not irrigated in 1913, would be an addition to figure given.

Acrease I gave includes all land under James Lake system. In 1913 there were 515 acres irrigated under Talmadge-Buntin project. Approximately 1,000 acres under that project tilled previously but not irrigated in 1913. This I consider as irrigation
992 of several years' standing. Irrigated probably within 4 years, since 1909. From evidence I observed, there have been about 1,500 acres irrigated under Talmadge-Buntin project. Indludes about 1,000 acres given as abandoned for 1913. On various tracts previously irrigated and tilled under Talmadge-Buntin project, irrigated in 1913, houses and buildings unoccupied. Approximately 12 families occupying land and tilling under Talmadge-Buntin project in 1913. Do not know number families there in 1909, '10 and '11. Judging from buildings and improvements there had been many more than number given. If lands under the Talmadge-Buntin project, or what is commonly called James Lake project, not considered, we deduct 515 acres from total irrigated acreage given. 445 acres oats and 70 acres alfalfa. 12 or 13 different fields varying from 5 to 70 acres, included in oats acreage. Alfalfa ran in four fields, acreages from 3 to 20. Two 20 acre fields.
994 Fields ran chiefly 10 and 20 acres. Did not ascertain tonnage production in 1913. In two or three instances, alfalfa under the Talmadge-Buntin project was poor, others no better than fair. Do not know number of cuttings harvested on fair stands. Some alfalfa not cut because too poor. Probably average crop oats on 445 acres, two or three instances of very poor ones. Do not know production in bushels.

May be some lands included in irrigated total given, on the Blackburn ranch, as recent in irrigation as Talmadge-Buntin irrigation. Blackburn ranch located on bench lands between Little Laramie river and Seven Mile creek in Tp. 17 N., R. 76 W. and Tp. 17 N., R. 75 W. Irrigated portion lies about south James Lake.
995 Cannot give acreage in that ranch of recent reclamation. Other than these two acreages no others appear to be of recent reclamation.

Two Rivers gauging station above mouth of Four Mile creek, but below all lands in drainage area of Little Laramie proper.

(Complainant's Exhibit E offered in evidence.)

(COPY OF COMPLAINANT'S EXHIBIT E.)

1913 *Irrigated Lands of Little Laramie River.*

Field Examination and Mapping by R. I. Meeker, Accompanied by E. D. Titus, on October 2, 3, 4, 7, 8, 9, 10, and 30, 1913.

Section.	Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
1	14 N., 78 W.	242	236	...	...	478
2		103	19	...	...	122
11		98	...	...	...	98
12		119	15	...	...	134
		562	270	...	...	832
6	14 N., 77 W.	50	46	...	...	96
7		...	82	...	...	82
		50	128	...	...	178
1	15 N., 78 W.	59	292	...	...	351
3		...	36	...	...	36
10		175	43	...	...	218
11		218	125	...	...	343
12		...	230	...	...	230
13		33	600	...	...	633
14		400	228	...	...	628
15		110	...	...	...	110
22		15	100	...	...	115
23		400	120	...	...	520
24		370	120	...	...	490
25		527	100	...	...	627
26		474	82	...	...	556
27		80	330	...	...	410
34		140	90	...	...	230
35		540	84	...	...	624
36		590	...	...	...	590
		4,131	2,580	...	...	6,711
1	15 N., 77 W.	122	...	...	...	122
2		145	70	...	...	215
3		...	175	...	...	175
4		70	120	...	...	190
5		182	32	...	...	214
6		367	320	...	...	687
7		150	120	...	...	270
8		57	32	...	...	89
9		30	25	...	...	55
10		...	165	...	...	165
11		125	...	...	...	125
12		50	...	...	...	50
18		51	230	...	...	281
19		107	12	...	...	119
30		300	...	...	...	300
31		97	4	...	...	101
		1,853	1,305	...	...	3,158
26	16 N., 78 W.	...	150	...	...	150
27		...	59	...	...	59
34		56	10	...	...	66

Section.	Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
35		77	287	...	...	364
36		10	325	...	...	335
		143	831	...	...	974
1	16 N., 77 W.	...	250	...	...	250
2		180	...	...	...	180
3		85	...	...	...	85
4		30	...	...	...	30
10		50	...	...	...	50
11		155	25	...	...	180
12		...	530	...	...	530
13		170	120	...	...	290
14		...	27	...	...	27
25		46	...	...	...	46
36		369	12	...	...	381
		1,085	964	...	...	2,049
1	16 N., 76 W.	425	150	...	...	575
2		450	58	...	...	508
3		376	145	...	...	521
4		429	30	...	...	459
5		74	43	B15	...	132
6		...	304	...	...	304
7		277	223	...	...	500
8		542	64	...	...	606
9		620	...	...	...	620
10		520	100	...	...	620
11		470	115	...	...	585
12		423	147	...	...	570
13		...	100	...	...	100
14		55	200	...	...	255
15		475	135	...	...	610
16		480	135	...	...	615
17		585	4	...	...	589
18		140	...	...	...	140
19		100	115	...	...	215
20		400	125	...	...	525
21		...	500	...	...	500
22		...	420	...	...	420
23		10	465	...	...	475
24		...	190	...	...	190
26		...	46	...	...	46
28		...	173	...	...	173
29		102	240	...	...	342
30		346	22	...	...	368
31		115	69	...	...	184
		7,414	4,318	15	...	11,747
1	16 N., 75 W.	390	...	...	...	390
2		60	15	...	...	75
3		...	20	...	...	20
4		180	75	...	...	255
5		540	120	...	...	660
6		626	75	...	...	701
7		440	65	...	...	505
8		275	...	...	...	275
12		150	...	...	...	150
16		...	150	15	...	165

Section.	Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
17	.....	...	215	...	...	215
18	.....	35	150	...	...	185
19	.....	390	54	...	...	444
20	.....	80	360	...	...	440
21	.....	...	84	87	...	171
		3,166	1,383	102	...	4,651
10	Poverty Flat	...	474	...	...	...
14	Ditch	...	155	...	...	...
15	Not irrigated 1912-13.....	...	190	...	...	820
S. M. 12	17 N., 77 W.....	75	160	...	...	235
S. M. 13	.....	...	50	...	...	50
		75	210	...	...	285
S. M. 7	17 N., 76 W.....	33	...	...	...	33
S. M. 9	.....	230	...	...	...	230
S. M. 10	.....	165	30	...	...	195
S. M. 16	.....	307	10	...	...	317
S. M. 17	.....	350	...	...	...	350
S. M. 18	.....	77	40	...	...	117
		1,162	80	...	...	1,242
23	.....	...	175	...	...	175
24	.....	...	240	10	4	254
21	.....	...	180	...	...	180
22	.....	...	190	...	...	190
25	.....	...	20	360	120	500
26	.....	...	80	480	...	560
27	.....Flax 20	45	333	...	18	416
32	.....	...	140	...	...	140
33	.....	...	320	...	...	320
34	.....	...	270	115	...	385
35	.....	...	185	120	...	305
36	.....	63	20	...	...	83
	20	1,270	2,233	1,085	142	4,750
Deduct: Seven Mile..		1,162	80	...	...	1,242
	20	108	2,153	1,085	142	3,508
13	17 N., 75 W.....	96	10	...	...	106
19	.....	...	155	...	...	155
20	.....	...	270	...	...	270
21	.....	100	...	...	...	100
22	.....	318	140	...	...	458
23	.....	370	200	...	...	570
24	75 tilled, no crop.....	218	75	W90	50	433
25	75 " " "	138	140	...	...	278
26	.....	560	60	2	...	622
27	.....	520	100	...	...	620
28	.....	615	...	...	...	615
29	.....	280	50	59	26	415
30	65 tilled, no crop.....	340	90	100	12	542
31	.....	270	...	...	...	270
32	.....	530	77	...	...	607

Section.	Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
33	.....	400	215	...	...	615
34	.....	420	200	...	...	620
35	.....	300	125	...	...	425
36	.....	...	60	...	...	60
	215	5,475	1,967	251	88	7,781
8	17 N., 74 W.....	172	243	27	...	442
9	.....	...	165	...	...	165
15	.....	...	75	...	...	75
16	.....	...	247	...	...	247
17	.....	97	427	...	...	524
18	.....	300	78	...	...	378
19	.....	...	460	...	...	460
20	130 tilled ground.....	293	157	...	...	450
21		...	(e)50	...	...	50
29	30 " "	25	100	...	...	125
30	14 " "	230	180	...	...	410
	174 " "	1,117	2,182	27	...	3,326

W—Wheat.
(e)—Estimated.

7	16 N., 74 W.....	...	100	...	...	100
8	.....	...	69	...	...	69
16	.....	...	20	...	...	20
17	.....	...	50	...	...	50
18	.....	...	230	...	...	230
		...	469	...	...	469
	Four Mile Creek:					
27	18 N., 76 W.....	...	10	...	...	10
28	.....	20	17	...	...	37
29	.....	37	...	...	...	37
31	.....	17	185	...	...	202
33	.....	52	...	...	...	52
36	.....	270	30	...	...	300
		396	242	...	...	638
36	18 N., 77 W.....	50	175	...	...	225
		50	175	...	...	225
1	17 N., 76 W.....	55	...	...	...	55
		55	...	...	...	55
	Seven Mile Creek:					
	17 N., 77 W.....	75	210	...	...	285
	17 N., 76 W.....	1,162	80	...	...	1,242
		1,237	290	...	...	1,527

Under James Lake System.

Section.	Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
28	19 N., 74 W.....	...	...	40	...	40
32	.....	...	...	60	20	80
		...	...	100	20	120

Section.	Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
4	18 N., 74 W.	...	...	35	10	45
7		...	...	5	5	10
8		...	...	110	...	110
17		...	...	20	...	20
19		...	...	40	...	40
30		...	...	...	20	20
		...	...	210	35	245
36	19 N., 75 W.	...	...	65	15	80
13	18 N., 75 W.	...	...	70	...	70

RECAPITULATION.

James Lake System.

	Oats.	Alfalfa.	Total.
T. 19 N., R. 74 W.	100	20	120
T. 18 N., R. 74 W.	210	35	245
T. 19 N., R. 75 W.	65	15	80
T. 18 N., R. 75 W.	70	...	70
	445	70	515

NOTE.—1,000 acres (estimated) as tilled in prior years. No crop in 1913.

RECAPITULATION.

1913 *Irrigation Lands of Little Laramie River.*

Township & range.	Meadow.	Pasture.	Oats.	Alfalfa.	Total.
14 N., 78 W.	562	270	...	...	832
14 N., 77 W.	50	128	...	...	178
15 N., 78 W.	4,131	2,580	...	...	6,711
15 N., 77 W.	1,853	1,305	...	...	3,158
16 N., 78 W.	143	831	...	...	974
16 N., 77 W.	1,085	964	...	...	2,049
16 N., 76 W.	7,414	4,318	15	...	11,747
16 N., 75 W.	3,166	1,383	102	...	4,651
17 N., 76 W. Flax 20	108	2,153	1,085	142	3,508
17 N., 74 W.	1,117	2,182	27	...	3,326
17 N., 75 W.	5,475	1,967	251	88	7,781
16 N., 74 W.	...	469	...	...	469
19 N., 74 W.	...	...	100	20	120
18 N., 74 W.	...	...	210	35	245
19 N., 75 W.	...	...	65	15	80
18 N., 75 W.	...	...	70	...	70
Flax 20	25,104	18,550	1,925	300	45,899
16 N., 75 W. Poverty Flat Ditch (*a*)	...	820	...	...	...
17 N., 75 W. tilled (*a*)	...	...	215	...	...
17 N., 74 W. " "	...	...	174	...	1,209
					47,108
Seven Mile Creek	1,237	290	...	...	1,527
Four-Mile Creek	501	417	...	...	918

(*a*)—Not irrigated in 1913. Irrigated in prior years.

Nov. 7, 1913.

R. I. MEEKER.

Cross-examination.

By Mr. Charles F. Tew:

In whole valley found about 300 acres alfalfa. That included Little Laramie valley and ditches from that stream. There was a large body of land brought under irrigation, under James Lake system, in 1909, that had not been previously in any irrigation system, 70 acres of this in alfalfa. Land under this system
996 is more bench land than remainder of Little Laramie Valley.
On land where 70 acres alfalfa is located large area has been capable of irrigation from James Lake system since 1909. Could have been irrigated in 1910, '11, '12, '13. Works were completed in 1910 and subsequent years. Remainder of valley where alfalfa was found is in stock raising country. Twelve families mentioned under James Lake project have been engaged more in rais-
997 ing crops requiring breaking of land than in raising native hay. Since 1908, at least, think that project has been farming less land each successive year. For irrigation purposes venture under the James Lake project, on area mentioned, is different from irrigation of pasturage and hay lands along other streams described, including Little Laramie.

Remainder of locality, where I found 18,550 acres irrigated pasture, 25,104 acres native hay, and along Seven Mile creek 1,237 acres meadow and 290 acres irrigated pasture, and Four Mile creek, 510 acres of meadow and 417 acres pasture, was ranch or stock country. From improvements and conditions would say business of stock growing had been well established on this area except under James Lake, showing that drift had been to establishment and permanency of stock growing. Also showing that where the experiment had been made of irrigating under James Lake project in 1909 possibly, and to my knowledge in 1910, '11, '12 and '13, the area had shrunk from year to year, and there were abandonments of homes and effort and the experiment had been failure, temporarily at least. Works under James Lake project completed in 1909. There had been sufficient works and water to irrigate lands under James Lake project, but believe there was shortage of water in earlier years.

998 Outlet ditch and works had been constructed to serve larger area than twelve farms. There was water and ditch capacity enough to irrigate several times number of acres irrigated in 1913. Did not include any lands under this project as irrigated except twelve farms.

In remainder of 48,000 acres scattered along Little Laramie valley, found 230 acres alfalfa, located mostly down stream in small
999 acreage; good portion on Blackburn ranch which runs more to upland than valley.

In valley of Little Laramie found 1,925 acres oats, subtracting 445 acres under James Lake project, would leave 1,480 acres Little Laramie exclusive James Lake project. Oat fields mostly on Blackburn ranch, eighties and sixties. Aside from Blackburn ranch, there is small area of oats or alfalfa at many ranches, with large

areas of native hay and irrigated pasture. Owners are engaged in stock raising, supplemented by the necessary farming. Alfalfa raised for home consumption. Oats for cow ponies, alfalfa
1000 for winter feed. Exclusive of James Lake project, Blackburn ranch is more farming proposition than others; oats there better than average of valley. Was informed that best oats on Blackburn ranch went 55 bushels to acre. Conditions on that ranch same as throughout valley, except it is upland or bench land, no more favorable than others. Blackburn lands smooth and
1001 slopes to east. Water beneath soil not near surface, ranch more exposed to wind than others. Found winds as strong there as elsewhere.

Cross-examination.

By Mr. Delph E. Carpenter:

Cannot give population of area comprising 48,344 acres. There are more than twenty families. Many of ranches in valley have supplementary lands on surrounding hills. Some range land open to general public. In upper reaches of stream, near Centennial, mountains are immediately adjacent to irrigated lands and
1002 are used for grazing. Practically entire area used for winter feeding of stock ranged in mountains or open range in Laramie Plains region.

General average of oats on Blackburn ranch about 40 bushels per acre but did not consult threshers. Two Rivers gauging
1003 station on Little Laramie located 400 feet above road bridge and approximately 1/3 mile above confluence with Big Laramie river and below all ditches on Little Laramie river. Station near Fillmore located in Sec. 2, Tp. 15 N., R. 77 W., about one mile below Fillmore post office, below headworks of Bellamy canal, and, with exception of two or three minor ditches, above irrigated area of the Little Laramie river below cañon immediately north of Sheep Mountain. Cañon approximately two miles above head of Bellamy ditch. Measurements taken at Fillmore station would not account for diversions by Bellamy canal, or its enlargement, but in conjunction with Fillmore station, records were secured on Bellamy canal at Wright's bridge. In event no such records were obtained, Bellamy diversions would not be included in records of flow at Fillmore station.

All lands in Tp. 14, ranges 77 and 78 W., Tp. 15, R. 78 W., and all of Tp. 15, R. 77 W., except sections 1 and 2, are irrigated
1004 by ditches diverting water above Fillmore station, as shown on plaintiff's exhibit E. a table prepared by me and showing irrigated lands in Little Laramie Valley, the Seven Mile and Four Mile valleys. Any measurement of flow at Fillmore station is water left in stream after irrigating lands in townships mentioned. Rating station maintained by U. S. Geological survey near Fillmore was located at May's ranch, a mile and a half above Fillmore Post Office and above Bellamy canal. Below all other canals in townships mentioned except one or two ditches between these stations. Their di-

versions are insignificant and would not vitiate conclusion as to totals.

On the table of irrigated areas, exhibit E, did not classify as irrigated pasturage all land under various ditches not used for meadows. I mean that in all portions of eight days' labor I ascertained with sufficient certainty for problem in hand acreage of irrigated meadow and pasturage of drainage areas specified on table.

Of lands under canal did not include in classification por-
1005 tions which have not been irrigated and also tilled lands upon which there were no crops this year. Exclusions were made in number of instances because not irrigated in 1913. In irrigated pastures determined irrigated land from production of native pasturage and native hay on the ground uncut and by ditches and other features. Followed areas under ditches. Land protected by fence and thereby had considerable increase growth excluded from irrigated pasturage. Used no instrument in making observations or deductions.

Referring to page 2 of table, exhibit E, and to Sec. 2, Tp. 15 N., R. 77 W., ascertained 145 acres meadow and 70 acres pasture, total 215 acres by methods described. Valley is narrow there, Sheep mountain slopes ascend quite abruptly. Do not think am in error

100 acres on that land. Two or three ditches take out above
1006 that section carried over into a Branch tributary into Lake Hattie and irrigates below Porter Lake. Referring to Sec. 1, same township and range, show 122 acres of irrigated meadow cut this summer. Think this correct. A correct stadia measurement would tell. In Sec. 1, Tp. 16, R. 77 W., there are 250 acres irrigated pasturage. The Loback canal runs across that section, probably some seepage from it, water also turned out, through

headgates. Water turned from Bellamy canal on that land
1007 below. Also includes ditch out of Mill creek above. Table includes irrigated lands on Mill creek, tributary of Little Laramie, and some land irrigated above Bellamy ditch. The 530 acres irrigated pasture on Sec. 12, same township, irrigated from Mill creek chiefly. Traversed land in auto and got out and walked in places. Had no assistance; Mr. Titus went along as a witness because of his knowledge of country. Did not guess at it. Determined lengths and widths of land by blocking off according to subdivision fence lines, ditches and contours and other cultural features. Used as much care up in that section as further down.

1008 Remember it very clearly. Think work on that section represents conditions there. Where no fences measured off distances by automobile and located sections lines and corners. Speedometer on auto measures within 1/10 of mile. That was what I used. Am not in error about 150 acres on the irrigated land in Sec. 2,

Tp. 16, N., R. 76 W. Made no note of acreage of potatoes
1009 and garden truck. Very small area around the ranch buildings and paid no attention to them. Almost invariably these were intended for local consumption. Do not believe that table shows 275 acres more land irrigated to pasture in Section 6 in that township than exists. As I recall, water is turned out of Loback

canal at headgate just above bridge at head of draw there and natural drainage utilized in distribution. Believe there is lateral under Bellamy canal, a short distance below. When I refer to the Bellamy I mean enlargement of Bellamy or Loback ditch. Recall that section fairly well. Was over it more than once because my areas overlapped. Worked up Mill creek after general
1010 body of land below Mill creek and my areas overlapped there. Grass on that section not best in world for irrigated pasture, because it has been well pastured. Cattle have access to it. Not like many pastures where cattle had been kept out during growing season. Cattle in there when made observations. Found 500 acres pasture on Sec. 21, Tp. 16 N., R. 76 W. irrigated from Ernest or Hecht ditch, water being turned out in draws in section above and run down across to that land. Show 390 acres irrigated meadow Sec. 1, Tp. 16, R. 75, cut over in 1913. A stadia measurement, if properly made, by competent man, would reveal true conditions there. Granted such would be more accurate than my work. In
1011 determining areas the judgment as to what has been irrigated would enter. In meadow classification anyone can see where mowing machine has gone. In Sec. 4 of the same township, 180 acres of irrigated meadow and 75 acres of irrigated pasture shown. Do not believe this is about 100 acres in excess of the meadow and 75 acres in excess of irrigated pasture. The 160 acres irrigated pasture for Sec. 16 is not 100 acres excessive. On Sec. 19 in the same township 390 acres of irrigated meadow and 54 acres of irrigated pasture shown. Could easily see meadow. Figures not made by instrument measurement. Do not consider method haphazard way. Have platted areas in this way on Boulder creek for similar problems. In irrigated meadows some pretty irregular places.
1012 No refinement was used for this work, but it was sufficient for problem in hand. Possibility exists that by mistake of few acres here and a hundred or two hundred acres there totals on tables can be run high and the areas large. Think general tone of work was about same throughout area. Went over area hurriedly, but sufficiently to secure data sought.

Do not see why, for practical purposes, stream measurements and records considered, work above Fillmore station would be eliminated in this proceeding. No records kept of amount of water used on upper ranches that I know of. Records obtained, say at Fillmore station, of flow of Little Laramie, would be flow after thou-
1013 sands of acres have been irrigated above. Have always made note in all tables made that there were large diversions above that did not represent productivity of drainage area. Bellamy canal is canal used by Lake James project for inlet ditch. Some irrigation takes place from canal along line, chiefly, on Blackburn ranch in vicinity of Mill creek. On Sec. 23, Tp. 17 N., R. 76 W. there are 175 acres pasture irrigated mostly from water flowing through natural depressions, water turned out above on other land. Would not call turning out of water on neighboring section to follow natural depressions onto other lands beneficial or economical application of water for agricultural crops; for pasturage it is different. Would

not call that economical application of water. Did not have
1014 to stretch imagination to get any irrigated pasturage on that section. Did not fail to credit 25 acres of oats and 8 acres of alfalfa to Section 24 where have given 240 acres pasturage, 10 acres of oats and 4 acres of alfalfa. In my judgment 240 acres irrigated pasture is correct. Don't recall that it took close scrutiny to determine irrigated pasturage. Irrigated pasturage distinguished by tracing out laterals and the running of water. Don't recall any laterals on Sections 24 or 23, other than perhaps some old laterals. Nevertheless gave Sec. 24 240 acres irrigated pasture. Did not include some lakes. Land included lies to southeast. Some seepage
there probably. On Sec. 25 have no meadow. Have 20 acres
1015 of pasture. On Sec. 26 have no wheat noted. Have not 65 acres too much when 480 acres of oats noted. Think there were more than 62 acres pasture or meadow on Sec. 27 where I show 333 acres irrigated pasture. No note of laterals, were some. If one says there were 62 acres of meadow and pasture combined on that section and I say there are 378 acres, our judgments would be 316 acres apart. Think water from laterals can be distributed over most
of section. Didn't pretend to make note of ditches. Didn't
1016 map them. On Sec. 34 note 270 acres pasture and 115 acres oats. I am sure there is irrigated pasture on that land. Main lateral from Bellamy ditch runs through. Water can be diverted either way from lateral. Oats on north side of lateral. On a small area there would be a variation probably as much as 10 per cent on acreages determined by my method as compared to instrument
measurement. Do not think figures are 34 acres short of
1017 acreage oats on Sec. 35. Think I am not 240 acres in excess when I give 370 acres irrigated meadow and 200 acres pasture on Sec. 23, Tp. 17 N., R. 75 W. Don't know of 14.16 acres of oats. Have excluded lot between two channels Little Laramie River overgrown with sage brush. On Sec. 27, Tp. 17 N., R. 75 W., show
520 acres of irrigated meadow, 100 acres irrigated pasture,
1018 total of 620 acres. Recall some hummocks on south half of south half; don't know amount sage and greasewood land there. Fence cutting through there makes pasture and land on that class laps over in two or three places north of fence. In northwest portion are small areas greasewood pasture. Don't believe I spent an hour on this section determining acreage, but don't believe as much as 200 acres in error. Would be surprised if figures given for sec. 33, same township and range, showing 400 acres irrigated meadow evidently cut over this year; 215 acres irrigated pasture, making 615 irrigated acres total, were 75 acres excess on meadow and 215 acres excess on pasture. Don't know I am that far in error.
Know there is some greasewood in there. Don't know time
1019 it took to go over section. Naturally careful plane table survey would be more accurate. I suppose exclusion more land classed as irrigated is matter of judgment. Each had equal opportunity on meadow where mowing machine had run. 75 acres discrepancy seems large. Do not think am 125 acres in excess on Sec. 35. There is fence cutting off south half. Lake in southwest

corner probably from irrigation, also another small lake in southwest corner.

While making these observations stayed one night at Centennial, two at Fillmore, one at Bass and one or two nights came to Laramie for gasoline. Mr. Titus went on account of knowledge of country and as witness. Had same system on Pioneer naturally carried it over on Little Laramie. On average spent nearly 12 hours a day. Cannot say covered 175 sections in eight days, have not computed them. It was a large area. If that many were covered it
1021 would be about 22 sections in 12 hours or about half an hour to the section. Drove on different portions of sections, some more than others. This method not as accurate as one employing a few hours to a day or more to a section. Might be discrepancies in deductions by my method and those of other method, based on judgment of surveyor. Naturally instrument survey would be more accurate. Would be surprised to find acreage by instruments much lower than that given. Do not know my calculations show
1022 thousands of acres more irrigated lands in Little Laramie Valley than are shown by careful instrument survey, but don't think it strange under circumstances if such should be the facts.

Redirect examination by Mr. N. E. Corthell:

1022 My testimony in cross-examination as to irrigation of Talmadge-Buntin project refers only to lands irrigated from the James Lake reservoir. I came here in May, 1912. Have no personal knowledge of amount in or run through James Lake Reservoir prior to 1912.

There are lands in Sections 10, 14 and 15, Township 16, Range 75, in the Bath Reservoir site. That reservoir is connected with the Laramie Water Company's system.

1023 Land formerly irrigated but not irrigated this year was purchased for that site.

1023 Recross-examination by Mr. Delph E. Carpenter:

Did not classify all land in Bath reservoir site as irrigated pasture. Portion under laterals where there were stack pens showing hay had been cut. It is not included in general tables, but in note at bottom referring to Poverty Flat ditch and is excluded from table. Lands under James Lake ditches more or less rolling with general slope toward the east. Irrigation would naturally produce a return flow of wastes into Laramie river east as soon as areas were of magnitude. In making observations of irrigated lands on Little Laramie noted
1024 acreages as I worked by blocking out areas in colors on the standard topographic sheet of U. S. Geological Survey, Laramie and Medicine Bow Quadrangles, scale one inch equals two miles. Deductions from these maps on small areas made by notes and computed areas in office from notes. Did not use planimeter in ascertaining areas from maps made in field. Used transparent cross-section paper to block out areas then computed area embraced in outline.

The cross-section paper had ten intervals to the inch each way, five spaces to the mile. Simply transferred areas from map to transparent paper.

Redirect examination by Mr. N. E. Corthell:

1025 I know the general physical and topographical features of the Laramie River drainage basin.

It is an oblong area of 4,472 square miles, 115 miles long, and of average width of 30 miles. 395 square miles of this is in Colorado, the remainder in Wyoming. The trend of its major axis is East of North. Laramie River flows North from Colorado, and toward the East in the lower end of the basin to its junction with the North Platte River. The southern one third of the basin is rimmed with high mountains, culminating in peaks 12,000 to 13,000 feet high in the Medicine Bow Range, and these mountains are the chief source of the water supply of the Laramie River. Along the East side of the drainage basin are the Laramie Mountains of average elevation of 8,000 feet, culminating in Laramie Peak of 10,000 feet elevation. Immediately west of the Laramie Mountains lies a semi-arid area of irrigable lands approximately 75 miles long and 20 miles wide, known as the Laramie Plains. The Laramie Plains are more or less rolling with gentle slopes and susceptible of cultivation and irrigation.

1026 East of the Laramie Mountains, at the lower end of the Laramie River basin are also large areas of arable lands along Chugwater Creek, Sybille Creek and North Laramie Creek. There are also small areas of tillable land along streams tributary to the Laramie River. The chief tributaries in their order down stream are Sand Creek, Little Laramie, Sybille, North Laramie and Chugwater. Little Laramie is the largest tributary and rises in the western rim of the basin. Its course is northeasterly to its confluence with the Laramie River at an elevation of 7,050 feet. The Little Laramie at its mouth has about 50% of the amount of water in the Laramie at Woods, Wyoming.

Sand Creek rises in Colorado and flows into the main stream a few miles above Laramie.

Sybille Creek, Chugwater and North Laramie drain chiefly the eastern slope of the Laramie Mountains. The run off from these streams is much less per square mile than the drainage from the Medicine Bow Mountains at the head of the Laramie River.

The mean annual precipitation at Laramie in the Laramie Plains area is 10.2 inches, at Wheatland 14.2 inches. In the mountainous portion of the drainage area in Colorado and Southern Wyoming it reaches as high as 40 inches. Elevations are as follows: The Laramie Plains, 7,000 to 7,500 feet; the Laramie River at the Colorado-Wyoming line, 7,675 feet; Laramie, 7,159 feet; Wheatland, 4,747 feet; the junction of Laramie with the North Platte, 4,250 feet.

1027 The soil of the Laramie Plains is chiefly from sand stones and shales of the cretaceous period, and produces naturally a native grass of large value from a grazing standpoint. Melting snow

from the Medicine Bow range in Northern Colorado and Southern Wyoming—the principal range of the Rocky Mountains in this region—is the principal source of the water supply of the Laramie River. The precipitation in these mountains is very much greater than that in the open plains country. This snow falls in the mountains from September to May, inclusive. There is no considerable supply to the Laramie River in Wyoming from the eastern side of the basin.

The greatest run-off occurs during the months of May and June.

1028 The Medicine Bow Mountains, and all mountains along the South and West boundary are heavily timbered. There are no trees on the Laramie Plains except along the beds of streams. There is sparse vegetation on the Laramie Mountains.

The tributaries of the Laramie in Colorado in their order are as follows: Down the west side, West Fork, Mill Creek, Fall Creek, Rapid Creek, Springer Creek, Rawah Creek, McIntyre Creek, Le Garde, Forrester, Grace, Stuck, Johnson, and a portion of Beaver Creek; Down the East side, Brinker, Porter Nunn, Deadman, a tributary of Nunn, Jimmie, and Sand Creek which enters the Laramie in Wyoming.

I have prepared a map of the drainage basin of the Laramie River and its tributaries which I produce.

Exhibit G.

The heavy pink line on the map shows the boundary of the Laramie River drainage area; the vermillion line shows the course of the stream. The other features as shown in the legend.

1029 I can testify that the boundary as shown on the map is correct, also the line of the Laramie River and the location of its tributaries. The ditches are located in accordance with the locations shown in the office of the State Engineer. I have checked them against other maps and from a knowledge of a large number of the ditches. Have been over the country shown frequently, and conducted surveys and made measurements and observations in regard to the streams and ditches.

The green tint on the map represents the old established irrigation prior to 1900, the yellow tint the developments since.

This map is generally a correct representation of the conditions.

1030 (Map marked complainants' exhibit "G".)

By Mr. Delph E. Carpenter:

To which exhibit G and the offer thereof in evidence, the defendants, and each of them, now and here object for the reason that the same is incompetent, irrelevant and wholly immaterial and particularly for the reason that the same is manifestly erroneous in this: That it seeks by artful coloring to establish priorities of water rights which the witness himself has testified in prior evidence are wholly beyond his knowledge and particularly in the error in said map in selecting the dates of 1900 before and subsequent to which large

areas are classified, when the evidence of this and other witnesses on behalf of the State of Wyoming heretofore adduced has shown that the dates of priorities of the larger areas marked on this map as subsequent to 1900 were in fact subsequent to 1908-9-10 and not earlier than those dates. Said map in that regard being evidently in error. Whether because said map purports to show large areas as developed and irrigated by solid colored portions thereof in green, which testimony of this witness and other witnesses has shown are yet only partially reclaimed. Said map being further contrary to the evidence in that it purports to show all of the lands so colored as irrigated and reclaimed, when in truth and in fact only a portion thereof are irrigated and reclaimed. And particular objection is made in that behalf of the Wheatland tract, which the evidence already adduced in this case in behalf of the plaintiff shows is only 50 per cent developed, whereas this map purports to show the full 60,000 acres of the original tract already irrigated and developed. Further, in regard to said Wheatland tract, that the evidence in this case already adduced by plaintiff shows that the portions marked yellow on this map, evidently referring to the Sibylle and Bordeaux tracts of the Wyoming Industrial Company were not initiated prior to 1908-9-10, while this map would infer that said development had been begun as early as 1900. And further as to that portion of the area marked yellow and shown as located west of Laramie City is misleading for that the same is wholly unreclaimed and the evidence shows in this case, has already been unreclaimed and the evidence map is misleading in that it purports to show irrigation, construction and development as early as 1900, contrary to the evidence. The same objection particularly as to that portion of the map marked yellow and noted as under the James Lake project. The evidence already adduced in this case shows the initiation of said enterprise as recent as March 29, 1908, and not as early as 1900, as shown on this map. And for the further reason that said map generally by the artful coloring thereof purports by evidence wholly immaterial and irrelevant to fix priorities. For the reason that said map does not show within the true boundaries of the drainage area all of the tributaries of the Laramie River. And for the further reason that con-
1032 siderable portions of the area marked yellow on the map purport to show irrigation development and at the same time the dotted lines, according to the legend on said map indicate that no canals are constructed for the reclamation of said lands, but are merely projected and still in the imaginations of men. For the further reason that throughout said map, both in Colorado and in Wyoming the areas are marked a green tint to exaggerate the actual irrigated areas.

Cross-examination by Mr. Delph E. Carpenter:

Am the same R. I. Meeker who testified before. My map, exhibit G, in error in notation in Tp. 10 N., R. 76 W. and along south line said township, where McIntyre ditch is indicated by heavy line, as

though constructed. Should be dotted line because ditch not constructed; only projected in conjunction with Glendevey reservoir site project. Is not projected by Colorado appropriators.

1033 Map showing extension of King ditch in Tps. 13 and 14, R. 75 W., shows completed ditch. Do not know whether or not some of the structures across Sand Creek are incomplete; ditch prism is complete.

Dotted line on Tp. 14, ranges 78 and 79 W., designated Bell Supply Canal No. 2, marked as a projected enterprise, indicates the canal upon which the Laramie Water Company has already done considerable construction for the purpose of bringing water from Douglas Creek over the Divide into the Laramie *Laramie* River, said Douglas creek being a tributary of the North Platte river. There may be some short sections on the Bell Supply canal that are completed, but you cannot show them on this scale on the map. There are a good many sections opened up there.

1034 Obtained information relative to tributaries of Laramie river in Colorado, and particularly on west side of stream, from various maps; one the exhibit in bill of complaint. Checked this against standard published maps such as Clason's and others. If error in map (Exhibit G) in that region, is due to errors in other maps. Found Government survey maps in this region lacking in details. Relied largely on other maps to get details anywhere nearly correct.

(COPY OF COMPLAINANT'S EXHIBIT I.)

Laramie River Run-off, 1912 *and* 1913.

Run-off, 1912.	Acre feet.	Distribution.	Acre feet.
Laramie River at Pioneer Dam, near Woods, Wyo. Run-off Jan. 1 to Dec. 31	207,000	Pioneer Canal	17,703
		Lake Hattie Res.	69,855
		All other ditches between Pioneer Dam and Two Rivers	29,892
NOTE.—Jan., Feb. & March run-off estimated as 8,300 acre feet.		Wheatland Reservoir No. 2 & intermediate ditches below Two Rivers	89,550
	207,000		207,000

Run-off, 1913.	Acre feet.	Distribution.	Acre feet.
Laramie River at Pioneer Dam, near Woods, Wyo. Run-off Jan. 1 to November 30	106,600	Pioneer Canal	13,504
		Lake Hattie Reservoir	28,470
		All other ditches between Pioneer Dam and Two Rivers	18,917
NOTE.—Run-off for period of Nov. 16 to 30, estimated as 1,788 acre feet.		Wheatland Res. No. 2 intermediate ditches below Two Rivers	45,709
	106,600		106,600

Monthly Discharge of Laramie River at Pioneer Dam, Near Woods, Wyoming, in Acre Feet.

	1912.	1913.	Means for 12 months.
January	.....	2,650	2,650
February	.....	2,355	2,355
March	.....	3,296	3,296
April	5,534	12,674	9,104
May	40,643	38,307	39,475
June	91,874	26,598	59,236
July	34,863	6,825	20,844
August	7,809	3,130	5,470
September	4,641	3,023	3,832
October	6,456	3,812	5,134
November	4,403	(a) 3,930	4,166
December	2,644	.....	2,644
Total	198,867	106,600	158,206

(a) Nov. 16 to 30, run-off estimated.

These records secured by the Laramie Water Company, R. I. Meeker, Hydrographer, Nov. 20, 1913.

(COPY OF COMPLAINANT'S EXHIBIT J.)

Little Laramie River Run-off, 1912, 1913.

Run-off, 1912.	Acre feet.	Distribution.	Acre feet.
Little Laramie River at Hattie Supply Canal #2 Dam, near Filmore, Wyoming, plus volume diverted by Bellamy Canal. June 1 to Dec. 31	68,874	Bellamy Canal and James Lake Reservoir	24,793
	24,793	Hattie Supply Canal #2	14,053
	93,667	Ditches between #2 Dam and Two Rivers	17,245
		Wheatland Reservoir and intermediate ditches below Two Rivers	37,556
	93,667		93,667

Run-off, 1913.	Acre feet.	Distribution.	Acre feet.
Little Laramie River at Hattie Supply Canal #2 Dam, near Filmore, Wyo., plus volume diverted by Bellamy Canal. Jan. 1 to Nov. 30	46,051	Bellamy Canal & Lake James Res.	12,310
	12,310	Hattie Supply Canal #2, ditches between #2 Dam & Two Rivers	22,254
	58,361	Wheatland Reservoir & intermediate ditches below Two Rivers	23,797
	58,361		58,361

NOTE.—Nov. 16 to 30 run-off estimated as 600 acre feet.

Monthly Discharge of Little Laramie River at Hattie Supply Canal No. 2 Dam, Near Filmore, Wyoming, in Acre Feet.

	1912.	1913.	Means for 12 months.
January	.....	1,045	1,045
February	.....	1,000	1,000
March	.....	1,476	1,476
April	.....	3,909	3,909
May	.....	14,142	14,142
June	42,147	15,590	28,868
July	13,558	3,431	8,494
August	3,911	1,353	2,632
September	3,701	1,107	2,404
October	1,697	1,562	1,630
November	2,702	(a) 1,436	2,069
December	1,058	.....	1,058
Total	68,774	46,051	68,727

(a) Nov. 16 to 30 run-off estimated.

NOTE.—Run-off of Litttle Laramie River included and accounted for in storage tables of Laramie River Basin for 1912 and 1913.

R. I. M., Nov. 20, 1913.

(COPY OF COMPLAINANT'S EXHIBIT K.)

Laramie River Basin.

Résumé of Stored Water, 1912, 1913.

Wheatland Reservoir No. 2.

Storage.	Acre feet.	Storage.	Acre feet.
May 27, 1912	36,600	Nov. 18, 1912	43,000
May 27, 1913	67,700	Nov. 18, 1913	9,000±

NOTE.—1913, April 29, reservoir contained 76,000 acre feet.
1913, May 3, First run of water from Reservoir commenced.
1913, Sep. 28, Full storage commenced in Reservoir.
1912, Sep. 12, " " " " "

Wheatland Reservoir No. 1.

Storage.	Acre feet.	Storage.	Acre feet.
Spring, 1912	No record	Sep. 10, 1912	10,500(b)
Apr. 20, 1913	10,000(a)	Nov. 1, 1913	2,100

(a) Rough estimate W. S. 8.5 ft. below top of dam.
(b) " " " 2.2 " " H. W. line.

James Lake Reservoir.

Storage.	Acre feet.	Storage.	Acre feet.
July 17, 1912	G. H. 15.0—15,000	Nov. 25, 1912	G. H. 17.3—18,400
Apr. 25, 1913	G. H. 18.7—20,400	Oct. 30, 1913	G. H. 18.2—19,800

NOTE.—1912, storage from Little Laramie River commenced about April 21.
1812, storage from Little Laramie River ceased about August 3.
1913, April 19, storage run from Little Laramie River commenced.
1913, May 25, storage run from Little Laramie River ceased.

Lake Hattie Reservoir.

Storage.	Acre feet.	Storage.	Acre feet.
Apr. 8, 1912.....	0(a)	Nov. 20, 1912.....	18,700
Apr. 24, 1913.....	19,400	Nov. 5, 1913.....	26,000

(a) 1912, storage from Big Laramie River commenced April 8.
1912, storage from Little Laramie River commenced June 4.
1912, " " Big Laramie River ceased October 5 and December 26.
1912, " " Little Laramie River ceased August 10.

No water run from Reservoir in 1912.
1913, storage from Big Laramie River commenced April 25.
1913, storage from Big Laramie River ceased June 13.
No water diverted from Little Laramie River in 1913.
1913, First run of water from Lake Hattie Reservoir July 13.
No water run from Lake Hattie Reservoir after September 26 on account of failure of Bifurcation Works North and South Canals.

R. I. M., November 20, 1913.

(Copy of Complainant's Exhibit L.)

Laramie River Basin.

Summary 1912, 1913, *Storage.*

Water Held in Storage Nov. 20, 1912, 1913.

1912.

Wheatland Reservoir No. 2, Nov. 20.....	43,500	acre feet.
" " No. 1, Nov. 20.....	10,500(a)	acre feet.
James Lake Reservoir, Nov. 20.....	18,400	" "
Lake Hattie Reservoir, Nov. 20.....	18,700	" "
Total volume in storage.....	91,100	" "

(a) Approximate.

1913.

Wheatland Reservoir No. 2, Nov. 20.....	9,000 ±	acre feet.
" " No. 1, Nov. 20.....	3,000 ±	" "
James Lake Reservoir, Nov. 20.....	19,800	" "
Lake Hattie Reservoir, Nov. 20.....	26,000	" "
Total volume in storage.....	57,800	" "

Note.—37,100 acre feet of storage carried over from 1912 in James Lake and Lake Hattie Reservoirs, and included in the total volume of 57,800 acre feet on hand November 20, 1913. Therefore, only 20,700 acre feet of the 57,800 acre feet represent 1913 storage.

Note.—These Storage Tables include all storage in Laramie River Basin except North Laramie Basin.

R. I. M., Nov. 20, 1913.

(COPY OF COMPLAINANT'S EXHIBIT M.)

Relation of Run-off Laramie River at Glendevey and Woods Gauging Stations.

Values in Acre Feet.

Laramie River at Glendevey, Colorado.

Net Drainage Area, Seventy-five Square Miles.

	1911.	1912.	1913.	Mean.	Mean.
May	15,096	12,600	12,342	.....	13,346
June	29,151	32,300	11,495	.....	24,315
July	8,144	16,400	4,465	9,670	.....
Aug.	2,323	3,300	2,201	2,608	.....
Sep.	1,571	2,200	1,833	1,868	.....
				14,146	37,661

Laramie River Near Woods, Wyoming.

Net Drainage Area, Four Hundred Eighteen Square Miles.

	1911.	1912.	1913.	Mean.	Mean.
May	42,600	40,643	38,307	.....	40,517
June	58,100	91,874	26,598	.....	58,857
July	15,600	34,863	6,825	19,096	.....
August	7,190	7,809	3,130	6,043	.....
September	3,190	4,641	3,023	3,618	.....
				28,757	99,374

$\frac{14,146}{28,757}$ = 49% of run-off at Woods, Wyo., derived from water-shed above Glendevey, Colo., during July, August, and September.

$\frac{37,661}{99,374}$ = 38% of run-off at Woods, Wyo., derived from water-shed above Glendevey, Colo., during May and June.

NOTE.—Run-off at Woods, Wyo., for July, August, and September represents substantially the entire run-off of the Laramie River Basin except surplus from the Little Laramie River Basin in occasional years and inconsiderable amounts produced by summer freshets.

R. I. M., November 20, 1913.

Direct examination by Mr. N E. Corthell:

1035 Since preparing table B, showing the run-off of the Laramie River, I have completed it to Nov. 30th, 1913, from actual observations down to Nov. 15, and from Nov. 15 to Nov. 30 estimated.

Produced and offered in evidence as Exhibit I.

I have also prepared a table showing the run-off of the Little Laramie for 1912 and 1913.

1036 Produced and offered in evidence as Exhibit J.

I have also a table showing a resume of the stored water in the Laramie River basin in 1912 and 1913 in tabular form.

Produced and introduced in evidence. Exhibit K.

I also have prepared in tabular form a statement showing a summary of the water that was in storage Nov. 20th, 1912 and 1913.

Produced and offered in evidence, Exhibit L.

These tables are from my personal observations except as noted on the tables.

1037 I have also prepared a table showing the relation of Laramie River at Glendevey and Woods gauging stations. This is based on records at Glendevey, Colorado in 1911, 1912 and 1913, and near Woods, Wyoming, in 1911, and at the Pioneer Dam in 1912 and 1913. The records for 1912 and 1913 at Pioneer Dam are my own measurements and observations. The 1911 run-off at Woods is from U. S. Geological Survey which maintained that gauging station. The 1911 and 1912 run-off at Glendevey is from the 16th Biennial Report of the State Engineer of the State of Colorado. The 1913 run-off at Glendevey I obtained from the office of the State Engineer of Colorado.

Table produced and introduced in evidence as Exhibit M.

1038 The tributaries of the Laramie River from the Colorado State line to the Pioner Dam are Johnson, Beaver, Bear, Porter, Woods and Fox Creek-. From the Pioneer Dam to the mouth of the Little Laramie they are Sand, Five-Mile, Harney, Soldier, Spring and Flood-Water Creeks and Little Laramie River. From the mouth of the Little Laramie to the dam for Wyoming Development Reservoir No. 2 the tributaries are Four-Mile, Wolf-Canon, and Wall Rock Creeks. From the last named dam to the Wyoming Development Co. Tunnel Dam, the tributary is Lost Creek. From the Tunnel Dam to the mouth of the Laramie River the tributaries are Salt, Slate, Cooney, Leeman, Sybille, Dry Laramie, North Laramie and Chugwater Creeks.

The Little Laramie River is the chief affluent of the Laramie River between the Colorado Line and the mouth of the Laramie.

Johnson, Beaver and Fox Creeks contribute a small volume of run-off in April and May. North Laramie, Sybille and Chugwater

Creeks contribute intermittently. The other tributaries may contribute water a short time during times of heavy rains but are extemely flashy and the greater portion of the year produce no run-off that reaches the Laramie River.

1039 During July and August, 1913, the Water Commissioner of the Laramie River stopped the diversion of water by the pioneer Enlargement on account of shortage of water. The latter part of September the bifurcation works failed in the outlet canal in Lake Hattie Reservoir interrupting the use of water in Pioneer Canal and also in North Canal. A delay occurred in the spring of 1913 in the Pioneer Canal at the intersection with the South Canal. There was a delay during the shortage of water in the latter part of the summer of 1913 due to the construction of a drop at the point where the south Canal goes into the Laramie River. This construction prevented the turning out at an earlier date of the stored waters of Lake Hattie Reservoir for the benefit of irrigators below who were in need of water because the flow of the Laramie River was very low at that time. A cloud burst interrupted the diversion from Wheatland Reservoir No. 2 in 1913, but that was a matter of only a few days.

1040 The drainage area represented in the run-off at Glendevey, Exhibit M, contains but a few more square miles than the area tributary to the collecting canals and tunnel projected by the defendants. The difference is about eight square miles. The Collecting canals take the drainage from 67 square miles, out of the 75 square miles which furnish the run-off at Glendevey. These eight square miles are below the defendants' collecting canals and are chiefly bottom lands and valley lands. The run-off in that portion is small compared with that tributary to the collecting canals which take the cream of the drainage area of the headwaters of the Laramie River. It is the high mountains which produce this large annual precipitation in the form of snow fall. The annual run-off in an average year is approximately 1000 acre feet per square mile.

1041 I am acquainted with conditions and methods of irrigation in various parts of Colorado. The conditions and methods of irrigation in the following places in Colorado are very similar to those prevailing in the Laramie River valley; namely, along the South Platte River in South Park; lands along Costilla River in Northern New Mexico and Southern Colorado; meadow lands on the headwaters of the Arkansas; meadow lands on the headwaters of the Grand River in Middle Park.

1042 Agreed that a printed copy of Exhibit H be substituted for the original and with the same effect.

Certified copy of adjudication of Laramie River and its tributaries offered in evidence. Exhibit N.

By Mr. Farrar: Objection on behalf of Colorado and all defendants to introduction of decree, Exhibit N, because defendants were not directly or indirectly parties to the proceedings in which decree was granted and had no particular right or privilege of becoming parties

and had no notice of the proceedings wherein said decree was granted; because the findings and decree is as to this case,
1043 exparte, and in no wise binding on defendants or any of them; that same is incompetent, irrelevant and immaterial, and for the further reason that it appears from decree offered in evidence that same is not the final decree or adjudication relative to priorities of water on Laramie River and its tributaries, but, on the contrary, that an appeal has been taken therefrom and is now pending, and for the further reason that said decree, upon its face, adjudicates more than one water right for the same tracts of land and contains many inaccuracies and duplications.

Agreed that printed copy may be substituted for Exhibit N, subject to the same objections.

Certified copy adjudication water rights by Board of Control of State of Wyoming for priorities on Soldier Creek offered in evidence and marked Exhibit O.

Mr. Farrar: Same objection on behalf of defendants and each of them as made to Exhibit N.

1045 Cross-examination by Mr. Fred Farrar:

The tables shown on exhibit M embrace an irrigation period. The flow during remaining seven months of the year not given. Referring to note at foot of page, exhibit M, the runoff from other tributaries, below Woods Landing, except the Little Laramie, is almost negligible part of general run off of the year. Regardless of my judgment as to whether or not they are negligible or substantial, there are tributaries that do, aside from summer freshets, furnish a small supply to river. Not a considerable flow in Little Laramie at all times of year. Exhibit J is correct. The note says "occasional years," in reference to surplus from Little Laramie basin. In
1046 note, Exhibit M, referring to surplus from Little Laramie Basin, mean that in majority of years there is little runoff contributed, in occasional years of extreme precipitations there is a runoff. In that note, refer not to total runoff of Little Laramie river, but to runoff during months of May, June, July, August and September. The note on Exhibit J does not apply for May and June. It states: "For July, August and September." Did not say that those quantities shown on exhibit J for three months mentioned were negligible. Runoff from Little Laramie basin, except these months, is substantially represented by table in "M," except during occasional years.

1047 Note in exhibit M refers specifically to these three months and covered general conditions. You were not supposed to take any specific year and apply that note. Personally acquainted with Little Laramie and Big Laramie rivers only two years, but have referred to older records. The note on Exhibit M, taken in conjunction with exhibit J, should include other years. It is a general statement. The records referred to were Wyoming records at Two Rivers station on Little Laramie river. Some are published, others not. Some of earlier records, those for years 1909-'10, secured

by state engineer I think not published, were taken into consideration in forming my judgment of this stream. The entire records secured those years are ones referred to as not published. Do not know why they were not published. No hydrographic records
1048 published in those years. Tables for year 1913 at Glendever, Colorado, shown on exhibit M obtained from state engineer of Colorado,—were not the final data as prepared for publication; checked over rating curves with measurements I made sufficiently to indicate their general correctness, also inspected Bristol record charts and took off and checked some gauge heights. Charts were shown me by Mr. Field, state engineer of Colorado.

Referring to exhibit L, showing two storage quantities held over at end of seasons 1912 and 1913, in Lake Hattie on November 20, 1912, 18,700 acre feet is active storage capacity. There is dead water in Lake Hattie in addition. Passive or unavailable storage is not considered in any of those. True also of 1913. In arriving at these figures, in some instances, have allowed for inflow based on records, excepting Wheatland Reservoir No. 1 in 1912. Exact dates of observation are given on table K, and where they disagree with that, allowance has been made for inflow from records, also inflow considered as equalizing evaporation. Wheatland reservoir was entirely exhausted in 1913, and for a time inflow ran through the reservoir. There are times before irrigation season, or in early part of irrigation season, when inflow is greater than outflow. Object of table is to show average carried over at end of year. It is subject to this qualification, reservoir is practically constantly refilling, to a certain extent, inflow and outflow simultaneously. Before that water failed there was some water temporarily stored, but all used for direct irrigation this year. There may be a greater inflow than outflow at times. On note, Exhibit L, have included Wheatland reservoirs No. 2 and No. 1, James Lake and Lake Hattie as all the storage on Laramie river basin, except North Laramie basin, have omitted Creighton lake and Hutton lake and numerous small basins and lakes scattered throughout plains, because do not consider them reservoirs. The Creighton lakes, or Hutton lakes, have no inflow from Big Laramie. They may have some inflow from Antelope creek. There has always been water in those lakes. Know of no water flowing into these lakes from Sand creek or Little Laramie river in 1912 or '13. Did not hear testimony by Mr. Hardman relative to Sand Creek water. I also omitted the Sodergreen lake, which is a reservoir, but no water has been carried over in that reservoir from one year to another. It is an equalizing reservoir for the Pioneer canal for short period; not been used in 1912 and 1913 to carry storage from one year to another. Some waste water flows into Big Basin but it cannot be withdrawn. Do not
1051 know of it being put in intentionally. Cooper lake not included properly in Laramie river basin because no flow or outlet from that to Laramie river. Know of no water withdrawn for irrigation.

Referring to exhibit K, based estimated storage capacity of Wheatland reservoir upon capacity curve prepared from areas taken from

contour map in state engineer's office, Cheyenne. Have a blue print copy of it. Storage capacity of Wheatland reservoir No. 1 is based on total capacity of reservoir as published in one state engineer's report, and certain data secured from Mr. Elliott, superintendent Wyoming Development Company. Observations notes in reference to Wheatland reservoir No. 1 made by myself. Under notes A and B, determined the elevation of water surface. Referring to exhibit K, showing that no water was run from Lake Hattie reservoir after September 26, because of failure of certain work, will state, water was needed for lands under the Pioneer canal and also for stock and domestic purposes. Very little needed for irriga-
1052 tion after that date, mostly for stock and domestic purposes. Water was applied to lands under north canal on grass at that date. Was not there, but know that some was applied by Laramie Water Company. Have seen grass growing on the Laramie Plains as late as September 26. If fall is late and rains in September, it grows a good deal. Application of water in fall would help grass next year. If I stated this afternoon that no water was run to the Pioneer canal during July and August, 1913, was mistaken. were times when headgates at Pioneer dam were closed during those months, the only water that entered the canal was leakage through the gates of approximately two second feet; during those times water users were supplied temporarily from Sodergreen lake when there was water there, and largely from Lake Hattie through outlet canal. Gates were first closed on July 17, remained closed
1053 until morning of 22nd; again closed on 24th of July, remained closed until 30th; again closed on July 31, remained closed until August 5th; closed on August 10 and remained closed until 17th, inclusive, being opened some time on 18th; closed again on August 22, remained closed balance of month. Were opened on September 1st, closed on September 7, remaining closed until September 14th, and water was run then until September 29. This was done by order of water commissioner. Intermittent and regular opening and closing of gates permitted by water commissioner for temporary runs, to care for crops under Pioneer canal between Sodergreen lake and South canal. Some crops were suffering for water. That is above point of surface from Lake Hattie,—could not be served by any of existing canals from outlet. Pioneer canal itself that was closed. No water run into Lake Hattie through the Pioneer enlargement after June 13, 1913. That was date storage ceased. Order of water commissioner denied water from stream to appropriators of water under Pioneer canal. Pioneer canal not shut down previously since I have been here.
1054 Am informed it was short of water other years.

The water was shut out of Pioneer canal in 1913 because needed for Wheatland project. Wheatland reservoir was full this spring (1913), at the time we stored that water in Lake Hattie. No existing working agreement between Wheatland people and Lake Hattie people relative to storage and distribution of water during past year or two. No agreement for reciprocation to avoid contentions between ourselves during pendency of this cause. Considerable

antagonism between two companies last year and this. Noth-
1055 ing specifically evidencing this antagonism, other than ill-
feeling when I arrived on project, not generated while I was here, but hung over from other years. Recall that gates of Pioneer enlargement were closed in 1912 by Wheatland Company. As to whether or not it has been our plan during 1913 and earlier to follow decree of district court shown in Exhibit N, relative to distribution of water on Laramie river, would say that when I came here there was no distribution, no methed of measurement of waters diverted by the various canals up here, referring especially to Pioneer enlargement. I came here for the purpose of establishing gauges and measuring water, and to initiate and demonstrate the distribution of water. This has occurred only in a perfunctory way heretofore and we did try to work to those decrees this year.

Pioneer canal was shut down for benefit of Wheatland project, because the State Board of Control did not have a certified copy of last adjudication and it was necessary to go by tabulation published by state engineer's office of adjudicated rights on Laramie river, and that tabulation contains but a few second feet of the oldest rights of the Pioneer canal, which are prior to the Wheatland decree. The decree shown by Exhibit N has been signed and executed by the district court, but water commissioner takes instructions from state engineer and Board of Control and they didn't have copy of decree and went by the document they had. I wrote over in reference to that matter. The documents they had showed no rights in Pioneer canal, except a few earlier ones, which antedated the Wheatland rights. These particular earlier rights on Pioneer were not allowed to be supplied, headgates were closed. Action was taken by Laramie Water Company and appropriators of water under the Pioneer to secure rights which they were entitled to under decree of the court. I took the matter up with the water commissioner and also wrote the board of control and consulted Mr. Corthell, he took certain action. Did not succeed in getting certified copy to board of control. They refused to have copy made themselves; I made attempts to arrange it. Rather, I started to arrange for certified copy, but by that time it was so late we were able to use water from Lake Hattie reservoir, so we dropped the matter. I talked
with clerk of district court in Cheyenne about it. He said
1057 they didn't make copies until money was paid. He asked
$70 or $75. I went on advice of counsel. At any rate, certified copy was never procured. We lost water during short periods. Had all water needed in Lake Hattie for all land except above South Canal. Had no other use for that water except to irrigate Pioneer lands and those under North canal. We didn't use all water we had even for that. Lake Hattie reservoir designed
primarily to serve north canal and extension thereof as well
1058 as Pioneer. Referring to Exhibit J, cannot give amount of
irrigated lands from Little Laramie river above Fillmore and amount below and between there and the junction. Exhibit J, first table, gives distribution in 1912 of Boughton canal and Lake James reservoir, 24,793 acre feet; Lake Hattie supply canal No. 2,

14,053 acre feet, next item, Wheatland reservoir and intermediate ditches below Two Rivers, 37,556 acre feet; Do not know how much of that amount is distributed to intermediate ditches between Two Rivers and Wheatland. No records were kept. The third item, ditches between dam of Lake Hattie Supply Canal No. 2 and Two Rivers, amount 17,245 acre feet, is the difference between amount of water at Two Rivers station and amount at number 2 dam during months of May, June, July and August. Don't know actually amount of land irrigated by that amount of water, the decrease between Two Rivers and No. 2 dam is very close to 30,809 acre feet between No. 2 dam. The amount mentioned distributed to these ditches is not a correct measurement, it represents the loss between those stations from irrigation and there is a large re-use of that water. Mean that on meadow lands of Little Laramie river water is applied copiously to meadow lands and returns to river and is undoubtedly used several times between the two points. This process con-
1059 tinues indefinitely as long as water lasts. Same explanation would apply to table for distribution for year 1913 so far as covered.

Referring to third table on Exhibit J, have three columns of figures, first, the monthly discharge for June to December, inclusive, 1912, and from January to November 16, inclusive, 1913; the third column being labeled "Means for twelve months." Mean there based, in so far as months of January to May are concerned, entirely upon experience of 1913, because no other records. Have compared records of flow of water for a number of years on most streams in this vicinity. Am generally familiar with them. The flow for 1913 varies on different streams. On Little Laramie it was about sixty per cent of normal.

Table does not indicate correct mean flow of Little Laramie river at that point for a normal year. It shows on face that the mean is based entirely on experience for one year, so far as those five months are concerned.

Exhibit I, a similar tabulation to Exhibit J, applying to Big Laramie river instead of Little Laramie river, same explanation will apply, that is, the estimate of amount distributed to ditches between the Pioneer dam and Two Rivers during 1912, 29,872 acre feet, is determined by deducting from amount found at Pioneer dam the amount found at Two Rivers. On third table on that page, means for months of January, February and March, based entirely on experience for 1913, the only records on that point; for balance of months upon experience for years 1912 and 1913; except for December, 1913, have nothing to base my mean on except December 1912. On third column both Exhibits I and J, have used the expressions, "Means for twelve months," the idea was that means were shown for those periods for twelve months.

Testified that total drainage area of Laramie river down to a point at or near Glendevey, Colorado, was ninety-five square miles, but did not make a survey of area. It was taken from map of Laramie river basin prepared under my instructions. Data for its preparation taken from map in state engineer's office at Cheyenne also from map

of upper Laramie river in Bill of Complaint and two or three other maps that I don't recall. No survey made to determine actual area. Not customary to survey drainage areas to secure area of them, but use best maps, planimeter or best available information. If maps or data are incorrect, figures would be incorrect. Information was taken from map of Laramie river drainage basin in state engineer's office. Do not know by whom surveyed. Did not assume it to be correct but used other maps with it. These maps did not always coincide. Do not recall procedure in case of lack of coincidence. No survey made of land or drainage area tributary to Sky Line ditch of Water Supply and Storage Company which I testified amounted to fifteen square miles. Have been over portions of it. Same is true of area testified to as tributary to tunnel of Laramie-
1061 Poudre system.

Exhibit M notes that 49 per cent of runoff at Woods, Wyoming, during June, July and August derived from watershed above Glendevey, Colorado: is based upon totals shown in tabulations immediately above where records embraced 1911-'12 and '13, for months of July, August and September, and the totals are 14,146 acre feet and 28,757 acre feet respectively. Make no allowance for water diverted from river between Glendevey and Woods Landing. Water diverted along the Laramie river between these points would be put on narrow shoe string meadow lands and a large amount of it, or the greater portion of it, would return immediately to the river. My knowledge of water sheds as dealt with in these
1062 two notes last mentioned on exhibit M not of a personal nature, but derived from maps mentioned, together with these measurements.

Wheatland reservoir No. 2 was full on May 11, 1913. Also inflow into reservoir after that time for storage purposes. Do not remember how long inflow continued in excess of outflow. A flood, testified to, occurred after May 11, 1913, between reservoir dam and the
1063 diversion dam at mouth of tunnel, a matter of a few hours. It took out part of the dam and occurred chiefly below Wheatland reservoir No. 2. I was not there at time.

Cross-examination by Mr. Delph E. Carpenter:

In direct examination stated that precipitation above Glendevey reaches as high as forty inches per annum and over a greater portion of the area is greater than 24 inches; that annual runoff in average year is approximately 1,000 acre feet per square mile. Obtained that precipitation of 40 inches from knowledge of similar high, mountainous area where records have been secured in Colorado. At station at Corona on Moffat road, 11,666 feet, it varies from 40 to 50 inches. In very dry years it may be less than 40. I also obtained data on Cumbres station in southern Colorado, about 300 miles south of headwaters of Laramie river. Do not recall record at that station, something over 40 inches. Also at Crested Butte, Colorado. That precipitation was over 40 inches. There is station at Long's Peak, 8,700 feet, I think that has a precipitation of some-

thing like 22 inches, but that is too low down to consider in this matter. Statement is based on general knowledge of high mountains' runoff. Think it best data on which we have to work. No station maintained up there on high altitude that I know of. Know of no observations at Chambers Lake.

1065 In distribution of water, common matter for water commissioner at times to shut down ditches. Administrative distribution of water in Laramie valley in years past has been more or less perfunctory. My information of valley was obtained in past two years from being over it; other than that is hearsay.

1066 Believe it customary for water commissioner to regulate ditches according to priorities. That is his duty by law. I spoke of interruptions occasioned by fixing certain structures, etc. Not uncommon for ditches to have interruptions for repairs during irrigation seasons. No particular stress need be placed on that feature, only interruptions in 1913 prevented use of water when needed badly. Am familiar with irrigation in other sections of country. It frequently occurs that breaks in ditches or structures cause temporary shutting out of water; it is to be expected. Not important unless interruptions cover extended period. There have been water commissioners who regulated Laramie river ditches at times. Can't give dependable table of water commissioners. During time I have been here, have seen and talked with water commissioners and informed of distribution of water by them in former years. Believe records of division engineer will show data. Think have seen some documents and correspondence at times in reference to those matters.

Since Lake Hattie project was constructed there might have been a little water from Laramie in 1911, but primarily first water was run in 1912. I am hydrographer for Laramie Water Company.

1068 Not especially familiar with details of all structures of company. Have seen them more or less. Had nothing to do with designing or construction.

Know of permits under which system of Laramie Water Company was constructed. Not familiar with number of permit for Lake Hattie Supply canal, application for which was filed by Z. E. Seveson, but know he filed one, about April 21, 1908. Do not recall exact dates on these filings. Have been through them and am more or less acquainted with them, but cannot give exact dates or numbers. Have copies of all permits in my office, issued to Laramie Water Company.

Believe Lake Hattie system built under permits, starting with No. 8612, filed by Mr. Seveson, and succeeding permits, 8612 being first application and filed on or about April 21, 1908.

(Witness temporarily excused to obtain permits and returning testified as follows:)

(At previous dates and particularly on September 3 and 4, Witness asked to furnish certain tables, as shown by testimony of those dates, also certain data and information.) Am now able to furnish information referred to without objection.

Mr. Corthell: I have no objection to furnishing that data.

(Witness furnishes following:)

Exhibit 18, showing monthly discharges of Little Laramie at Fillmore and Hattie Supply Canal No. 2 dam; exhibit No. 19, a table showing discharge of Little Laramie at Dougherty's bridge; exhibit 20, a table showing Hattie Supply canal rating station 400 feet below headgate. (All of said three exhibits being for the year 1912, and the said exhibits being marked at time purely for identification.)

1070 Will produce other information requested as same is compiled.

Have in my possession various permits under which Laramie Water Company's water system has been constructed or is building.

Examination by Mr. N. E. Corthell:

Have had time to go over matter and ascertain if these are all the permits affecting system; do not need additional time.

Cross-examination (cont'd).

By Mr. Delph E. Carpenter:

The numbers of those permits are as follows: 8518, 8519, 8520, 8521, 8612, 8613, 10,363, 10,364, 10,365, 1331 reservoir; 1372 reservoir; 1373 reservoir; 1883 reservoir; 2051 reservoir; 2052 reservoir; 1939 enlargement; 2113 enlargement; 2538 enlargement; 11,016; 11,017; 11,018; 11,019; 11,020; 11,021 and 11,022. 11,016 to 11,022 are attached to 2538 enlargement; 2719 enlargement; 2720 enlargement.

1071 These permits issued by State Engineer's office, Cheyenne, Wyoming. Do not include any filings or claims of Laramie Water Company outside state of Wyoming. Do include permits issued by State Engineer's office of Wyoming. Construction not proceeding under all permits; cannot tell off-hand under which ones construction is being carried on. Some earlier permits merged in later ones through enlargements and otherwise I believe. Refer to some of earlier permits in series, as shown by earlier numbers, original filings. In addition, to above permits, there are six additional applications not approved by state engineer. The inclusive dates of filing of these applications for permits on each of these series of numbers given above are 8518, June 19, 1908; 10,365, December 12, 1910; 1331, reservoir, June 9, 1908; 2052 reservoir, December 5, 1910; 1939 enlargement, September 18, 1908; 2720 enlargement, July 11, 1912. These dates are dates applications were filed in State Engineer's office rather than dates of permits themselves.

Redirect examination by Mr. N. E. Corthell:

1072 In the note on Exhibit M referring to the surplus run-off from the Little Laramie River basin, this term is used to designate the run-off of the Little Laramie at Two Rivers, or the point where it joins the main stream.

On Exhibit J the 37,556 acre feet run-off in 1912 and the 23,797

acre feet in 1913 distributed to Wheatland Reservoir and intermediate ditches below Two Rivers includes the return.

As the winter 1911-1912 was very cold and severe I believe the run-off for January, February and March, 1912 was materially less than for the corresponding months of 1913.

1073 There is no material difference between my map, Exhibit G, showing the upper portion of the Laramie River drainage area and the map attached to defendants' answer.

H. R. INGHAM, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1074 I am in the grocery and hardware and ranch business. Live at Laramie, and have lived in the County since May, 1877. Have engaged in ranching on the Little Laramie, on the lower part of the stream, for 29 years. Was County Assessor in 1888, '89, '90 and '91. Have been acquainted with conditions along the Little Laramie for over 30 years.

1075 Outside of the tract irrigated from the James Lake system there has been increase of several sections in the area irrigated ten years ago. This increase is chiefly in the extension of old ditches. Could not swear whether or not any new ditches built from the stream below the Sprague lane in the last 13 years.

1076 The Carroll and Haley ditch is the latest one I can recall and that has been there for 15 years.

My ranch is in Sec. 19, Town. 17, Range 74.

Quite a change has taken place in the last 15 years in the lands irrigated from the Little Laramie East of the Sprague lane through the old ditches that were there 15 years ago.

Very nearly all of Sec. 23, Town. 17, R. 75 has been irrigated 25 years to my certain knowledge.

1077 Section 24 for 30 years. Hay has been cut on all but 125 acres of it. I cut hay there myself 17 years ago. The 125 acres have also been irrigated.

1078 At least 240 acres in Sec. 13 is irrigated land. Part of Sec. 25, T. 14, R. 75—nearly half of it, is irrigated land upon which hay is cut. I helped build a ditch there 29 years ago.

Section 26 has all been irrigated for 20 years.

The biggest half of Sec. 35 has been irrigated hay land for 20 years any way.

1079 About 125 acres in Sec. 36 has been irrigated for 29 years.

Practically all of Sec. 18, T. 17, R. 74 has been irrigated at least 26 years.

Section 19 has been irrigated for 29 years.

All but 25 or 30 acres has been irrigated so as to cut hay for 16 years. It took about three years to get it so it would cut hay.

1080 All of Sec. 29 but about 70 acres has been irrigated for 15 years.

In dry seasons we have not had water enough for that Section.

All of Section 20 has been under irrigation for 15 years.
The most of Sec. 16 has been irrigated for 15 or 16 years.
Section 17 has all been under irrigation for 25 or 30 years.
About 600 acres of Sec. 8 has been irrigated for 30 years.

1081 There is irrigation on Sec. 9, but I do not know the number of acres.

I know they have cut as high as 400 tons of hay on Secs. 1 and 2, T. 16, R. 75.

There has been for 15 or 16 years irrigation in Secs. 7, 8, 9 and 10, T. 16, R. 74, but I could not state the amount.

On the lands in which I am interested we have raised alfalfa, rye, oats, wheat, potatoes, turnips, etc., when we had water to raise it with.

1082 We have also raised native hay, of which we cut about 800 tons this year and would have cut more if we had had the water. Our crops have been successful when we have had the water to water them with. We have been short of water nearly every other year ever since I can remember. It all depends on the amount of snow in the mountains.

The soil in the valley of the Little Laramie is a sandy loam, very gravelly. In some places we get a soil which we call gumbo. This makes our best hay land when the grease wood is grubbed out. Our land would produce nothing without water. The longer it is irrigated the more it produces. Most of the crops raised are fed to live stock. There is more profit in it that way.

1083 We irrigate the native hay and cut it and put it in stacks and fence the stacks.

After cutting the hay we run our live stock on the hay land and pasture it and haul out hay and feed them.

We also irrigate land on which we do not cut hay. Wherever there is water it makes good pasture. That is fed off without cutting. That is the most profitable use to which we can put this land and crops.

1083 Cross-examination by Mr. Delph E. Carpenter:

My ranch on Little Laramie consists of sections 19, 30, 29, 33, part of 20, Tp. 17, R. 74; 200 acres in 24, Tp. 17 R. 75, also sections 3, 11 and 13 in Tp. 16, R. 74, called dry sections. Think we have 5,240 acres of land in the ranch, of which 2260 is hay land.

No measurement of hay we cut this year, estimated at 800
1084 to 900 tons. All native hay. Did not cut quite as much hay in 1912 as in 1913, because native hay gradually increased in area every year and gradually increased in production. As land is watered from year to year you get blue stem, next year fox tail and it takes three or four years to wear that out and then wire grass, the best hay. Requires three or four years heavy irrigation to wear that out. Fox tail won't stand water many years. Think we cut more hay this year than previous. Hard to give number of acres of irrigated pasture on ranch. Could not intelligently swear to it, because it is in little corners where waste water gets on it and makes good pasture land. We could support more cattle than

we have on ranch; could winter 1000 head if we had them. We run
from 500 to 700 head. Summer them between the rivers
1085 on high lands on open range. Cannot tell whether we get
the best value out of our hay and crops by use of these cattle
or not. They eat all our feed.

Did not raise any oats this year or last year. We farmed between 70 and 100 acres several years, and finally the water got so uncertain we stopped, because water went down last two crops during the irrigation season. During those two seasons we raised rye and oats principally, a little barley and few peas, just trying them out. Oats proved best crop to cultivate, next best was spring rye. Potatoes did not do very well, because water went down when irrigation was needed. Planted Early Rose and Early Ohio potatoes. Have
never been bothered with frost on grain or potatoes. Did
1086 not know potato vines froze down at Agricultural College,
Laramie, on July 30 or 31. Sometimes frost here and none there and sometimes a snowstorm out there only 12 miles away when sunshiny here. Have had snow storms out there in September. No serious frost in July to my knowledge. Have been here 37 years and think I have seen frost in July only twice. Have had only five or six acres of alfalfa on ranch. Estimated about three tons to acre
from two cuttings. Never weighed alfalfa. First year we
1087 were very proud of it and measured it under old Strode
rule, which prevailed among ranchmen; do not know what it is. Was told hay averaged three tons per acre; didn't measure it myself. I was at ranch almost every pleasant Sunday. They claimed we had five acres; never measured it. Continued to raise alfalfa until last three years. Haven't cut it for three years. Water has been so scarce last three years we have neglected to water it and used water where it would make hay. In 1902, irrigated same amount of land as today, but it was not all producing hay then.
Have three men to do irrigating.

1088 Keep water running as nearly as possible over whole tract while irrigating hay, it requires that on native hay. Run water until it stands over meadows in pools; have to because ground is so uneven. From distance meadow looks very smooth, but is uneven,—all the land is. Don't know any land in this country that is not. Meadow irrigation is entirely by flooding. We turn water off to dry up meadows about July 1st; some years turned off for us, all gone. In flush seasons, let it run to about July 5. As soon
as ground dries, haying until freezing weather. Takes week
1089 or ten days to dry sufficiently to cut.

On bottom land, went ten feet below surface for water in well. Would not have to go far to obtain water under Little Laramie valley lands.

Little Laramie divides into two channels, Brown creek and Little Laramie proper through our portion of the valley. Channels unite again above Two Rivers; run about a mile apart for about nine
miles. Land between these two branches practically all
1090 meadow land. When I came were prairie. Ties floated down
stream; tie drives in spring, along in June, when water

highest. Land on ranch in Little Laramie valley is gravel,
1091 that is, sandy loam. Have two groups of ranch buildings. Besides hired man, there are seldom less than six persons living on ranch throughout year. Income of ranch is derived entirely from profit from handling cattle and horses, principally cattle. Run 65 to 160 head of horses; handled practically the same we do our cattle.

1092 Sold grain from ranch only one year. Requires our hay and pasture to carry stock through each winter. Rarely sell hay.

From 29 years' experience, have found this only profitable method on this ranch. Feed our stock on ranch from about middle of October for about eight months. Have lands for summer pasture, sections 33, 11, 13 and 3, and two leased sections open and used by everyone. Never start in winter without at least a ton of hay to the head. Don't consider it safe, from my 29 years' experience, to go into winter with less. Wouldn't borrow money to buy cattle unless we had that much hay. Cattle put on pasture land
1093 when brought in in fall; as this gets short, we feed hay. Little Laramie valley proper from my place up to Centennial is, generally speaking, a stock and hay country. Our rance is irrigated from Carroll and Alsop ditches. Also own some interest in Murphy ditch. We are down near lower end of Little Laramie river. Shortage of water has occurred nearly every other year for about twenty-nine years, depending on snow in mountains. Called on water commissioner to find water in 1911 and 1909, and
1084 about fifteen or twenty years ago we had a squabble there but could get nothing. Generally speaking, water commissioner does not regulate our headgate because no water. Can walk up and down stream without wetting your shoes some years. Don't think state engineer ever measured it when it was running, I would be surprised if shown that water runs every month out of mouth of Little Laramie at Two Rivers, I don't think it does. In spite of shortage of water, it seems that they have let people go
1095 ahead and build large irrigation works taking water from Little Laramie river. Lake Hattie people have built inlet from Little Laramie river to Lake Hattie. They have not been diverting water this year; can not say as to last year. The James Lake people built a large canal. Have heard they have been diverting water ever since 1909. Never tried to get water down from new projects, nor to have the water commissioner close down Lake Hattie inlet. No measuring weirs at heads of our ditches. Our dams are of rock, manure and brush. So far as I know, that is character of dams up and down Little Laramie. Poles and the like of that. Don't think irrigators have had more than needed in spite of fact each irrigator has been accustomed to helping
1096 himself.

No official going up and down stream regulating headgates and measuring out water to various consumers to my knowledge.

Banford and Craydon lived on sections 1, 2 and 12, Tp. 16, R. 75 near Big Basin. Irrigated and raised hay. Heard Banford say he

had 350 or 400 tons of hay. I think this year he said he had a hundred and fifty or two hundred tons. Didn't have enough water. All native hay. He is engaged in stock business same as rest of us. I don't know how many head of cattle he supports on ranch. Some hay is cut on sections 7, 8, 9 and 10, Tp. 16 R. 74, never measured it. Know only by seeing hay stacks and seeing him at work when we were haying. Has been irrigated ever since I can remember. Don't know from what ditch. Section 23, Tp. 17, R. 75 has been irrigated for 25 years. May not be all meadow, but is all irrigated. Am guessing that about 240 acres irrigated on Sec. 13, Tp. 17, R. 75 W. Greater portion lies on upland and north of Laramie Valley. On Sec. 31, Tp. 17, R. 74, only very small patch irrigated. On Sec. 30, Tp. 17, R. 74, all except about thirty acres has been irrigated. Carroll lake takes quite an acreage there. I count that as pretty well irrigated land. Of course, it does not produce crops. There is seepage lake northeast of Caroll lake. It dry-s up as soon as irrigation is ended. Not all Sec. 29 is irrigated meadow land. Some of it taken up with ponds. About half section 29 cut over this year.
1099 Balance was used for pasture. Some land formerly plowed not cultivated this year. Just part of Sec. 16 irrigated. About 120 acres on Sec. 18 can be irrigated. Have been ranching there for 29 years. If there is water for new projects, should be water for older ranches, but do not know reason we don't get it.

Redirect examination by Mr. John D. Clark:

1101 I think the Laramie Water Company purchased Sec. 16, T. 17, R. 74, from the State this year.

EDWARD HICKS, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1102 I live in Laramie. Have lived in Albany County 26 years. Was engaged in Ranching on the Middle fork of the Little Laramie River for 25 years up to last spring. I handled stock and raised hay and sold a good deal of hay. I had 837 acres of land and irrigated from the Middle Fork principally. Raised hay
1103 principally. I am acquainted with the irrigation on the North Fork, the South Fork and the Middle Fork of the Little Laramie, and also on the Little Laramie itself for three or four miles down below where the forks come together. The amount of land irrigated there on these streams is about the same as it has been for 15 or 20 years,—very little change in the last 20 years.
1104 Think there are only two new ditches that have been taken out in the last 10 years, one by Charlie Anderson which irrigates 160 acres and one by Dwight Smith which irrigates 80 acres. With that exception the present irrigation has continued since 1888. The crop raised is principally native hay, and a few small patches of grain, and some irrigated pasturage. The hay and pasturage is chiefly fed to live stock. That is a profitable way to use it. The people make their living that way.

1105 Cross-examination by Mr. Delph E. Carpenter:

Sold my ranch to Walter G. Decker, who used to live on Big Laramie river in Colorado, is a son-in-law of Oscar Sodergreen. Principally all of the 837 acres is irrigated except we have no water right for probably 90 acres. Lands I own are in sections 1, 2, and 35, Tps. 14 and 15, R. 78, bordering stream in mountain valley. Country back of valley is mountainous. Land that I and other ranchmen irrigate in that vicinity is narrow river bottom along stream. Irrigate through Hayes and Bird ditch, C. W. Hicks ditch and Hicks ditch No. 2. Bird brothers owned lower and upper Bird ditches. Now Mr. Geddes owns them. Irrigated about 400 acres sec. 35, from Hayes and Bird ditch. All native hay land. Irrigated 160 acres from C. W. Hicks' ditch. Sold forty acres, leaving 120 acres at time I sold out. Irrigated full 160 acres;
1107 native hay meadow land. Irrigated eighty acres, section 35 from Spring Creek ditch, native hay; about 140 acres from Hicks' ditch No. 2 in section 1, Tp. 14, R. 78; all pasturage. By 837 acres I mean that is what I owned and irrigated when I sold to Decker.

Cut between 400 and 500 tons of hay on the full 837 acres of irrigated land. Did not cut all over it.

Never ran many cattle, probably not over 150 on average. About 50 head of horses. Used ranch to support that stock. Made
1108 my living that way. Never ran my stock off ranch. Just my family and I lived there. It took this ranch to support my stock and family. Sold considerable hay. Sold 100 to 200 tons a year of late years. Bought land at different times. Shipped hay to different people, some to man in Cheyenne, some up in hills, hauled it up there.

Mr. Walbol at present also interested in Hayes and Bird ditch. believe John Bird has 40 acres under that ditch. Walbol must have 300 acres under it and Bird 40 besides my ranch. I have
1109 water right in Hecht ditch also. The ditch comes out of Spring Creek. Eighty acres under that ditch all native hay land. Hay from that eighty part of amount mentioned and 80 was figured in 837 given.

1110 Usually turned water into ditches about middle of May. When ready to irrigate, we opened ditches and turned water in and onto land; did not ask permission of water commissioner, simply took what we wanted. There was water there for us. Kept water running more or less constantly over meadows which are along and parallel to creeks. North of middle fork, meadows extend as much as 2½ miles from river; on south side, probably 2 miles; watered from middle fork. Then south fork comes in and takes rest of valley. General fall of land was with course of river. Cus-
1111 tom was to keep water running constantly over meadows, keeping them wet all the time, in that way raised best crops of hay. Kept water in ditches until time for haying. Generally turned it off about July 10, but many ran later. My ranch—good hay ranch—produced better possibly than neighbors. Irrigation

water ran across meadows back immediately into stream from my place into South Fork. Sub-soil was gravel. Haying commenced July 25 to August 1. Employed twelve to thirteen men. In
1112 good weather, finished in three weeks. Two men to take care of ditches during irrigation. One man and self practically ran ranch excepting during haying. Haying nearly always through before last of August; bad weather sometimes delays us. If weather dry, meadows would dry in about a week after irrigation. Neighbor's land would dry sooner than mine.

Has no measuring weirs in ditch at headgate. We had no
1113 dams in the river; regulated water with rock dams and stone dams in head of ditches. Water commissioner up there two different times; Mr. Price was sent up four years ago. Mr. Jones 10 or 12 years ago, adjusting some ditches between a neighbor and myself; water was short. That was on Spring creek.

Hicks ditch No. 2 not built until 1900, one of later ditches in that community. Think commissioner did not regulate ditches on north, middle and south forks of Little Laramie river during time I was there. Spring creek was stream of smaller flow than other streams.

Native hay principally wire grass. Haying season commences about same time as in Laramie Plains. Mountain hay usually of superior quality to that of plains. Finer quality up above than it is below. Have held hay over when prices low. Usually
1115 fed this hay. Shippers prefer our hay to hay in valley. Best price I ever received was $11 a ton on the car, baled. It is worth $2 a ton to bale it and $1 a ton to load it on car from my place. Loaded it right on the ranch. Net about $8 a ton in stack. In first baling, no waste. Some later as stacks got damaged.
1116 We fed that portion. Have sold hay as low as $9 a ton, baled, on the car. That would be about $6 a ton net in stack. A ton of hay per head for winter is sufficient for cattle feed; seldom
1116 took a ton when good pasture. Used fields for roughage all winter. Horses run through winter on half a ton per head or less. If had all grown cattle, requirements would have been more than with the class of stock had. A calf will winter on about one-half a ton, will take one and one-half tons per head for a three year old steer in good condition. If not kept so well, less than a ton per head.

To sum up, used this ranch and its livestock as a means of making a livelihood for myself, wife and three children.

JOHN W. ERNEST, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

1117 I have been ranching since October 1898, on the Little Laramie River, about midway between its source and its mouth, in Township 16 in Ranges 75 and 76. We irrigated land for hay and pasturage and raised and fed horses and cattle from the fall of 1898 to the summer of 1909.

1118 I was and am familiar with several of the ranches and their condition. Am County Commissioner. The extent of irrigation on the stream now is practically the same as in 1898, outside of the James Lake and Lake Hattie systems, the additions since then not being more than 1500 to 1600 acres in the aggregate. The crops have been native hay, oats, barley, some potatoes and gardens.

1119 The Blackburn farm adjoins me. They have three sections of plowed land, and irrigate additional lands for pasture, and also some alfalfa.

The hay raised is fed to live stock or shipped out. Cattle are pastured on the irrigated meadows to quite an extent.

1120 There is now about 30% of the cattle, sheep and horses in the Little Laramie valley of what there was 15 years ago. Attempts to sell ranches for farms have not been successful.

Of the property in which I was interested there were 7680 acres; of this 6900 acres were irrigated. I cut 3000 tons of hay in good years and from that down to 1500 tons in dry years. The difference of production in the different years was caused by the lack of snow in the mountains,—lack of water. About half the time ever since I came we did not have enough water to make a full crop.

1121 Cross-examination by Mr. Delph E. Carpenter:

My method of irrigating in Little Laramie valley was to raise headgates and turn water into ditches and spread it around through laterals to carry it over land. Idea was to secure as large a head as possible so as to flood meadows. Practice general on Little Laramie. Can not pull big loads through and across valley during irrigation season except on county roads, crossing valley. Little

1122 Laramie divides into three or four channels below my place. Little short ditches are built along valley to carry waters out of channels onto meadows. Probably fifty ditches between Fillmore station and Two Rivers taking water from Little

1123 Laramie.

Blackburn ditch only one with measuring weir. Custom of appropriators to take water when wanted, as much as ditches would carry. Water from irrigation returned to stream and reused below. There were years we didn't have water to flood valley or irrigate it. From slight observation, would say we used a different method of irrigation from that of Poudre Valley in Colorado in Little Laramie valley. They were irrigating alfalfa and beets, different crops from ours, and so have to use different methods. On Box Elder creek near Fort Collins, they use our method. Generally our object is to run a large quantity of water over each meadow so as to cover ground with big head of water. The river

1124 (water) commissioner has appeared on Little Laramie River every time called on. He shut our Mammoth ditch headgate down in June 1901 for balance of season and several times during 1910 and 1912. Wouldn't say had river commissioner on river every year, but quite often. When Ingham and Pascal and some of them began making a fuss he would come up and shut our head-

gate down. Their ditches were junior to ours. I did not
1125 construct any ditches after I went there. Besides Lake James and Lake Hattie projects, Reed Ditch was built in 1900. Think Carrol and Ingham put in some little ditches and there were one or two built up above Filmore, between there and the May place. Don't know whether they were adjudicated or anything more than taking ditches across the road. No work of any extent done in the country since I came, outside Bellamy ditch and work done to run water down to Lake Hattie.

Attributed falling off in production of live stock to purchase of most ranches by speculators. Believe they did sell a lot of it, but the people they sold to didn't come out and settle and many that did went back again.

Little Laramie Valley is primarily a live stock country. My opinion is we should do some farming in connection with pro-
1126 duction of native hay and raising of live stock, to get best use of it. Lower meadows or first bottom should be strictly native hay ground. Some years when prices low, live stock business not profitable. The live stock industry is not now leading industry of Little Laramie Valley. They are growing hay and shipping it away.

This was good hay year, prices considered. General scarcity in Kansas and Nebraska has made exceptionally good prices. Heard they are getting $12 a ton for good native hay delivered at Laramie, baled, f. o. b. cars. Price of baling, $2 a ton. Cost of hauling to railroad depends on distance to be hauled. Net returns to ranchman probably from $9 a ton down, in the stack, this year. My large hay ranch used to cut from 3,000 tons down to 1500
1127 tons a year according to season. Never checked over to tell definitely number of acres cut, but think probably 4,000 acres. We had a larger yield per acre on that ranch than in average Big Laramie Valley, but think about the same as rest of Little Laramie Valley. Some places they planted timothy and got a larger yield than native hay.

I figure that three quarters of ton per acre per year about an average yield in good years on our best meadows; would be less in poor years. We sometimes sow timothy in native grass to increase yield; obtain best returns two years after seeding.

1128 Believe Basin Land & Livestock Company, our lessees, irrigated about 400 acres out of the 760 we owned on Seven Mile Creek. I sold it to that company in 1910. It was irrigated in 1909 from Boulder ditch. Don't know how long before that. I owned 6,920 acres on Little Laramie River. Of that about 6,500 acres was irrigated from following ditches: Hecht No. 1, Mammoth ditch, Hecht and Farrell, Blackwater, Slough No. 1 and No. 2, the Grow ditches No. 1 and No. 2, Jacks Ditch, and Corner Section No. 3 ditch, McKimmel and Garden, Grant Ditch No. 2, Grindstone ditch, and some other small ones.

1129 We irrigated about 6500 acres, but it didn't all get into heavy native hay during my time, but it would if continued to be watered from year to year. Would take several years to bring

it into a stand of grass yielding enough to cut for hay. We used that for pasture land. Never liked to cut anything for hay that yielded less than a half a ton to acre; did not pay. Had about 2500 acres irrigated land which I did not cut. Used all pasture for feed during winter months some years and on some years not. Had 1200 to 3600 head of cattle during winters, depending on what we were trying to do with them how much hay it took. Ordinarily a ton of hay per head would be enough for winter, but took more for full feeding for grown stock; younger animals less according to age and size. When I carried any stock over summer, it ran on ranges to north and south. First few years we had she-stock. After we sold them we bought steers and those that got fat enough to sell in the spring we sold off for beef on Denver market, others we carried over that summer on irrigated uplands and shipped them as they got in shape. Required about 40 pounds of hay per
1130 day for full grown animal to do that kind of feeding, more than a ton to head.

Many outside people bought hay and pasture. Usually measured hay in stack in the fall, and threw in pasture in fields and feed yards. Customary to allow 422 cubic feet per ton for native hay and 512 cubic feet per ton for alfalfa. When wintering cattle for stock purposes, we fed them through storms and grazed the rest of time. Turned cattle on meadows from outside range in October
1131 and turned them back on range again about May 10th. Some seasons we had to feed more hay than others. I never raised any alfalfa.

Did my utmost to get all revenue possible from ranch. Believe I obtained more revenue from ranch during that time than has ever been obtained since I sold it. Had 160 acres in grain and some garden patches, but not more than that, although there was lots of good upland not adapted to hay. Had more that could have been plowed if wanted. The grain yielded from 50 bushels down
1132 to 30 bushels oats per acre. Never planted anything but oats. Had some barley over home, never threshed, but stacked it for chickens. Never tried anything but oats. Some claimed barley was better, but never tried it. Raised oats for feeding my own stock. Think Blackburn people shipped oats and sold them around, but, generally ranchmen raised only what they wanted for their own use. The Blackburn place has been cultivated and farmed more than any other place in Little Laramie valley. This is place I always show to prospective purchasers, land buyers. Is our best exhibit. Think Colonel Bell started to plow that in 1900, but it had been plowed from looks of it some years before by old Douglas-Willand-Sartoris Company, but think Bell started this last exhibition up there in 1900. Same Colonel Bell who had many photographs taken of his crops; now deceased.

1133 They obtain two cuttings of alfalfa per year from Blackburn ranch; first cutting about end of June and last cutting about last of August or first of September.

Some new fences built since I came up here, but ranchmen have been using forest reserve in mountains for outside range more than

when I came up. Think there is as much open range as there was when I first came, taking it all in all.

Redirect examination by Mr. N. E. Corthell:

1134 The date of the priority of Mammoth Ditch is June 7, 1890. Priority of the Bellamy Ditch which irrigates the Blackburn ranch, Nov. 15, 1889.

The Haley ranch on the Big Laramie has about 70,000 acres, the Riverside on the same stream 32,000.

Recross-examination by Mr. Delph E. Carpenter:

1135 In spite of all efforts to colonize there has been considerable land sold, but very little actual settlement.

E. D. TITUS.

Direct examination by Mr. N. E. Corthell:

1136 I accompanied Mr. Meeker in all the inspection of the lands irrigated from the Little Laramie River and have examined the list of such lands, Exhibit E. I assisted in estimating the quantities. The table, Exhibit E, correctly describes the lands we found irrigated the present year. I have been acquainted with the region covered by these lands since 1876.

1137 Have been over it a great many times in different years. There is less land under irrigation this year, 1913, than there has been in years before. This is because land has changed hands and the parties that got it failed to irrigate this year. There has been a shortage of water in the last 20 years. The production of hay there has been large, from 18,000 to 20,000 tons maximum between the Fillmore Ranch and the mouth of the river.

1138 There have been extensive shipments of hay from there, and the production of hay there has been profitable.

I know of no ditches of size or importance taking water from the Little Laramie, that have been constructed within the last 15 years except the Lake Hattie and the Lake James ditches.

Cross-examination by Mr. Delph E. Carpenter:

1138 Meeker and I were out on days named on list, October 2, 3, 4, 7, 8, 9, 10 and 30. That was time consumed by Mr. Meeker and I in making a determination of acreage. No one else was with us except driver. Am acquainted with Ernest ranch. Can not tell amount of hay that ranch has produced one year with another. Have been over Ernest ranch number of times; put in dividing gates in their ditch known as Black Water ditch; never estimated amount of hay. It was one of largest ranches originally on Laramie River.

1139 Think Millbrook holdings at one time cut more hay than Ernest ranch. Besides two ranches, there were a number of small ranches between Filmore and mouth of Little Laramie.

Coughlin brothers had large ranch, they hauled lot of hay to Laramie and carried good many cattle. Was not as large as Ernest or Millbrook ranches. Webb ranch west and north of Coughlin
1140 ranch, not as large as Ernest ranch. John Reid ranch and Deerlove ranch were cutting hay below Filmore. Do not know acreage of any of those ranches. Have given practically all of ranches above Ernest ranch on Little Laramie. Alsop's ranch 25 years ago put up probably 500 tons of hay. Lands on that ranch are better now than they were then. Portion of that ranch is now owned by Mr. Ingham. Could not tell amount of hay Ingham ranch produced.

1141 Do not think more land under irrigation there now than 15 years ago. Is as good hay ranch now as then, if not better.

1142 Stickney ranch adjoins Ingham. Do not think it would cut as much hay. Do not know the owner of much of that land. Wasn't looking for production of hay on Meeker trip. Know country, but land has been changing hands in last 15 years up in that country. Could not tell you how much tonnage was produced on that ranch just mentioned. Know of other ranches, but can't tell names. There was old Jack Fee ranch and old Sprague
1143 ranch. Fee had about half a section right on the river, I cannot tell you hay produced 15 years ago. Think heard old man Sprague say about 20 years ago that he cut 500 tons of hay. Cannot remember acres he cut. Can't tell production of hay on Bath ranch. Think there were more than 500 acres irrigated in Sprague ranch. There was also Judson ranch just below Ernest ranch. Was quite a large ranch at one time; probably sold out now in smaller tracts.

1144 By smaller tracts I mean 160 acres to a section. Fleming ranch cut hay; been noted as a good hay ranch. Fleming ranch, as I knew it years ago, when Fleming owned it, would produce more total tons hay than Ingham ranch. It has been cut up and owned by a number of people. Part is now part of Bath ranch. In Bath holdings and Fleming lands there would be overlapping. The Al Bath ranch and the Fred Bath ranch over on south side and irrigated by Poverty Flat ditch. They produced hay when they owned it. Pastured much that was not cut. When land irrigated first in this country for a year or two get good hay and then comes fox tail; you have to get rid of that, drown it out, and then you get good hay, and about the time they began to get good hay they disposed of that land, or part of it. Banforth ranch located 15 years ago on west edge of Big Basin. Gardiner's ranch in there too. Are right south of the Ingham ranch. Should judge Bamforth had 200 tons of hay there two years ago. Gardiner ranch not as good as
1146 Bamforth ranch. Would not produce over one-third as much hay. Have named about all ranches producing hay 15 years ago. Probably some I don't remember. There is old Abrams ranch, just below Judson ranch, next to Ernest, was small ranch. 25 years ago saw at least 125 tons of hay on that ranch. It was not as good 15 years ago as it was then. 25 years ago Abrams was running ranch himself; has been in hands of renters since,

they don't irrigate as well as a man will himself. Phil Mantel ranch was producing hay 15 years ago. It now produces about 800 tons of hay. Do not think it produced that much 15 years ago.

1147 Would be startled if told that, judging from testimony of men who owned best of these ranches hay production in general has been over-estimated by me 100 per cent. I never measured that hay up and down the valley to learn amount produced. Am pretty fair judge of hay in stack, but never counted stacks in Little Laramie Valley; wasn't out to do that. In inspection of lands under irrigation on Little Laramie river and in driving over it in a car, made an estimate from different points of view, that there were between 16,000 and 20,000 tons of hay in valley. They are shipping hay now. A man can't help but size up stacks if

1148 he is interested in hay at all, when he goes by them. Did not note down each stack; only measured the stacks with my eye. Would say they would run from 10 to 60 tons per stack. Noticed uncommon large stacks on Judson ranch; guessed at amount in it. Could not change my rough estimate made of tonnage

1149 of hay in whole valley. When I described Little Laramie valley as immense in production, I had in mind, for comparison, hay lands of Big Laramie river. Irrigation has been attended to with better results in Little Laramie River than on Big Laramie.

Ernest ranch on Little Laramie River about same as lands under Dowling and Bilderback ditches on Big Laramie. If anything, Ernest ranch little the best in production per acre. Don't think any difference between Ernest ranch and Riverside ranch for hay production. Fifteen years ago, think Riverside ranch better acre for acre. Ernest ranch a good average of Little Laramie hay ranches. No ranch of same acreage to compare with it.

1150 Coughlin or Fleming ranches probably, acre for acre, little better. Little Laramie has been better hay producing country than Big Laramie; produced on average a little more to acre than Big Laramie.

Many ditches in Little Laramie valley below Filmore. Use streams and little ditches combined to keep diverting whole river as near as may be out over floor of valley. From north to south, valley, as a whole, is reasonably flat with a fall to east; about fall enough to permit good flooding, with lots of water. Requires

1151 lots of water, because Little Laramie Valley is cut with sloughs, old river channels, all over from east to west, showing there is lots of sand and gravel underneath the soil. Water soon finds its way through, and the next man below diverts it from dam and uses it again, and so on down. Evidently hay lands on Little Laramie are old river deposit. River separates into several channels.

Are headgates on Little Laramie ditches between Filmore and Two Rivers, but think no measuring weirs at head of ditches. I put in, about 12 years ago, weir dividing gates in Blackwater ditch, but know of no measuring weir at head of ditch; never was any. Same is true all down valley. Is common sight to see one of river

channels dammed up entirely and all water going out in ditches. In high water, which lasts a short time in June, practically don't need any ditches. It runs over banks which are low and out through old river channels; by a little help in them it does pretty good spreading. Meadows are largely naturally irrigated by overflow for short time, but not sufficient to make crop of hay. Is common sight for a short time, when irrigation is going on, to see various
1152 sloughs, or ancient water courses standing full of water and flowing from one to another across intervening higher lands, so, to a casual observer, it looks like a country filled with little lakes and sloughs. Has been practice for each man to take as much water as his ditch will carry, so as to spread it over land.

No large ditches taken out of Little Laramie during last 15 years, except canals of James Lake and Lake Hattie projects; not many new small ditches, although some ranches have changed diversion of water the better to distribute it. Mr. Ingham may have taken out two ditches during winter of 1903 and 1904, but didn't see any large ditches that looked different from 15 years ago. Mr. Jensen and A. L. and Annie Hall have taken out small ditches east of Sprague lane, don't cover very much land. All ditches mentioned are east of Sprague lane. Old Carrol and Alsop ditch carried bulk of water onto Ingham land. Mr. Bell built one small ditch here about five years ago. May be Mr. Brown took out a ditch
1153 since 1911. Ditches taken out by Carrie Porter in 1909 divert water from Little Laramie River above Filmore, taking supply that used to go down to lower valley.

Quite a demand for hay this year; considerable shipped out; price $12 a ton, I understand, f. o. b. cars, baled. Vendor has to pay for cost of baling and transportation from ranch to railroad and
1154 receives $12 a ton gross; costs about $1.75 to bale it and about same amount to haul and put it on cars. He receives about $8.50 net per ton in stack. Bigger demand for hay this year because of drouth in eastern Colorado and Kansas and Nebraska and eastern Wyoming. Did not include in estimate of hay tonnage that produced above Filmore on Little Laramie and tributaries. Feeding and raising of hay quite profitable. Phil Bath and Fred Bath have made profit during last twenty years. Bath left here number of years ago, I understood with $50,000 made in ranching on Little Laramie and came back and invested here again a few years
1155 ago. Old man Pulse made profit on part of old Milbrook ranch and near Ernest ranch. Jack Fee made money on Little Laramie; Carrol and Ingham also. Ingham interested also in mercantile business. Don't think Ernest made money. The people are fairly well to do. Don't think any of these ranchmen sold their lands, that I have mentioned. They have been buying a little more, buying out smaller ranchmen. Bath people engaged in raising cattle, horses and hay. Some ranchmen used open range in summer time.

Paid particular attention to way these men handled their stock: am interested in stock myself, horses especially. The plunging of speculators in these lands did not tend to raise estimate of values in

my mind. Gave what I considered actual value. Believe average value of native hay meadow in Little Laramie Valley is $40 per acre, based on what it will produce. It costs about $1.75 per ton to produce a ton of hay, including irrigation, cutting, stacking and putting in shape for baler.

A. W. AUSPURGER, a witness in behalf of the Complaint.

Direct examination by Mr. N. E. Corthell:

1157 I have been ranching on the Little Laramie River since 1907. Am interested in the Blackburn place, and Secretary and Treasurer of the owner, the Laramie Development
1158 Co. The Blackburn ranch is in Township 17, Range 76, and originally occupied 6400 acres. About 1200 acres have been sold off. About 640 acres are occupied by tenants. The Company itself cultivated 1000 to 1200 acres each year. Have raised wheat, oats, barley, rye, flax, potatoes, and some other crops.
1159 Have had as high as 300 acres of peas. We had sheep, horses and cattle. Our production would be about the same as it is in Colorado, Nebraska, Idaho and other parts of Wyoming.
1160 As near as I can judge, Mr. Meeker's statement, Exhibit E, is correct so far as relates to the Blackburn properties. We had from 600 to 1000 cattle. We pastured them chiefly on irrigated land that was not cultivated.

1161 Cross-examination by Mr. Delph E. Carpenter.

Came to Laramie directly from East, August, 1907. Have had direct supervision of this farm all this time. No farming experience in Colorado or Nebraska. Business in Illinois was buying grain. Was raised on farm in Illinois near Bloomington. In Iowa I bought grain, also supervisor of a farm in Iowa for at least three years.

Blackburn ranch is irrigated by ditch known by three names, Bellamy, Loback and Loback extension. Can't remember
1162 amount oats produced in 1908 or subsequent years; have no records. Have no records of exact acreage for this year, merely approximate acreage figured up from time to time, but this year not as close because a good deal of land was sold, and I don't know exact acreage different people had out. Can tell approximately amount company had cut this last year. Have to trust entirely to my memory. This year company had 135 acres of oats. About 70 acres on S. ½ of N.E. ¼ Sec. 26; about 30 acres on N.E. ¼ Sec. 34; about 25 or 30 acres in S.W. ¼ of Sec. 24.
1163 Company owns threshing machine, operated under my direction. The 70 acre tract of oats this year threshed 2382 bushels by machine measure, and we allowed a ten per cent deduction from actual machine measurements. We wanted to
1164 give farmers good measure. Test weights out there showed about that result. 30 acre field in section 34, new ground; estimate about 750 bushels.

Think Mr. Moreland had about 3200 (2828) bushels oats machine measure. Allowance of ten per cent over would be proper there. Tests on this allowance showed it correct. In arriving at this conclusion, they measure out a certain number of bushels by machine and then weigh it. Standard weight was 32 pounds to bushel.

1165 Mr. L. B. Penton purchased S. E. ¼ of Sec. 26 from company; had approximately 140 acres oats in 1913, a little wheat, five acres perhaps. As I remember, he had a yield of 4300 (3966) bushels, approximately, threshed by machine measure. In other words, to get production in bushels, at 32 pounds per bushel, I take the machine measurement and add ten per cent. Don't know what his wheat threshed, but it was poor on account of freezing out. He had a very thin stand and his wheat was sown in November last year, winter wheat.

1166 Mr. L. H. Humphreys, a tenant of company on N. W. ¼ Sec. 35 had about 120 acres of oats.

M. M. Smith, a tenant, has about 130 acres oats, which threshed approximately 4,000 bushels, as near as I remember.

Will procure exact figures later.

(After recess).

1167 Mr. Wessell had two pieces of oats; total yield was 3,083 bushels. From the four or five acres on section 24, threshed approximately 136 bushels. Threshed 2828 bushels of grain for Mr. Moreland, grain raised by himself. This figure 2828 bushels should go in place of my estimate previously made of 3200 bushels.

1168 All machine measured. My record for Penton property, S. E. ¼ Sec. 26 is 3,966 bushels oats and 55 bushels wheat. Presume made same allowance for machine measure of wheat. Records show Humphrey property threshed 3,293 bushels oats. M. M. Smith oats threshed 4,075 bushels, both fields. Mr. Moreland's tenant threshed 3297 bushels. Company also threshed 852½ bushels oats from 30 acres in N. E. ¼ Sec. 34. These are all oats threshed by our machine on Blackburn ranch this year.

1169 Had two small patches of potatoes, possibly an acre, on Blackburn ranch in 1913 for home consumption. Had no barley in 1913, no spelts, planted a few peas, but did no good; few acres macaroni spring wheat, don't know yield. In 1913 had about 4 acres alfalfa, also about 30 acres seeded on Blackburn ranch

1170 this year in addition. A tenant of company raised some flax this year, production, estimated, 5 and 6 bushels to acre, threshed 152 bushels machine measure. Have found oats best crop to sell.

Company have something like 1,000 or 1,200 acres of cultivated land. Can not give net returns to company. When company was farming on large scale, were practically feeding everything they raised. Had gross returns, 1909, from 70 acres that sold as high as $54.20 per acre. Received about $2 per hundred for 85 bushels of oats to acre. In 1912 our yields were exceptionally light, chiefly on account of unfavorable weather in September. Grain was badly

logged by snow storm, September 13, as I remember. We threshed, 1911, on S. E. ¼ Sec. 26, from 145 acres, 8,287 bushels of grain; above average; some other grains besides oats. Some barley. Acreage was estimated. Poorest field that year, as I remember, was about 30 bushels to acre, but I can not give that absolutely. Crop was oats. Up to time we sold these lands, used what I con-
1172 sidered good farming methods. Object was to sell the land.

Redirect examination by Mr. N. E. Corthell:

1172 The yield from our cultivated land this year was about 50% of that in 1909; about 50% of that in 1911; and about 75% of the best yields in 1910. This year, leaving out a few small fields, we had 27114 bushels.

Redirect examination by Mr. N. E. Corthel:

Included, in this 27,114 bushels production from a field called Chrystal ranch, which had 2603 bushels, in addition to fields mentioned. That field was on N. W. ¼ and S. W. ¼ Sec. 29, and on part of section 30. All in oats. Estimate the acreage at
1173 from 100 to 120. One field of grain was badly damaged by cattle.

Redirect examination by Mr. N. E. Corthell:

During time we have been farming Blackburn property we have been breaking up 50 to 100 acres new land from year to year and putting it in cultivation. The results given include production on new as well as old land, all average results.

1174 Recross-examination by Mr. Delph E. Carpenter:

Could not give gross expenses or gross returns of ranch each year.

1175 Complainants' Exhibit F, a letter mailed by Clarence T. Johnson, State Engineer of Wyoming, September 16, 1909, to D. A. Camfield and S. H. Shields, president and secretary, respectively, of The Laramie Poudre Reservoirs & Irrigation Company, and to the president, secretary and board of directors of The Greeley Poudre Irrigation District, offered in evidence subject to objection on ground that the same is immaterial and irrelevant, and upon the further understanding that said letter is offered and urged, not as competent evidence to establish any of the statements of fact or conclusions of law therein set forth, but that the letter is offered solely for the purpose of proving that such a letter was mailed and received and for no other purpose, and particularly not for the purpose of establishing any of the facts or statements therein made.

(*Copy of Complainant's Exhibit F.*)

The State of Wyoming.
Engineer's Office.
Cheyenne.

Clarence T. Johnston, State Engineer.
Harry A. Patten, Assistant Engineer.
Ralph D. Goodrich, Deputy Engineer.

CHEYENNE, WYO., Sept 15th, 1909.

DEAR SIR: Realizing fully the complications which arise after construction has been undertaken and money invested in an irrigation project where the water supply is inadequate, we are taking this opportunity to notify you that the water of the Big Laramie River and tributaries is fully appropriated in the State of Wyoming.

The adjudication of the Big Laramie River discloses the fact that at the time these proceedings were concluded by the Board of Control, 89,561.47 acres of land were irrigated from the main stream in 1903. Under the state law and established beneficial use, these lands require 1,286.95 cu. ft. per second; or estimating the irrigation at 120 days 300,000 acre ft. per annum.

At the time the adjudication proceedings were in progress much construction was under way and rights had then been initiated which could not be established under the general determination.

The records of this office indicate that construction is under way or completed since 1903, for the reclamation of 100,000 acres of land in addition to the area now enjoying adjudicated rights. This land will require 2 acre feet per annum and it would be impossible to serve the entire tract, if it were not that there is a certain volume of return water, because all of the use proposed is along the valley of the river.

Any further diversion of the waters of the Laramie River for use in irrigation outside of the drainage area of the stream would injure Wyoming appropriators. The State of Wyoming, with the proper Government authorities, has maintained measurements on the Laramie River for a long term of years. There are many years when the flow of the stream has been wholly inadequate for the Wyoming lands under ditch, except through the utilization of large volume of stored water. Reservoirs have already been constructed which store 130,000 acre feet of water from the Laramie River in Wyoming. Reservoirs are under construction which will store 75,000 acre feet in addition. When these reservoirs are completed, they will have sufficient capacity to store all the waters of the Laramie River during the season of minimum flow, and to reclaim all of the lands under these reservoir systems, it will be necessary to store water and hold it from one year to another, if we are to develop stable agricultural communities.

In addition to the area having water rights from the main Laramie River in Wyoming, an equal area is not supplied from the

tributaries of that stream. These are largely independent of the main stream, hence they are not made a part of this discussion.

You are doubtless familiar with conditions on Sand Creek a tributary of the Laramie River which has its source in Colorado. Several years ago an attempt was made to divert the waters of Sand Creek in Colorado, without regard to the rights of prior appropriators in Wyoming. Wyoming water users immediately secured an injunction in the United State Courts against this proceeding.

A diversion from the Laramie River, such as is contemplated, would ruin Albany County and Northern Laramie County as agricultural districts. The State of Wyoming will therefore encourage every move to protect the water users and to protect the interests of the State along this stream. This office is in close touch with the water users and this letter is written to assure you that should a diversion as is contemplated, be attempted, resorts must be had to the United States Courts for protection.

This letter is written in advance of construction, so that there may be no excuse advanced in the future as to ignorance relating to prior rights to use the waters of Laramie River in this state.

Sincerely yours,

CLARENCE T. JOHNSTON,
State Engineer.

M. C. BROWN, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1176 I am 70 years old. Lawyer. Have lived at Laramie most of the time for the last 45 years, and during that time have been familiar with the irrigation and agricultural development and history of this part of the country, particularly within the Laramie River basin.

1177 I have been engaged in ranching in the '70s and other times, some 8 or 10 years. I was on the Big Laramie at Hutton's place and Alsop's place in 1868, and in the same year was on the Little Laramie at Phil Mandel's place. Hutton was then irrigating quite a considerable meadow between his place and Fort Saunders. Alsop and Mandel were irrigating small tracts. When it was discovered that hay could be increased by putting water on the land, irrigation increased.

1178 When the cattle business became important in 1873 and '74 the valley lands along the Laramie River between Laramie and Burg's place, about 30 miles was generally fenced, and a considerable portion was under irrigation. At one time I estimated the land under irrigation on the Big Laramie up to 1873 was 5000 acres.

The first large irrigation project was the Pioneer Canal begun in 1879, and water turned through in 1880. In 1880 that was completed down to a point opposite Laramie. In 1884 the capacity of the ditch was enlarged and irrigation became more general.

The next large ditch was the Boughton Ditch, constructed in the early '80s and later the Oasis. Smaller ditches were taken out by

ranchmen along the Big and Little Laramies for hay throughout the '80s.

1179 I visited the Fort Collins region in Colorado in 1870 or '71. There was a little irrigation there then in a primitive way, like that in Wyoming. Also at Greeley, Colo. about the same time irrigation was begun in the same way on a small scale. Men did not then know how to use the water, and their efforts for a few years amounted to little.

The early irrigation which I saw in California, Montana, Oregon and Washington was similar, experimental.

1180 The first irrigation in Idaho was in the Boise valley and was likewise primitive.

From these simple beginnings irrigation has grown into great importance everywhere in the arid country.

The ditches constructed and in use in later years are altogether different. The first ones were small and dug to the stream so as to catch the high water. As years went on and more water was taken out they found these old ditches high and dry and had to dig ditches anew.

1181 I was ranching at the junction of the Big and Little Laramie about 1870 or '71. The irrigation development took place from 1870 up to now, but was chiefly prior to 1900. The increase since 1900 has not been large. There are some large projects under construction on Rock Creek. I also know of the James Lake and Laramie Water Company and Denver Laramie Realty Company projects.

1182 Rock Creek is not a tributary of the Laramie, but runs into the Platte.

I have frequently traveled over Wyoming, and become familiar with its irrigation projects.

1183 I was in California from 1860 to '62, then in Oregon, Washington and Idaho. The irrigation in all these states then was practically the same. It was experimental and very primitive.

1184 The irrigation in California and Colorado has since become quite extensive. The irrigation in Washington is not as extensive as in Wyoming.

The progress of irrigation in the Laramie Valley has been about the same as in the other states mentioned.

Very little was ever grown in the Laramie Valley without irrigation. Some little hay was cut before, but irrigation has increased it many hundred fold.

1185 As men found they could grow crops, the population increased. If the irrigation were withdrawn the valley would return to the same conditions as existed before there were any settlements here.

1186 Cross-examination by Mr. Delph E. Carpenter:

When toward Fort Collins in 1870 did not visit valley of Boulder Creek and Platte River valley between Denver and South Platte

cañon. First time I passed up Platte Valley and through Greeley was soon after railroad was completed from Denver to Cheyenne. Know nothing of early development on either Boulder creek or Big or Little Thompson creeks, or South Platte Valley above Denver until time I speak of. From Evans, of course, into Denver, was easy to observe condition of irrigation through that country in passing. If there were flour mills in that section of the country as early as 1868, on Boulder Creek and South Platte river above Denver, I did not know it. My acquaintance with irrigation prior to that time was mostly north and west of Wyoming and in Wyoming. When I spoke of many hundred-fold increase in production by irrigation, referred to irrigation of lands prior to that time wholly arid. Much same sort of lands that are now used for grazing in this section. Meadow lands differ in quality somewhat from the rolling lands and those on the second table. Meadow lands are mostly an alluvial soil along river bottoms. Prior to irrigation they would have been
1187 classed as grazing land. If it were possible to wholly withdraw irrigation from Laramie River Valley, meadows would return to primitive condition, grazing land. You might as well turn them over to the Indians, I think. Perhaps my opinions are somewhat strong on that subject, but I think that if conservation conditions had been practiced in this country in 1850 as practiced now, this whole country west of Missouri River would have been practically in hands of Indians yet. These conservationists would have had no basis for their argument had it not been for the fact that long before they dreamed of such a thing, the whole country had been largely developed. It is undoubtedly a fact that these same conservationists are largely claiming credit for development that they never heard of or thought of at the time it took place. My own opinion is that conservation has not increased development to any extent, but retarded it, conservation as practiced by our general government. The great development of the country has unquestionably come about through the individual effort of the settler or the efforts of a community of settlers.

Have observed climatic conditions of Laramie Plains and
1188 Wheatland section for number of years. Think seasons for growth in Wheatland are trifle longer than along Laramie Plains. At Fort Collins seasons are very much longer than in Laramie valley, both in latitude and altitude. Growing season in Laramie valley is comparatively short. Certain crops can be grown as abundantly in Laramie valley as anywhere else, but they are crops that are grown rapidly. Grain of some kinds grows in Laramie Valley abundantly. Think I have seen larger returns in oat crop in Laramie valley than I ever saw anywhere else. Doubt whether we could count on a crop of over 35 or 40 bushels of wheat to acre. In oats 115 and 120 bushels to acre have been grown. Barley and rye grow successfully. Peas grow very successfully. Alfalfa has a fair growth, not as large as you get in Colorado.

Redirect examination by Mr. N. E. Corthell:

Interested in cultivation of apples here in my yard in Laramie

City. Have been successful in cultivating apples here in a small way. Have a few trees in my yard and have grown apples very abundantly of their kind, for ten or fifteen years.

1189 Recross-examination by Mr. Delph E. Carpenter:

The variety grown by me is Transcendent Crab, an apple of very rapid growth, maturing fairly early and growing very abundantly. Have had to prop my trees up every year to keep them from breaking down. Mr. Ivison, right across the way from me, grows an abundant kind of apples. Very few people in this section that grow apples. Mr. Lund on Laramie river has an acre or two, in apple trees that bear bountifully,—nice apples. Mr. Ivison, in his yard right across street from me grows a regular apple every year. I have never tried that. Only experiment I have made has been with crab apples. In 1913 I gathered from one tree over 300 pounds of apples. Was a good apple year for variety of apples that I grow. 1912 was just about the same. Apple trees bloom the early part of May. I harvest my Transcendent crabs about first of October.

GUY H. DAYTON, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1191 I have been deputy county assessor for Albany County off and on for about 9 years.

The total assessed valuation for the County for 1913 is $15,307,-848.89.

There were 2,925 taxpayers in the Laramie Drainage basin in Albany County in that year.

The number of land owners assessed for taxation in the basin and outside of the City of Laramie in 1908 was 778. In 1913 it was 1178.

1192 The market value of the lands in the Laramie River drainage basin in Albany County at the present time is $9,500,-000.00.

According to the United States census the population of that basin in Albany County in 1910 was 10,317.

1192 Cross-examination by Mr. Delph E. Carpenter:

Last figure includes population of Laramie, a trifle over 8,000 inhabitants. Ascertained population of Laramie river basin in Albany county by taking poll books for years 1910 and 1912, found number of votes cast for congressman, and number of people living outside boundaries of this drainage basin and prorated it. Used poll books for basis of getting proportion of population in Laramie River basin as compared with population of whole county. First con-

1193 nected with the assessor's office in 1904 or '5. State Board of Equalization fixed assessment on railroads, car lines, telephone and telegraph lines and all public utilities. Our law calls for actual values as the basis of assessment on real estate. There are

808,056 acres of assessed land in entire Laramie River basin.
1194 Assessed valuation per acre in 1913 on average in Laramie River basin was approximately $4.52, inclusive of improvements.

The total assessed valuation of property, Albany County, 1913, is $15,307,848.89. Assessed valuation of railroads and other public utilities for 1913 in Albany County, fixed by State Board of Equalization, was $5,114,040.89. Assessed valuation of all property in the city of Laramie for 1913 is $4,138,763. Assessed valuation of property in other towns and municipalities in Albany county as follows: Town of Wyoming, $5,435; Centennial, $825 for lots and $3,250 for improvements; Bosler, $11,760, improvements, $4,445. Rock River $32,305. This major figure of $15,307,848.89 includes improvements. The total live stock valuation is $1,370,996. Deducting the total values that I have just given you from the original figures of $15,307,848.89, it leaves $4,626,029. The value of all other personal property in Albany county, other than live stock, is $1,275,887. The valuation for 1913 of all lands in Albany
1195 county outside of city property and town lots, is $4,126,990. Now, in addition, I presume there is some property sold for taxes, not appearing in the 1913 valuation, the property sold for taxes is $56,040. Valuation of all lands outside of city property and town lots, would accordingly be $4,183,030. Figure of $4,626,029 formerly given is nowhere near valuation, because, as we talked before, on account of corporate property of town of Laramie being in that derivative figures of $4,626,029, given by me, do not really represent any significant result, owing to the method by which this result was reached, figures which were taken to make it up in several cases including duplications.

Value of all improvements on all lands in Albany county outside of city and town lots is $626,085. These improvements consist of fencing, buildings, reservoirs, and canals. Land figures represent naked land without any improvements. We classify our lands into seven classes: cultivated, uncultivated, grazing land, coal lands, timber lands, mineral lands and mineral reservations belonging with grazing lands. Cultivated lands include lands plowed
1196 and which have grown crops. Uncultivated lands are meadow lands. Grazing lands, just common grazing lands and irrigated grazing lands. These three classes, cultivated, uncultivated and grazing, subdivided on assessment schedule but not on assessment roll. The standard valuation on cultivated land is from $22 to $25 per acre, according to locality. The lands of Mr. N. E. Corthell are classified as town lots and assessed at $35 to $36 per acre. Valuation of meadow lands varies from $15 to $25 an acre, according to location and proximity to town of Laramie, productivity and other things. We never use it, but it is understood that there are first, second and third classes of meadow lands. We have a basis of figuring production of hay per acre on meadow land. If it
1197 produces over three-fourths of a ton of hay, it is first class meadow land and so on down. Valuations on grazing land runs from $1.25 to $10 per acre. Irrigated grazing land is assessed

from $5 to $10 an acre. Lands between what we term the two Rivers, are assessed at $3 per acre, that is, the native grazing land. The northern part of county is assessed at $2 an acre, and grazing land in the hills is assessed at from $1.25 to $1.75. Only two tracts in county assessed at $1.25 per acre.

There are 1,114,903 acres of land assessed in entire county; 9,899 acres cultivated land, 53,543 acres uncultivated land, 1,044,092 acres grazing land, 80 acres coal land, 1,570 acres timber land, 5,712 acres mineral land. 545,912 acres of mineral reservation. The latter is just the mineral reservation on land sold by Union Pacific Railroad and is included in areas of other classifications. Figures of mineral reservation land are really duplication of figures
1198 in other classes.

The 808,056 acres assessed land in Laramie River basin are classified as follows: cultivated lands, 7,078 acres, valuation, $153,670; uncultivated lands, 46,488 acres, $887,314; grazing land, 745,502 acres, $2,168,581. In addition there is the property sold for taxes, cultivated lands, 98 acres, $1,670; uncultivated lands, 590 acres, $8,850; grazing lands, 8,300 acres $45,520.

When I spoke of number of land owners in county in 1908 and 1913 I referred to taxpayers. I might explain that in 1908 a man owning land in different school districts was assessed in one
1199 school district, when the law was changed in 1909 they were assessed in all school districts, so that a man who owns land in one or more school districts is termed a taxpayer in each district. Did not make a deduction of duplications in this way in arriving at my figures of 1178 land owners in 1913. That figure includes the duplication. If a man owned land and paid taxes in three school districts, his name would appear three times. Stated that there was an increase of 400 land owners between 1908 and 1913. Increase was obtained partly by adding some 65 or 70 names where lands sold for taxes, that have been added to the others. This figure, 1,178, includes duplications and also owners whose land was sold for
1200 taxes. The figures 778 for 1908 do not include any duplications.

Redirect examination by Mr. N. E. Corthell:

1200 The assessed value of the lands is about 70% of the market value. The improvements are assessed separately from the lands. The assessment for improvements does not include irrigating ditches, except those that are common carriers, such as Pioneer Canal and Wheatland Company, which are separate from ownership of land.

1201 Recross-examination by Mr. Delph E. Carpenter:

Irrigation ditches and reservoirs, connected directly with land as appurtenances, as in case where a farmer or rancher has a private ditch, are assessed and taxed with the land. The fact that these lands have these ditches and reservoirs appurtenant to them gives to the land its increased valuation. In figuring valuations of culti-

vated and uncultivated land and irrigated pasture, both land and water-rights are included in term lands. On irrigated pasture land, ditches, reservoirs and water-rights connected with the lands give an additional valuation as compared with grazing lands without water-rights.

Assessed valuation of lands actually equals 70 per cent of real valuation. The law requires assessment for actual value.

1202 The market valuation of $9,500,000 for lands in Laramie River basin in Albany county does not represent assessed valuation. It is 43 per cent above assessed valuation. That assessed valuation includes lands, lots and improvements on lands, and lots within drainage basin. The method stated was the sole method of arriving at my figures as to actual market value.

ROBERT J. COWPER, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1203 I have lived on Soldier Creek, a tributary of the Laramie River for 20 years. 1185 acres of land are irrigated from Soldier Creek. These appropriations were all made between 1870 and 1889.

1204 The flow of the stream is 2½ feet. Practically no water from that stream has run into the Laramie River during the years I have lived there.

1204 Cross-examination by Mr. Delph E. Carpenter:

By 2½ feet, I meant 2½ cubic feet per second. Call that constant normal flow of that creek. It comes mostly from springs. The fish hatchery is located at upper end at the springs. There are strips of land along creek that are irrigated.

ASMUS FRANZEN, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell.

1205 I have lived in Albany County 20 years and just across the line in Carbon County 5 years additional. I worked on the Boughton Ditch cleaning it out and repairing it in 1889. We irrigated from that ditch in 1889. We plowed up quite a little land and put in oats under the ditch.

1206 The ditch irrigating the Ghost ranch came out of the Boughton Ditch on Sec. 27 and ran up into Sections 21, 22 and 16. It took in all up to the river. Part of it was used on the Willan land.

1207 The water all came out of the Boughton Ditch. Besides that all the land was irrigated down to the lake and over to the bluff. All that was irrigated in 1889. The amount irrigated from that ditch in 1889 was the same as that irrigated now. I sowed about 150 acres of that land in oats in 1889 and the oats was a good crop when I left in July.

1208 There was also 800 tons of hay raised there that year. I have seen 1200 tons of hay cut there. The crops and hay

were produced by irrigation. The land would not produce hay without irrigation.

Cross-examination.

By Mr. Delph E. Carpenter:

I left that year before harvest of oats. Can't tell you how many years after that they raised oats on the place; according to my idea, they plowed up 500 or 600 acres and put it in timothy. Three years later was there for a few days, and they had all that timothy there. They put it in oats first and then in timothy. In this country if not reseeded, timothy naturally dies and land goes into wild hay again. Frequency reseeding required depends somewhat on soil. Have seen ground, for instance, this rich soil on Shell Creek on Goetz ranch, hold out well, but at Bosler it gives out in about 5 or 6 years if not reseeded. They allowed timothy to be substituted
1209 by wire grass. Perhaps wire grass better than timothy. Ranch used many years for native hay. Is best adapted to raising native hay. Have seen as high as 1200 tons of hay on that ranch, in 1908.

The irrigation went down towards the lake. Water from Boughton ditch wasted off meadow and snow and made that lake. Cannot tell number acres of hay meadow on ranch, probably over 1,000 acres. I quit before close of irrigation season. During irrigation, had eight or nine men with me for a while. Do not know
1210 yield of oats produced, it was a good crop. I sowed it all by hand. They didn't have any seeders those days. Am now ranching at Rock River.

JACOB HERBST, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell.

1210 I have lived in Albany County, Wyo., since 1884. Engaged in ranching and riding on the Laramie Plains. I know the Boughton Ranch. Worked there from 1897 until 1911.

1211 Helped fix ditches up, built dams, etc. All the land under the ditch was irrigated then. The water flowed generally in a westerly direction from the main ditch. We grew some alfalfa and oats besides hay; 75 to 100 tons of alfalfa on 40 to 50 acres.

1212 About 65 to 85 acres of oats. The crops were fairly successful, nothing extra. Also raised native hay every year. The ranch was a cattle ranch.

Sometimes after the water was all out of the mountains we had to dam up the river to get out more water. Generally we had enough. We had a dam in the river, and during the time I worked there changed the location of the dam to a point a mile further up the river than the old dam.

1213 The old dam was crib and rock. At the new one they piled sand bags in the river when it got low so as to turn the water into the headgate.

1213 Cross-examination.

By Mr. Delph E. Carpenter:

During years I worked on ranch I cut from 900 to 1200 tons hay. Can not give number acres. We turned cattle off meadow about first of May, so as to get the water on. Started haying July 20. We would turn water off just about a week before cutting.

The water in river here is cold water, terribly cold on an average. Mountain trout live in our ditches and go out on meadows.

I did not use over two men irrigating hay; on grain we had two or three. The meadows were irrigated by flooding. The water formed a waste lake at northwest part of ranch. Don't know whether lake formed before ditch was built or afterwards, but water wasted into it each year. Always water there since I knew the lake. It covers more than 300 acres, and has no outlet. It is located a little to the west of end of ditch. Is used as a wasteway for the ditch, a natural course runs down into lake. Water flowing from meadows naturally runs into lake. Some knolls next the river not irrigated.

Should judge meadow does not extend quite a mile from ditch. The farthest lateral did not extend quite a mile away from ditch.

Don't think meadow extended over a mile in the furthest
1216 place from main ditch. Hay was cut on a strip about two and a half miles long.

We tried oats about four seasons, sometimes more, sometimes less.

The first year we got a snow storm just before harvest and
1217 didn't succeed very well. The second year we got about 3,000 or 3,200 bushels; had about 85 acres. The third year didn't have much. The fourth year we didn't seed at all, just volunteer oats which we cut with a mower. Don't think we raised any more oats after that.

Alfalfa mentioned was on south side of grain, north of buildings. The grain was three miles north of the house. We had about 40 or 50 acres of alfalfa. It got thinner every year, and was losing out, didn't have a good stand. It cut about 75 or 80 tons both cuttings. We got two cuttings.

In all these years, outside of these crops of oats and alfalfa, the ranch was used for native hay. That is its best use. We could have cut some more, had greasewood and sagebrush been removed from places. They added a little more each year. Boughton ditch is a pretty good sized ditch. I understood first dam washed away. It was second dam when I started to work there. We moved ditch up the river about five years ago, because we were bothered by wash outs more or less. Bottom of old ditch was about 14 inches above

bottom of river. After head of ditch was moved up stream,
1219 did not have any more trouble while I was there. We got water right along.

During haying we worked from 19 to 25 men. We kept six machines in field, on an average, sometimes less and sometimes more, according to the season. It took five weeks to put up the hay if we had good weather. We never had our hay hurt by frost down

there. It is a little lower there than it is here, further away from the hills, and naturally milder.

Place used as livestock ranch during those years. Cattle were run principally on open range during the summer, and in pasture. We had three large pastures, can not say how many thousand acres we had pastures, but it was a big ranch.

1220 Redirect examination.

By Mr. N. E. Corthell:

1220 We used through the Boughton ditch all the water it would carry. We pastured cattle on the meadows in winter from about December until the first of May at the latest. They used to run there about 4500 head of cattle.

Recross-examination.

By Mr. Delph E. Carpenter:

They turned strong cattle onto range in April. This 4500 head included stock cattle and all. They raised them to four years of age before shipping. They started feeding hay to poorer
1221 cattle about Christmas and after ground was covered so cattle could not get any grass in meadow, they were all fed. The whole ranch was used for wintering of stock.

WILLIAM S. INGHAM, a witness in behalf of the Complainant.

Direct-examination by Mr. N. E. Corthell.

1221 I have lived in Albany County, Wyoming, 26 years. Ranched at the Boughton Ranch from July, 1886, to the winter of 1894.

1222 I assisted in irrigating from the Boughton Ditch. The main ditch was completed when I went there and for the next 8 years we were extending laterals and completing the irrigation system. It was almost but not quite completed while I was there. There were still possibilities of bringing a small amount of additional land under the ditches. I think practically all the land susceptible of irrigation from the ditch has been irrigated. The crops grown while I was there were principally native hay; some years considerable oats, and once some alfalfa.

1223 The alfalfa was in 1889 or 1890. They turned 6,000 cattle on it the year it was put in and this destroyed it. The cattle were Douglas-Willan-Sartoris cattle. The oats grown for several different years were from 100 to 200 acres. The crops of oats were good. When I first went there they cut only about 200 tons per year of native hay but the year I left it had mounted up to about 1300 tons. Before irrigation from the Boughton ditch, that ranch produced native grasses, sage brush and grease wood.

1224 Not more than 50 to 60 acres of the land without irrigation would produce hay.

The irrigated area on that ranch when I left was about the same as now, about 7,000 acres.

1224 Cross-examination by Mr. Delph E. Carpenter:

I think the acreage irrigated under Boughton Ditch would run up to 7,000 acres.

WILLIAM L. AYRES, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1225 I have been farming since 1895 under the irrigation system of the Wyoming Development Company, near Wheatland. I have 860 acres. There have been years when we were a little short of water. That has also occurred since the completion of the large reservoir on the Laramie Plains known as Reservoir No. 2. There have only been one or two years that the farmers had all the water they wanted. We were short this year.

1226 Last year we got along fairly well, though there were a good many complaints about the water last year. The lands of my neighbors take more water than mine. Some of mine is sub-irrigated. With that exception I use about the same amount of water as they do. They are using it to the best advantage they know how. We usually feel the shortage in the last irrigation of alfalfa, the last of August and first of September.

There have been several years they have had to sectionalize—give one lateral water for three days, and then change to another section for three days.

1227 Cross-examination by Mr. Charles F. Tew.

I have nothing to do with methods of carrying water from Wheatland reservoir to Wheatland land. Water used under system about Wheatland comes almost entirely from Laramie river through the reservoir and the tunnel into Blue Grass and then into Sybille creek. We also have a little supply of water from Sybille Creek. The water is discharged from Wheatland reservoir into Laramie river again, then through tunnel into Blue Grass. A man is stationed at diversion dam in the river most of season to keep it calked. Calking has been required on a number of occasions.

1228 Sometimes condition of dam has affected the flow of water so much that dam had to be calked. I lived near Wheatland. The reservoir is about 40 miles from where I live. A range of mountains lies between me and the reservoir; the same range lies between me and this diversion dam at head of tunnel. I have been at dam quite often; have heard frequently that the dam was leaking. That had nothing to do with our shortage of water, they calked that, as a rule, the first thing in the spring. Lara-

1229 mie river flows along north of Wheatland tract. If dam had been leaking the people in that vicinity would have noticed it. There are a few ranches on the river below the dam, but most

of water there raises below the dam. Mountains mentioned are known as the Laramie Range. The Cooney Hills lie between me and the mountains. The dam that requires calking is at the upper end of tunnel. It water was not diverted from stream by the
1230 dam it would go on down Laramie River to the north. These waters are turned by the dam, when it is in good shape, through a tunnel into Blue Grass Creek, which is on east side of Laramie range. It then passes down Blue Grass Creek. From Blue Grass it is discharged into Sybille, then down Sybille about a mile or more, and is diverted into No. 1 Ditch. Below there is Ditch No. 3. Have made a good many trips up to the tunnel with par-
1231 ties with my auto. Used to make it with a team quite often. I have the only car that has been through there except one. The dam stops the entire flow of the river at times. My car registers 15 miles from the dam in the canon to the reservoir. I never had anything to do with filling reservoir.

We aim to commence irrigation about the first of May, on the hay meadows up above, and continue until water plays out as a rule. The country under the Wyoming Development Company project near Wheatland is a different character of farming from that up in the Laramie Plains. Wheatland has lower eleva-
1232 tion and is better fitted for culture of agricultural crops. Along the river above Wheatland, the old places were nearly all hay ranches, but they have been opening up a lot of farming around Laramie City, raising some grain the last two years. We usually raise pretty good crops of wheat, oats, alfalfa, barley, a few potatoes and some beets at Wheatland. New land is broken out each year in that district. I have 860 acres. I farm that
1233 myself; have a couple of Mexicans living there now on one place, but otherwise I run it with hired help. Have several houses on the property. All of this land is broken. I have 860 acres of deeded land of my own, and my brother has 100 acres in with me. I have had 500 acres in alfalfa last 4 or 5 years, but have been breaking up some old alfalfa and reseeding. Have
1234 about 160 acres that has been in alfalfa 8 or 9 years. The Wheatland tract is becoming more devoted to the culture of alfalfa but a few years ago it was nearly all grain. In irrigating we have to flood all our ground except what sub-irrigates. Sometimes there is ample water and not distributing capacity in the ditches to meet the desires of all who want to irrigate at the same time. If they had sufficient capacity to give all all they want they would have the water in the reservoir down in 30 days.
1235 Shortage of water is the usual complaint in every irrigating country. My country no exception to the rule. Some of our farmers needed more water in 1913. Part of them got three cuttings of alfalfa, and part but two. Some lands that take more water than others. You can use too much water on certain lands. There are some such lands within Wheatland territory. The grain crop in Wheatland district 1913 not as good as in some other
1236 years, due to hot weather we had, but we did not have water to give it, as we should have given it, in the hot weather.

The cause of shortage depends somewhat on land. It depends on many circumstances. Weather conditions and so on, and all sorts of theories are advanced for these shortages. The same is true in our country as in any other. It takes two good waterings to make a grain crop in our community. Some do not go over their crops a second time, and some water three times. Most of our grain is of the spring variety. We generally commence irrigating grain about June 1 to June 15, it varies, sometimes we don't get our grain sown until the first of June. June and July is
1237 when we give it the two irrigations. The average farmer usually finishes the first irrigation of grain in June; the second irrigation in July; although at times we irrigate grain
1238 after the first of August. The heavy flow of water in Laramie river and Sybille creek begins about May 20. Before we had any reservoirs we figured our river water that had to do all our irrigating between May 20 and July 1, because the water fell after first of July. During this period there was a considerable flow in the stream. The heavy flow of water in the Laramie and the Sybille varies somewhere between May 1 and July 10.

Winter grain is irrigated earlier than spring grain. Outside of spring grains, I think alfalfa occupies the greatest area. It is pretty nearly half and half, I should judge. The grain and alfalfa constitute the greatest portion of the irrigated area. About as many acres devoted to the culture of sugar beets this year as last. Last year less than preceding year. In 1910 they put in more beets, but were discouraged because of shortage of water.

1239 I think they estimate about 30,000 acres of tilled land under the Wheatland project. In 1912 we had more water
1240 than in 1913. Every user got water all summer. In 1913 the users got water, but not all the time. Many users didn't get water for the third crop of alfalfa. In 1911 the water was short and a number of farmers did not irrigate in the fall. There was plenty of water in 1909. The grain was pretty fair in 1911. Most of the irrigators got over their grain twice. We irrigated
1241 it practically continuously from somewhere in the middle of May to the first of July, but there was lots of it needed water later. They were probably irrigating hay between the two waterings of grain. We get water started in the ditch from May 1 to May 10, as a rule, and continue until we haven't any more water. However, they shut the water down at times and hold it for beets and potatoes. If they have the water, they continue to run it straight through the season. I think the ditch was shut down for two
1242 weeks the first of September, 1913. The ditch was running pretty well in 1913, until that date. That covers the irrigation season rather well, but there were some who didn't get through. In 1912 they did not shut the water down entirely, but they shut us off for grain and allowed it for beets and potatoes. I think there was water running in the ditches all the time. I think they were short of water in September, 1911. Part of
1243 my land does not require much water, and I am not half as particular about my water as others are. A lot of my land

is sub-irrigated from seepage. I suppose the seepage comes from the ditch. There are a few patches in the area that don't use much water, but the majority of them use all the water they can get, and call for more, late in the fall. In June and July they have about all they can take care of, I believe. Everybody has plenty. They irrigate wheat, oats and alfalfa. That is the time we are doing our heaviest irrigation. During the time we are irrigating the grain of all kinds and the alfalfa we have plenty of water. The cails
1244 for more water come late in the season. We have lots of late grains needing late water.

The delivery of water from the reservoir is under the supervision of the manager, and under him are certain superintendents, or ditch riders. If water is short they have to shut it off and hold it until they need it the worst. In 1910 there was ample water for
1245 the crops from May until July 1. There were complain-s in August. In 1909 we had all the water we needed and some left over in the reservoir. In that year the ditch ran full all summer and a considerable quantity of water passed down the river north of Laramie; for over six weeks the water ran down the river in very large quantities.

1246 In 1909 I was at the diversion dam at the upper end of the tunnel. They took the boards out of the spillway and water ran down the river. There was a big head of water going down for a month anyway. The reservoir was full that year and we didn't empty it. The water ran over the spillway of the reservoir, while the gates of the reservoir were wide open. I should judge that condition continued for three or four weeks. I think we had a little better crop that year than since. There may be a little more acreage in crop the last two years than before. Don't know that there are any larger yields. I think other years were about as good
1247 in crop production as 1909. It seems to me there was one other year when water went over the dam that we didn't use, but could not say what year that was. There could not have been more than two years in which we had the reservoir full. I
1248 think the dam in the river will divert nearly all the water in the river going through the gates of the reservoir. I have not been in charge of the reservoir or those gates. Outside of the
1249 years 1907 and 1909 I don't think there has been a year but there has been some complaint of shortage. Some farmers cut alfalfa only twice, some of mine is cut three times. During this time I have been continuously irrigating and growing a very similar acreage of wheat and grain. The crops have turned out a good deal better some years than others, like any farming country. We have had very good crops there right along, of course I will tell you the better farming they do the better crops they get.

Cross-examination by Mr. Fred Farrar:

I own this 860 acres. There is 640 acres I think that all joins at the corners. It is six miles south of Wheatland. I have 80 acres four miles northwest of my home place. The 200 acres that my brother and I own together is a mile and a half east.

Fall grain is generally ready to cut in the Wheatland area about July 15 to August 1. We very seldom commence cutting fall grain before July 15; spring grain runs from August 1 to October 1, usually ready for cutting about August 10 to September 10. Many persons in the Wheatland tract secure only two cuttings of alfalfa. There are more who get only two crops than there are who get three. I have been familiar with the irrigation there since the farmers first started. On most of the land there I don't see but what it takes just about as much water now as it did at first. Of course, there is some of the land that lays through the valley that does not take so much water. It depends on what the sub-soil is. On an
average through the original Wheatland tract I don't think it
1252 takes as much water to irrigate the land now as it did in the
earlier years. My lands on the original Wheatland tract were formerly owned by The Wyoming Development Company. My source of supply is mainly the Laramie River, supplemented by storage water in Wheatland Reservoir No. 2. I don't get any water out of Reservoir No. 1. The lands generally get water from No. 1 also.

To the south of the original Wheatland tract there is a second tract known as the Bordeaux tract, consisting of about 10,000 or 13,000 acres. In a northwesterly direction there is another tract known as the Sybille or Cooney Hill tract. I think they claim
something like 15,000 acres in there. At any rate it is quite
1253 a large tract. I know there is a small amount irrigated under
the Bordeaux tract and none under the Cooney Hill tract. These two tracts in their entirety are to be irrigated from this same system of irrigation which is used for the original tract. They are running water through the Bordeaux tract. I don't think they have run any water through the Cooney Hill tract. As far as I know, all of the acreage in the Sybille tract if it be 30,000 acres and the acreage in the Bordeaux tract, if it be 10,000 acres or more, will be added to the number of acres of irrigated land under this system of reservoirs and ditches. As a matter of fact there is no other place from which they can get the water.

I have from 200 to 300 acres of land that is sub-irrigated. By sub-irrigation I mean that the land is saturated with water from some other source than by the direct application of water to it, it is wetter now than it is in the summer time. In other words, the
water has seeped through the land. It is land that lays in
1255 a little valley or draw, and the water ditch hits it two miles
south of it. The seeped area does not seem to be increasing. I don't consider it a favorable condition to have my land seeping that way.

Cros-examination by Mr. Delph E. Carpenter:

I testified that there was a shortage of water in 1910, '11, '12 and '13, caused from the fact that we did not have our reservoirs full to start with. I was up there in 1910, '11, and '12. I did not know that in 1910, 10,000 acre feet of water out of the river was put into James Lake. I did not know that in 1911 about 10,000 acre feet,

in 1912, 22,000 acre feet, and in 1913, 21,000 acre feet was put into Lake James. All I know is about the water in our reservoir. The water didn't come down to our reservoir. Lake James is a brand new project compared with our reser-
1256 voir. I was up to see Lake Hattie in 1911. I don't think I would be surprised if I knew that their engineer testified that they were running water into that reservoir in 1911. I know that to be a fact. I wasn't up there in 1912. If they took 21,000 acre feet and put it into James Lake in 1913 and about 30,000 acre feet and put it into Lake Hattie in 1913, it probably had an effect on us. A mere 50,000 acre feet of water out of the river might affect us a little. I did not know that they were running water out of Lake Hattie and irrigating raw sod and wasting a large ditch full into Big Basin, a hollow without an outlet, right during September 1913, when I claimed they were short at Wheatland. If that was the fact it is not surprising that we were short down below. Our water shortage might arise from a number of sources that I personally never considered. The only thing I know of was that our reservoir was not full to start with in the spring and never did fill. I understand the reservoir was within six or eight feet of being full when we started to irrigate in 1913. I don't know only from what I heard from good authority. It looks funny to me, if it was full, that we didn't have more water than we did have this year. There has been no water went down the Laramie River this year below the dam.

W. A. BAKER, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

1258 I have been farming under the irrigation system of Wyoming Development Company, near Wheatland, for 10 years. At first farmed 80 acres, later added another 80.

There has not at all times been sufficient water. I do
1259 not remember the details except in the last two or three years. In these years in the first part of the irrigation season we had a pretty fair run until the latter part of July, then we began to fall short and cut down and sometimes we would be stopped for a few days. That is the experience of my neighbors also who are under the same ditch—Canal No. 1.

There are always some careless people who waste some water, but as a rule there is very little waste. The road supervisor has been looking after it pretty close, telling the farmers to keep the water out of the roads.

There was not sufficient water this year at the end of the run. There had been no waste of water the early part of the season that I know of. I live 5½ miles from Wheatland. I am familiar
1260 with the south one-third of the Development Company lands. In that district there has been very little waste.

There was a shortage of water this year and last year.

Cross-examination by Mr. Delph E. Carpenter:

The shortage of the last two or three years has occurred the latter part of the season. Some farmers order their water shut off. The canal company are readjusting the delivery of water to the various consumers during the period. I presume oats, beets and potatoes would be termed a late crop.

Some oats are planted in June; not ripe until the latter part of September. The principal late crop is beets. Some irrigate beets before August 1st, usually the first irrigation the latter part of July. Oats are the latest crop; spring wheat a little earlier. I have had some late oats caught with frost. We irrigate these late oats until September. Oat harvest usually commenced the latter part of August. In the latter part of July irrigation of oats mostly completed. My farming has been devoted almost entirely to grain and hay. I think people in my neighborhood are careful in providing labor for the distribution of water.

Cross-examination by Mr. Fred Farrar:

I never read my contract with the company. I don't know just what the wording is. I have understood that I get my appropriate share of what water comes down. I don't think it is probable that I have used most of my water supply early in the season and so am short at the latter part, because I don't get any more in my ditch than my neighbors do in theirs. I was short in the latter part of the season of 1912. I did not make any demand on the company for water. I just simply found out what was the matter. They said there wasn't anything in the reservoir. I did not know that as a matter of fact they carried over 40,000 acre feet in reservoir No. 2 at the close of the season of 1912. I was not up there. I know Mr. J. A. Elliott, the surveyor and manager of the ditch this year. He should have more definite information about these things than I do. That would be his duty if I understand his position. Assuming it to be true that in 1912 they carried over 40,000 acre feet of water in that reservoir, any lack of water which I had in 1912 was not due to failure of supply. If Mr. Elliott testified that the river stayed up all season in 1912 until fall, I should not question his statement.

J. A. WHITING, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

I am a civil engineer and reside at Cheyenne, Wyoming. I made an examination of ditches diverting water from the Big Laramie and its tributaries in Colorado during the spring of 1910, from April 28th to May 7th.

There were six in the party. I was in charge.

Mr. Decker, the water commissioner over there, took me up the Big Laramie and showed me these ditches except one or two, the location of which he described and I made a note of this location in

a book. I found all but one. This one I could not find though I searched assiduously.

1267 The ditches from the Laramie River in Colorado use the flooding method, that is, they merely divert the water from the stream and let it flood the meadows. I saw only one or two laterals. The distance from the ditch to the river was, in most places, so short that no lateral was needed. The land irrigated was river bottom, generally extending 500 to 600 feet from the stream. Some of the ditches get back approximately 1200 feet from the stream. The land was used mostly for native hay. Some of the ditches were in sage brush, some in timber, and some was irrigated for pasture.

1268 None was cultivated for crops outside of a garden or two. In some places the water was diverted by piling rocks in the stream, in some places bushes were used and in some places the fall of the stream was sufficient to force the water into the ditch without any dam.

In some places we found wooden head-gates and in some places no head-gates at all. We surveyed the total acreage under the ditches, and made two classes, first, that on which hay was cut, and, second, that in willows which had been irrigated for pasture.

1270 The total acreage of meadow was 1287.52 acres, and 567.6 willows, making a grand total of 1856.64 acres.

That included the entire acreage lying between the ditch and the river.

We carried this work up the river about three miles above Glendevey.

We took into consideration the tributaries, Stuck Creek, Link Creek, McIntyre Creek and one other Creek whose name I forget. Think Glendevey is about 20 miles above the state line, and about three miles below the diversion tunnel of the Greeley-Poudre Irrigation district.

These ditches were average ranch ditches. There was one of the ditches that gave evidence of having been used at some time but not recently.

1271 That was Long Park Ditch No. 2.

Cross-examination by Mr. Delph E. Carpenter:

I found a mountain valley above the Colorado-Wyoming line. Up around Long Park Ditch No. 2 and above Glendevey there are high mountains on both sides with a sort of basin in which the Link ditches are. I remember one of them covering quite a nice meadow, the other one, which was on the West side, covered very little meadow. Then, there was sort of a narrow channel down until you passed Glendevey, or just opposite; below there the mountains were less high, and the valley was probably three-quarters of a mile wide, it varied at different distances. The irrigation consisted of strips of meadow down through this mountainous valley on each side of the stream. I was supposed to survey the land under all the ditch from Long Park down to the state line. I found a frame but no head-gate

in Long Park Ditch No. 2. No gate whatever in Link Ditch
1272 No. 2 out of Link creek, so far as I know, the only ditch taking water out of that creek. I found the Homestead Ditch. As far as I remember that is all. I think I found measuring flumes in all of them. I was advised that those ditches, for many years, had been in charge of the water commissioner. In fact, a former commissioner, Mr. Walter G. Decker, aided us in this matter.

I did not go on the Little Laramie River at that time and investigate the diversion dams there. The structures which I have seen on the Little Laramie are those for recent ditches. As far as I know there is only one concrete diversion dam or headgate on the Little Laramie, that of the James Lake project. All of the dams that I know of on the Big Laramie River in Wyoming are timber or plank. Some of those I saw were very well constructed, while not expensive in any way. It is evident from the dams constructed in Colorado that they were able to get the water out into the ditches. Perhaps a little more work would be required after the time I was there. It was in the spring and the water was low. The irrigation by means of these ditches would take place at a time when there was more water in the river. I did not run the instrument in this sur-
1274 vey. Mr. Grant and Mr. George Marsh each of them had an instrument. I was out from April 28 to May 7, inclusive.

Cross-examination by Mr. Fred Farrar:

There was no snow in the valley when we went in there. The valley which I have described is the Laramie Valley in Colorado. The trend of the stream is generally north. It flows between two ranges of hills more or less clearly defined all the way from the upper point I visited to the state line and even below that. This valley is narrow, being possibly half a mile in width on an average, and the irrigated land lies right in the bottom of this valley alongside the stream. There is here and there an enlargement which we might call a pocket. Aside from the garden patches the irrigated land was devoted to native hay. The Laramie river has numerous tributaries coming in, some on the east and some on the west
1275 side, all the way up and down its course through Colorado. The country is entirely a mountainous country. At the upper end the mountains are extremely high.

Redirect examination by Mr. John D. Clark:

1275 The Laramie Valley at the most southern point reached by me is about one-third of a mile wide.

Recross-examination by Mr. Delph E. Carpenter:

I made no measurements of meadows above that point. I took those ditches I have mentioned from there to the state line.

MORTIMER N. GRANT, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

1276 I am a civil engineer. In 1913 I was Water Commissioner for that district in Wyoming covering the Big and Little Laramie Rivers and their tributaries from the state line down to a point about a mile below the junction of those two rivers.

On the Big Laramie complaints about water were made that year, the latter part of May or first of June, by the Wyoming Development Company, and complaints were made about July and August by four or five ranchmen. On the Little Laramie more complaints were made, mostly down towards the mouth.

1277 The complaints on the Little Laramie were chiefly in July and August.

I encountered quite a bit of trouble in distributing water among the users from the Little Laramie in 1913 because of the low stage of water in the Little Laramie River. It practically disappeared before it got down to its mouth. I took a vacation and ended my duties that year about Sept. 1st.

1277 Cross-examination by Mr. Fred Farrar:

During the period mentioned, my headquarters were at Laramie. During July and August I was in the field the major portion of the time. My trips generally consisted of the following: I went up to the head of the Little Laramie, down the Big Laramie and back up the Little Laramie. I think I made seven complete round trips, aside from side trips. That is only approximately, I don't know the exact number of trips. The Wyoming Development Company, mentioned, which made complaint, is the Wheatland Company. No complaint was made against Lake James, there was one complaint made against Lake Hattie. I don't remember the exact date, it was about June 8, I imagine. In the year 1912 I think there was a man named Wilson acting as water commissioner on the Little Laramie, I don't know who was on the Big Laramie, I understand there was a commissioner. Previous to that year there had been water commissioners appointed, but they have never been out in the field to amount to anything. The water commissioner, as a rule, only goes out in the field when called. Otherwise he does no actual work.

1279 Cross-examination by Mr. Charles F. Tew:

I was called on to measure water. I usually did all my work with a current meter. I was not making reports for the state engineer's office. The current meter was employed because there were no measuring devices in the Big Laramie ditches that were adequate. The practice prior to 1913 on both the Big and Little Laramie rivers, so far as I know, has been to employ the water flow of the stream without the assistance of a water commissioner on the grounds, also without the assistance of any measuring devices in the ditches. The only time the water commissioner had been employed

on the Big and Little Laramie rivers to my knowledge was when there was complaint by water users. I think that was the practice all over the state. I think in 1912 the water commissioners on the Big Laramie were put on a salary and supposed to be in the field all the time.

1280 There have been differences prior to 1912. In 1912 there was no complaint that I know of. There was a man employed as commissioner but I have forgotten his name. I never heard it mentioned. With the exception of the Pioneer dam on the Big Laramie river and the Lake Hattie Supply No. 2 dam on the Big Laramie river, the dams all up and down the river are what you would ordinarily call ranch ditch or beaver dams, consisting of brush and the like. Each freshet modifies the dams somewhat. There were no set or fixed conditions at the head of any ditch whereby former measurements would be a proper guide as to the inflow into the ditches. It would be impossible for a person on either river in the year 1913, to state without a current meter, or measuring device, what amount of water was being taken into any ditch at any time.

1281 All that could be reached without the use of instruments would be a poor approximation. From conditions I saw on the ground, I imagine that those conditions had existed and prevailed always. With the exception of the Bellamy canal diversion and the Lake Hattie No. 2 diversion on the Little Laramie, the remainder of the dams were of brush and the measuring devices lacking the same as on the Big Laramie. The Bellamy ditch is the intake for James Lake. From what I have seen on the Big Laramie, it is as I have described. When I made these trips I generally went to the several headgates. I established rating stations and put in gauges on several of the ditches. I traveled up and down the river with a team and went up as far as Wright's and stayed there and then went around the country and crossed over to Lake Hattie and Sodergreen's. I measured pretty near all of the ditches from time to time. I put in staff gauges to see what was flowing in. On the Little Laramie River there were quite a number of complaints made in July and August. Rating stations were placed in only the biggest ditches. There were no particular clashes that I had any trouble over. I either shut them down a little bit or opened them

1282 up accordingly. There were some cases where there were no headgates. The only place I had any trouble was on the Big Laramie, and there I sometimes shut down the gate or throw manure in it, probably old gates were in, but they would leak.

Most of the ditches on the Big Laramie River are what you might call two-story ditches; that is they were above the bottom of the creek so they would have to have a dam to divert at low stages. At high water they got all the water they needed. They start to drawing water for these meadows in the higher stages in June. The whole territory along both streams is used as a hay ranch

1283 country. The irrigation season is close onto ten weeks for hay. They generally use their water right up to the time they cut their hay, which is about the middle of July. Some may start in later than the first of May to irrigate, but they generally irri-

gate from the first part of May to the middle of July. There was clamor of shortage of water but they gave us no trouble; the flow could be regulated by using manure as described. The Big Laramie River got down pretty low in the latter part of July and August, with a manure and rock dam you could divert all the water.

There were a number of what I called two-story ditches. The average ditch does not cut the bottom of the river. A great many of the ditches are two-story. With a two-story ditch the irri-
1284 gator obtains all the water he wants when the river is high, but at low stages it requires a dam. At such times the user goes to the head and throws some obstruction in the stream to suit his desires. The change of elevation of water of course makes a change of intake capacity in these two-story ditches. The irrigators settled their questions themselves; they probably would be disgruntled, but didn't bring complaints to my office. From the conditions I noted there on the channel of the river, it looked to me that the same conditions prevailed as they had in the past. It is also true that each high water flow modifies these dams to some extent, washes them out and they have to be re-installed. While the dams have been changed from time to time, the ditches have remained unchanged.

1285 Cross-examination by Mr. Delph E. Carpenter.

Lake Hattie evidently had been receiving water after the ice had passed out of the river in the spring. I cannot tell you the amount water in Lake Hattie, I haven't the data with me. They had diverted only from the Big Laramie River in 1913 but I did not keep a record of the flow. I read the gauge every time I was there. They ceased running water into Lake Hattie on about June 8, 1913, and I think that Lake Hattie was about half full in addition to all the dead water space in the lake. I would say that they had approximately 20,000 to 30,000 acre feet of water available for irrigation
1286 in Lake Hattie.

I did not know that they were running water out of Lake Hattie and wasting it into Big Basin until about the first of September. The only time I knew of their running water down into Alkali Lake or Alkali Basin was when they tried out the canal once or twice. It only ran for a day or so at that time. I heard that at a later time when Mr. Goldsborough had some prospective land buyers out there he ran water for several days and wasted it into Big Basin. I did not go to look it up. I think there was considerable water left in Lake Hattie when I resigned, about September 15. My active duties as water commissioner ceased September 1st, after that date I was only subject to call.

Water was diverted through a ditch known as Sodergreen's high line ditch in the summer of 1913. That is a recent ditch; a recent appropriation. The Sodergreen high line was shut off in June some time with the exception of one or two day's run.
1287 I cannot say how much water was diverted into Lake James during the summer of 1913. I kept no record.

I had the record of flow and gauge height of Lake Hattie from Mr. Meeker; the only gauge heights I took from time to time were those I had to take when I was there to check his.

The first complaint I received was from the Wyoming Development Company, directed against Lake Hattie enterprise. There was, I imagine, about a week, I didn't get any records on the steel bridge at Lookout. I think Mr. Elliott went up and measured the water at the steel bridge and made complaint at that time. His complaint was that there was insufficient amount of water coming down to the Wheatland reservoir to satisfy their rights. I turned the
1288 water down from the Lake Hattie diversion because Lake Hattie was what was called a flood water right to fill Lake Hattie, and Wheatland was prior to Lake Hattie. In other words, the Lake Hattie enterprise was a very recent one, more recent than the one below.

On both the Big and the Little Laramie rivers it is practically physically impossible for any water commissioner to properly apportoin the waters with the appliances that exist at the present time. The Little Laramie is better as to headgates than the Big Laramie. Everything is so crude on both rivers that an apportionment according to the legal rights of the parties is practically out of the question, unless one has a current meter to measure it, and then it is a matter of a good deal of labor to try to regulate the water. Each rating consumes considerable time and expense. So that, for the orderly administration of that water supply the conditions are not there. The accuracy of the ratings depends on the per-
1289 centage of errors you expect to allow. You can't get them down to any fraction of a foot or so, on any of those ditches, without cleaning out the channel, but it is almost as good as a measuring flume ordinarily. The Big Laramie is passing through the same history that all streams have passed through until a certain pressure is brought to bear on them, when they have to put in certain devices to regulate the water.

The James Lake enterprise is a comparatively recent one.

JOHN CHAPLIN, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

1290 I have been secretary and treasurer for Wyoming Development Company for about 30 years.

Prior to October, 1885, the company expended on its Canal No. 1, $142,210.94; from 1885 to 1902, it expended $1,390.82.

1291 Up to October 1885 the Company expended on Canal No. 2, $33,023.46. Subsequent to October 1885 and up to 1902, it expended $1,795.65.

Before May, 1886, the Company expended on the tunnel $138,311.66. The first expenditure shown in the books was in 1883. The Company expended on the construction of the diversion dam in April and May, 1885, $1,835.27. Expended in constructing laterals in 1885, $4,178.42. The expenditures in construction of No. 3 Canal and No. 1 reservoir were as follows:

In 1894	$14,442.55
In 1895	18,884.18
In 1896	779.20
In 1897	8,067.59
In 1898	2,181.76

1292 Subsequent to 1898, $907.

The expenditures in constructing Reservoir No. 2 were as follows:

In 1894	$47.70
In 1895	225.85
In 1898	77.30
In 1899	7,992.70
In 1900	55,886.63
In 1901 to July	49,330.59

Subsequent expenditure, $1,980.79.

The general expenditures by the Company not included in the above from 1882 to 1901 were $156,075.17. This does not include advertising and commissions for land sales agents.

1292 Cross-examination by Mr. Delph E. Carpenter:

According to my recollection those figures are inclusive to January 1, 1902. The $47.70 for 1894 expenditures was for preliminary work. There was some investigation being made and that was the expenses. I think probably they were Mr. J. A. Johnston's traveling expenses. I cannot explain what items went to make up these $225.65 for 1895; probably some surveying. In 1896 and 1897 there was nothing charged against the reservoirs. I do not remember for what the $77.30 was expended in 1898; I suppose some investigation. I presume the figures for 1899 of $7,992.70 were for construction.

JOHN MCGILL, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

1294 I own lands in Albany County about 40 miles north of Laramie, which have been irrigated since 1882. We have one main ditch, the construction of which began in 1879. We got water through in 1882. We have irrigated 705 acres every year since 1882.

1295 The land is in Townships 22, Ranges 73 and 74. The ditch is the McGill Ditch.

1295 Cross-examination by Mr. Delph E. Carpenter:

I irrigated land devoted mostly to native hay, some little oats, a narrow strip on the west side of the river. We originally had our own dam, but when built the dam of reservoir No. 2 Wyoming Development Company submerged our dam and we now use their

dam for diversion. We turn the water off the meadows to go to haying about July 15. We begin irrigating in the spring along about May 20. Our ditches are so constructed that the snow piles into them, and very seldom they are opened before May 20, before the ice is all out.

The lands belonging to me and those belonging to Mr. and Mrs. Dodge are the only irrigated lands between the dam of Wheatland Reservoir No. 2 and the canon of the Laramie River through the Laramie mountains. This 705 acres I speak of is all part
1296 of my ranch. We usually cut hay over the whole 705 acres, sometimes it is a little light and we don't cut it, but let the cattle eat it. I should think we average between 600 and 700 tons of hay per year over the whole area, but I have never weighed or measured it. I feed the hay to my own stock. I handle cattle, sheep, and a few horses. We own something over 5,000 acres of land. There is 2,368 acres of that land we call the Home Ranch in one body, all fenced, of which 705 acres are irrigated. The remainder of the 5,000 acres is scattered and is used mostly for grazing. We get some little hay off of some of it. We now have about
4,500 sheep; our average holdings would probably be 6,500 or 7,000. We have 850 head of cattle, a little more than our
1297 average holdings. We have from 90 to 100 head of horses, including work animals, brood mares, colts and all.

In the summer time we turn our stock loose on the range, we find some of them clear over in Carbon county. The range is open and unfenced through a large area west of us. We turn the cattle loose about the 10th or 20th of May of each year, and try to get them all in each winter. We usually get them gathered about October 15. We have herders with the sheep all the time and keep them out at our camps over the range, winter and summer. We keep our work horses in the pasture during the summer;
1298 the brood mares and colts run out.

We have from 30 to 60 acres plowed, for about 25 years. We raise oats for our own use at the ranch, sometimes we cut them and don't let them get ripe, cut them just for hay. I find that we obtain the best returns one year after another from the land which is irrigated to native hay. I planted alfalfa, but it kept killing out. Our land is too low, the next bench a little higher up would be better for alfalfa. We estimate that we have about 1200 bushels of oats now to thresh, we have threshed as high as 1500 bushels. We must have at least 50, probably 60 acres this year. I think that is the highest we have ever had. Other than the crops mentioned, we have always raised a garden and some potatoes just for
1299 our own use. We have the post office at our ranch. My family and I and one man and his wife live there. The nearest ranch to us up the river is that of the Swan Land and Cattle Company, at what we call the shearing pens, about nine miles from us. They do not irrigate any land there. The next ranch up the valley from the shearing pens is Gillespie's place, at Lake Ione; the first irrigation up the valley from my place. It is about 12 miles from us. The Swan Land and Cattle Company is some-

times called the Two-Bar outfit. They range sheep in the vicinity of my ranch and between it and the Gillespie ranch. Out-
1300 side of the family at the ranch and the family that are taking care of the reservoir, I don't think anybody gets mail at the McGill post office. The rest is sent out in little sacks, and left at the mail boxes. The first ranch down stream from the Dodge place is the Cramer place, at the lower end of the cañon. I own it now. From there on irrigation prevails more or less in strips of land along the valley to Fort Laramie. Between the Cramer place and the Dodge place, probably 25 miles, there is not irrigation. Dodge Creek and Duck Creek empty into the river between these two ranches. The Dry Laramie comes in below that. Dodge Creek and Duck Creek drain country to the northwest of the river.
1301 I am State Tax Commissioner for the State of Wyoming at the present time. I am the entire commission.

Below my ranch about 4 miles there is a very large spring called Big Springs. Didge creek is fed a good deal from springs and Duck Creek partly. There are springs over on the Blue Grass, but they empty into the Sybille. There are the Sybille springs further south. The range of mountains that runs from Laramie City down on the east side are called the Black Hills ranch. The Laramie mountains, as we understand, are the mountains around Laramie Peak north of us. It is all practically one range. Sybille Creek rises
1302 pretty well on the west of the Black Hills, flows northeast through the mountains and discharges its waters into the Laramie River on the west side of this range. Blue Grass creek is a tributary of the Sybille.

My place is pretty close to 7,000 feet in elevation. The Cramer ranch, on the east side of the Black Hills, is very much lower.

1303 Cross-examination by Mr. Charles F. Tew:

There is a range of mountains extending from Laramie Peak southeasterly which we commonly call the Laramie mountains, cut through by the Laramie River cañon. The river has a big fall. In this 25 miles of cañon through which it flows I think it falls 2,000 feet or more. The country around Wheatland, which, generally speaking, is at the lower end of this fall, is some 2,000 feet, or more, below the level of the country where I live. Wheatland is 2,000 or 2,400 feet lower than the general level of what is known as the Laramie Plains, in which my ranch is situated. They are raising some alfalfa on the Laramie Plains, but in a general way they engage in raising stock and hay and some alfalfa and oats
1304 on the Laramie Plains. They have longer growing seasons down in the Wheatland country than on the Laramie Plains. There is no question that the season for the growing of crops is considerably longer about Wheatland than it is on the Laramie Plains; Spring is earlier in the Wheatland region and the frost does not come so early as it does with us. A hay ranch country is all we have used the Laramie Plains for. That is what it is naturally adapted to. The Wheatland country is more adapted to farming. Experience has shown about Wheatland that they do and can raise

crops by what we commonly call farming methods. Thus far experience has shown on the Laramie Plains in about 30 years of effort and trial, that they are fitted for this other purpose of raising hay and oats and some alfalfa and the grazing of stock. During all the time that I have been engaged in the business I have only tried to raise stuff enough to winter our stock. I recognized that was the fitting business for the place. We shut off irrigation
1305 of our native hay July 15th and sometimes irrigate our oats after that. Our place, at an elevation of about 7,000 feet, is about the lowest place where hay ranching is done in what is known as the Laramie Plains. We are at the lower end of the plains. These plains are separated from the plains which lie to the east of them by a chain or rim of hills, which are known in the northern extremity as the Laramie Mountains, through which the Laramie River breaks, and then have a name south of the Laramie river of "Black Hills," which rim extends down to about Sherman Hill, so-called, where the Union Pacific crosses. This rim is the eastern boundary of the Laramie Plains. The point where the railroad crosses is the highest point on the line of the Union
1306 Pacific. Southwest of that the rim extends on and runs into a range of mountains which is called Boulder Ridge, which is in Colorado on the southerly side of the Laramie Plains. The Boulder Ridge extends into the Green Mountains, that is, the
1307 extreme southern boundary of the Laramie Plains. Under these several names there is a continuous rim or east boundary, of the high territory or hay country, called the Laramie Plains, extending from Laramie Peak to the east and south. Fish Creek heads in the southern rim of the Plains and runs south into the Cache la Poudre. It drains a very little portion of the land.
1308 I had a dam across the river at the head of my ditch prior to the construction of the dam of Wheatland Reservoir No. 2. When they built their dam, it left our headgate and intake point on the Laramie River above the embankment which they placed across the stream. Consequently it was necessary for the operation of my ditch to have an outlet tube through this embankment. This has been maintained there since. I have always had plenty of water to take as soon as the snow went out of our ditch. There has never been any lack of water. Nobody ever objected to our taking what we wanted. Sometimes I opened the gate at the reservoir and sometimes they did. Ever since the reservoir was
1309 built I have always found plenty of water there. There was one year the reservoir was pretty low. They wanted water below and they shut my ditches and we had trouble about it. I wanted some water for my stock. That was nothing serious, but water was pretty scarce. My ditch is 5 or 6 miles long; 10 or 12 feet wide on top and 3 feet deep, without much fall. Water passing through my ditch and unused flows back into the Laramie River.
1310 All the seepage goes back. One year they used my ditch for the wasting of water from the reservoir. There was a tremendous head of water came down and they had all their ditches

open and we opened ours and used it as a spillway. At the time of this flood they employed our ditch and outlet tubes to waste water from the reservoir; the water was also running over the wasteway, which is several miles to the north and about the northerly extremity of the reservoir. I saw the quantity that was flowing there. It was a very large amount. It began to cut through and made quite a gorge there and they were afraid it would cut away the whole thing. Then they began to discharge a large quantity through these gates. I would not attempt to say what quantity was flowing through. They employed every method to relieve the reservoir for some time.

I think the reservoir had been practically empty the year pre-
1311 ceding. The supply that particular year was enough to fill the entire reservoir and in addition, there was probably more than enough to fill it again. I live about 10 or 15 miles from the place where the Wheatland people take the water from the Laramie River through the tunnel. Water at that point passes two ways, sometimes down the river and sometimes through the tunnel. I have seen it sometimes when there was very little water passing; other times I have seen very large amounts passing; several hundred feet. We have had some trouble, I own the Cramer place below it, and when the water is taken out through the tunnel we get no seepage, and the result is we are short of water and we have had trouble with them about getting enough water down. We gen-

erally have enough water from Duck Creek, which comes
1312 in below the Wheatland diversion dam. On these occasions when I saw considerable water passing the diversion dam, it flowed over. Formerly the Wheatland people had a dam higher up, and now they have placed it lower down and I think it is more water tight. Formerly the dam leaked a good quantity.

During the thirty years I have never had any trouble with any of my neighbors about my water supply. The water commissioner

has never been there once to my knowledge, during the
1313 thirty years. I do not have any device in my ditch or in my tube out of the reservoir to determine the cubic feet of water per second that I take any time. There is no need for any, so far as I am concerned. There is no need for the water commissioner coming there so long as there are no disputes. The water commissioner was out at the Cramer place once and shut down our ditches and I objected to it, because later ditches were not shut down. There is no inflow to the Laramie River from the right hand or east side between the Dodge and the Cramer places, but, as I have said before, there is Dodge Creek and Duck Creek on the

west side. Outside of two years, there has been sufficient
1314 inflow from the river down there through the cañon, so that the people down below the cañon have not bothered me. On these two years that I mention I had trouble at the Cramer place. I obtained the water for the first crop, but not as much as I really wanted. All along the river below the Cramer place there is a narrow strip of valley, north of what we call the Wheatland country and below the mouth of the cañon, irrigated to native hay

along the bottom. They always have an ample supply of water for their crops below the Sybille because they get all the leakage.

1315 Cross-examination by Mr. Fred Farrar:

There is considerable return seepage water from irrigation of land in the Wheatland district below the mouth of the Sybille Creek. There is a distinct chain of mountains to the east of the Laramie Plains which is about 1,000 feet higher than the Plains at Sherman station.

Redirect examination by Mr. John D. Clark:

1315 Dodge Creek and Big Springs furnish the only contributions to the Laramie River between Wyoming Development Company Reservoir No. 2 and the diversion tunnel. Dodge Creek is from melting snow and drains in April, May and June. After that the flow is very light. You can't step across it when it is high.

1316 You can after it is low. Big Springs gives a steady flow. You can step across that. My testimony as to flowing over the dam has reference to the old dam which was changed several years ago.

1316 Recross-examination by Mr. Delph E. Carpenter:

Duck Creek is quite a good sized stream when flowing water from melting snow. You can't step over it. The same is true of Dodge Creek, but it does not have such a large volume of water as Duck Creek. Duck Creek has probably three times as much water as

1317 Dodge Creek. Dodge Creek flows a pretty heavy head of water from about the middle of April to probably the middle of June. The water runs very rapidly, it has an awful fall. When it is high it carries more than big ditch full of water. Sometimes it comes up and flows strong all the way during the summer months, when there are cloud-bursts or rains. The same is true of Duck Creek, only there is more volume of water there, there is more of a water shed. Even the late summer Dodge Creek is flowing all the time, there are springs there that keep it flowing, but very little.

Redirect examination by Mr. John D. Clark:

1317 Dodge Creek is above the tunnel and Duck Creek below.

1318 Duck Creek does not have so much water as Blue Grass Creek and considerably less than the Sybille.

Certified copy adjudication of the Little Laramie by the Board of Control offered in evidence, Exhibit H.

(Objections to introduction of Exhibit H.)

By Mr. Clark: We will offer in evidence a certified copy of the decree of the Board of Control of the State of Wyoming entered May 5th 1892 in the matter of the adjudication of priorities of appropriation from the Little Laramie River.

By Mr. Farrar: Your Board of Control is a board having quasi-judicial powers relative to awarding or adjudicating priority of right for the use of water, is it not?

By Mr. Clark: That is correct.

By Mr. Farrar: And from the decision or findings of the Board of Control appeals lie to your nisi prius courts and thence to your court of last resort in this state?

By Mr. Clark: That is correct.

By Mr. Farrar: Has any appeal been taken from the findings or awards made by the Board of Control in the matter covered by the decree which you offer in evidence?

By Mr. Clark: No, there has been none.

By Mr. Farrar: Under your law has the time elapsed within which an appeal could be taken?

By Mr. Clark: Yes, sir. This is the Little Laramie.

By Mr. Farrar: On behalf of the State of Colorado I desire to object to the introduction of the certified copy of the decree of the Board of Control with respect to appropriations on the Little Laramie for the reasons:

First, that the State of Colorado, one of the respondents herein, was not either directly or indirectly a party to the proceedings under which said decree was granted and had no opportunity nor privilege of becoming or being a party to such proceedings; neither did it have any notice that such proceedings were being had.

Second, that so far as this cause is concerned, any record or proceeding or any finding or decree made by the Board of Control is ex parte and in no wise binding upon the State of Colorado, and the State of Colorado is in no wise governed or controlled thereby.

Third, that the decree of the Board of Control, a certified copy of which is offered in evidence, is incompetent and improper as evidence in this cause and irrelevant to the issue herein.

By Mr. Carpenter: Let the Record show that counsel for the defendants, Greeley-Poudre Irrigation District, and the Laramie-Poudre Irrigation & Reservoirs Company, concur in the objections already offered by counsel for the State of Colorado and join in said objections.

The copy of the decree was marked Exhibit "H" and is attached to this report.

CLYDE A. DUNIWAY, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

1320 I am President of the University of Wyoming, all of whose departments, College of Liberal Arts, of Agriculture, of Engineering, etc., are at Laramie. The investment in grounds, buildings and apparatus of a permanent character is about one million dollars, exclusive of the value of land holdings derived from federal land grants, and of funds realized from the sale of such lands.

1321 The university campus has 54 acres, and the experimental farm and stock farms just across the river 1,154 acres.

At the experimental farms we expend about $40,000.00 per year,—

$30,000.00 from the Hatch and Adams fund, and $10,000.00 from other sources. We experiment as to stock breeding, as to production of wool, milk, butter and cream, as to fattening for market, and other things connected with animal husbandry. We grow experimentally a great many crops.

1322 Those crop experiments are carried on largely by means of irrigation.

Our station by the Board of Experiment Stations at Washington is regarded as one of peculiar value because it is the highest experiment station in the United States, and the highest station carrying on extensive and continuous work in the world. We irrigate approximately 200 acres. Our plans include the cultivation of the entire 1,150 acres except 60 to 80 acres.

The entire stock farm and about four-fifths of the agronomy farm lie under the Pioneer Canal. The other farm, 640 acres will be under the Lake Hattie Project.

1323 The upper part of this last farm lies under the North Canal, which is completed. The University has been carrying on these experiments since 1891. The water for our use is all derived from the direct flow of the stream. There may be some of it stored in the Sodergreen Reservoir. We use the water chiefly in July and August, occasionally in June and September. We could not carry on these experiments without a continuous supply of water.

1324 The University also owns about 15,000 acres of Federal land grant lands in the water shed of the Laramie River. Of this about one half is susceptible of irrigation. The income from these lands is devoted to University purposes by the terms of the grant.

1325 Cross-examination by Mr. Fred Farrar.

I have been president of the University and a resident of Laramie since August 1, 1912. I had no connection whatever with the University prior to that time. I had been living for four years in Missoula, Montana, engaged in educational work there with the University of Montana. Before that time, for 11 years I was a professor in Leland Stanford University. I am not director of the experimental station here. Henry G. Night is the director. The 15,000 acres of land I have referred to are the endowment lands of the agricultural college, under Morril acts of Congress, passed in 1862 and amendments thereto or there may be some of those lands granted to the University as a university, because Congress may grant both to the university as such and to the agricultural college as a department of the University. So I have to make the explanation to be perhaps technically correct. I am not certain whether those are the Morril grant lands or some other grant. When I speak of Hatch and Adams funds, I refer to two funds created by acts of Congress introduced by members of Congress, Mr. Hatch and Mr. Adams. The Hatch and Adams funds are available for all states conducting experimental work in agricultural and animal hus-

bandry. Wyoming is not peculiar in relation to those funds.

1327 The grants or appropriations under those funds are made directly to the states. I find myself inclined to rather emphasize the fact that this is virtually Federal or National work. It is quite true the appropriations are made to the states in aid of such experimentation. The experiments under these funds are limited to certain lines which are designated by the acts themselves and they are under the supervision of the director of the experiment station at Washington. The agricultural college of this state is a department of the University. It is difficult to give the enrollment of the agricultural college, because of the peculiarity of our organization, and owing to the fact that comparisons are instantaneously made between so-called colleges of agriculture where their organization is very different in different states. The college of agriculture and mechanical arts, which is the official title, showed last year thirty students. I made my preliminary statements because in all separate colleges of agriculture with which I am acquainted, and I have studied them quite well, these institutions, include a great many other departments than strictly agricultural and mechanical arts. There is no clear line of demarcation between students in one department and another with us in our interdependent system of departments, students in the department of agriculture take their work in English in the same class with the students in the college of liberal arts, and then the same thing is true in everything except those things which are strictly agricultural. Our course in the college of agriculture is four years.

1328 The total enrollment in the University commencing June 30, 1913, was 329. That included all departments. We have a preparatory school of 49. Those were included in the 329 I gave. Our school of commerce is a business school, but is both elementary and advanced. Those who wish to take the elementary course, such as the subjects of stenography, bookkeeping and typewriting, are classed as the third and four year, preparatory. They must have two years' high school work before getting into this course. On top of that preparatory course there is a two years' course of college grade. The entrance requirements for admission to our school of agriculture are exactly the same as for the college of liberal arts.

1329 There are 188 acres of land in our experimental farm now under cultivation. The evidence which I have given in response to the interrogatories by Mr. Corthell was, of necessity, based somewhat on reports and the general experience which the University has had. The historical statements which I made are not strictly within my personal knowledge. I did not know that one of the tracts at least covered by our experimental farm was under irrigation from a ditch which was constructed prior to the Pioneer ditch. It requires 1½ second feet to the irrigating season for the irrigation of the 80 acres in the lower farm of experiment station; that is the water now used. In the upper farm of 108 acres under cultivation we use approximately 1½ second feet during the irrigation season. Our requirements for the present cultivation

would be about 3 cubic feet per second of time for both places. Our experiment relative to reclaiming alkali land is of import-
1330 ance, because a great many irrigators have found that a few seasons more or less of successful irrigation has been followed by the alkalifying of the land, rendering it unproductive. I believe that to be, from my general knowledge and study, quite extensive. It occurs in practically every irrigation region throughout the country. There has been some experience along that line in the Laramie Plains, and more particularly when this lower farm was turned over to the University as an experiment farm by the state, a good portion of the lands has been alkalied. The experiment station undertook to see if these lands could not be redeemed and the experiment met with striking success. The bulletin on the subject is in considerable demand from those who have been having experience of the same kind elsewhere. I have observed some alkali in this vicinity, but my testimony on that would not be important.

1331 Climatic conditions enter into the consideration of the station on account of the altitude. What is called by the farmers the growing season has a great deal to do with it. Those are the approximate limits between the last killing frost in the spring and the first killing frost in the fall. That season differs from the season that might be covered by any other experiment station on account of our altitude. We have a much shorter growing season than that enjoyed by the average station, because we are so high. I could not give an idea of how much shorter our growing season would be than the season at a lower elevation accurately. I do not remember what the length of our season is. We published this fall a detailed bulletin on that and gave the average date of the last killing frost in the spring for Laramie as May 30; the average date of the first killing frost in the autumn is September 16. The bulletin does not institute comparisons with other stations throughout the country, but simply institutes comparisons with other sections or points at which there had been weather records in Wyoming.

1332 I consider our experiment station work in ensilage or silos important because the men engaged in the sheep industry or in the cattle business have been accustomed in Wyoming to shipping all their stuff out and have it prepared for market or finished. We have been experimenting with these Wyoming growing crops which can be produced successfully at an altitude like ours and an altitude of the average of southern Wyoming and we find ensilage of Canadian field peas and oats and barley successful. They have even started experiments with other grains, and ensilage of such material is very valuable indeed. The treatment is to cut these crops green and put them in the silo, where they ferment; the resulting product is ensilage, used as a fodder. Our idea is to permit the feeding of livestock here in order to bring it to a marketable condition rather than to have it shipped out of here and fattened elsewhere. The district yields itself readily to the production of livestock. The shortness of the season is indeed an important con-

sideration, because while the average is as stated here in this record naturally there are many seasons when the killing frost or the first destructive snows come earlier, and if these grains can be harvested when green and put into the silo the danger of loss is very much lessened. The season which I gave, according to the report in the bulletin No. 100, Agricultural Station of Wyoming, is the
1333 average season for Laramie. In many cases we have frosts later than May 30 and earlier than September 16th. It would be putting it rather strongly to state that we have frosts at any time during the year. I cannot remember other statistics, but I do know that we have had frosts in June, and do know that there have been frosts in the latter part of August. There may have been some frosts not known to me in mid season. I was at Laramie only a part of last season. I remember a cold snap occurring about July 26th this year (1913). The damage was hardly material to the experiment farm. The man in charge reported to me that the loss was very much less than they feared. There was a good deal of loss at large in this region and also in other parts of Wyoming at that time. Frosts of that character are not uncommon at this latitude and altitude in the spring or in the fall. The number of such frosts occurring in what you might call the middle of the growing season I do not know.

1334 I do not have available any consecutive report about wind. From the standpoint of personal comfort I know that we have a good deal of wind. Those winds are very apt to be cold and raw at times.

The application of water on the experiment station plats is of necessity different from the application of water on an ordinary piece of agricultural land, they naturally make the most careful measurements. The experimental tracts consist of small plats of this crop or that species of crop and next to it we have another one and they will be growing in rows or little blocks, so that they can be carefully observed and cared for minutely. Sometimes it will be a plot of an acre, and in other cases two acres, and last year I had pointed out to me that they had some plats of four acres for experiments. In some cases there is less than an acre and sometimes only a few rows. Sometimes we get a very small shipment of seed from the department at Washington.

Instead of having an impression that we were about to lose all of the available sources of water for irrigation I have an impression that if the Colorado project now under construction were carried through it would probably interfere with the continuous water supply that we find valuable from the standpoint of the work, that is not an expert opinion, it is an impression. If that impression were shown to be untrue my mind both individually and as President of the University would to that extent be relieved of the opinion that at present prevails, one of my troubles as President.

Cross-examination by Mr. Delph E. Carpenter:

1335 I think I was told of the severity of the frost of July 26, 1913. I believe I remember Prof. Parsons said the damage

was not anywhere near what they thought it would be. It is a fact that the records of the University show that frosts have occurred at the Station every month of the year in some years since the Station was established in 1891. The records show that they have occurred in June. I count nine years out of twenty where the temperature was below 32 degrees in June. 32 is freezing but it is not
1336 counted a killing frost. Temperature during June has been 30 degrees Fahrenheit or below in 16 of the 20 years for which records are given on page 41 of our Bulletin 100. The table, however, does not give the day within the month, whether early or late. This same table shows two years in twenty during which there was a low temperature of 32 degrees Fahrenheit during the month of July, one in 1897 and one in 1904. The mean lowest temperature for June over a period of 20 years is shown to be 30.4 degrees Fahrenheit. During July over the same period 36.9. The records also show that during the year- 1891 to 1910, inclusive, six out of the twenty years show a low temperature of 32 degrees or less during the month of August. The mean low temperature over that period for that month was 33.9 degrees Fahrenheit. September, during the whole twenty years shows a low temperature of less than 32 degrees.

I have been at the University since August 1912. I have not so familiarized myself with the college work and the experiments as to be able to give the duty of water for irrigation for agricultural purposes.

1337 Our University is a co-educational institution. We have 108 men and 221 women.

Cross-examination by Mr. Charles F. Tew:

The budget of the Experiment Station included an expenditure of about $40,000 each year. I describe the Station as being somewhat eccentric because of its location at its altitude and in the midst of these climatic conditions and winds. In that respect it is located in a place very different from the ordinary Experiment Station. I think it different from any in the United States and probably in the world. The experiments are of peculiar value because of these peculiar conditions. The experiments are made for obtaining and learning all we can in order to combat these adverse conditions in farming. The conditions here are less favorable to successful agriculture than in other circumstances.

1338 If we go by comparison, the conditions here are more adverse and less favorable than in most places where agriculture is carried on. That is because of the high altitude, the Experiment Farm has an altitude of 7,190 feet. There are climatic conditions other than the elevation, which are less favorable to agriculture in the vicinity of the station. The winds are one of these conditions. The soil is cold when the climate is cold. The water which is applied to the soil by means of the ditches from the streams is also relatively cold as compared with most irrigation ditches. That is what might be termed an adverse condition. I believe it is true, that the major portion of the Laramie Valley and the Little Laramie

also, which is devoted to agricultural purposes, is higher than the Laramie Station.

The latitude is not particularly unfavorable because agriculture in places of higher latitude is very successful, provided the altitude is much lower. I have seen that farming is successful here to a considerable degree at least. The comparison which I had in mind when speaking of the unique value of this Station is with other experiment stations and not a comparison between this exact location here and areas or farms under cultivation. I think I tried to point out that we believe this station to be of value to the agricultural industry of Wyoming particularly because of the average elevation of so large a body of Wyoming land, along the whole south it is practically the elevation of this station. Our hope is, and we seem to be realizing it in some degree, that we may demonstrate successfully methods of farming under such an approximation of conditions.

1340 The institution has been devoted to this series of experiments since its inception. They have been experimenting and demonstrating the different crops which can be grown under conditions existing in this region. During all that time the valley has, to a very considerable degree, been confined largely to experiments of those who engaged in hay culture. There is also a great deal of successful grain culture. The men who have paid most attention to that could give you the figures. Oats, barley, field peas, rye and such products. These are all limited in amount as compared with the area that is devoted to native hay. This native hay will survive the winds, continuous frosts, low temperature, cold water and cold soil, coming from high elevations and the conditions that are here; it would not be here native if it was not true.

Redirect examination by Mr. N. E. Corthell:

1340 The quality of oats raised here as compared with oats grown in lower altitudes is ranked high.

1341 The same is true of field peas, barley and potatoes.

The "mean lowest temperature" referred to is the mean of the extreme lowest temperatures occurring at any time during the month.

The attendance at the University is increasing.

1341 Recross-examination by Mr. Delph E. Carpenter:

In making my comparison of the quality of crops produced, it was not meant to be accurate, but by comparison with such crops as I have known in regions where I have lived, such as California, Oregon and Montana. I have no knowledge of the details of the work of the Agricultural College at Fort Collins, Colorado. I considered Wheatland, Wyoming, in general as to quality in making

1342 my comparison. In both the Wheatland and Laramie districts oats seem to be considered of good quality. That is all I am willing to affirm.

My immediate predecessor there was Charles A. Merica.

Recross-examination by Mr. Fred Farrar:

My professorship at Stanford University was in history and political science. I then went into executive work and do not claim to be an expert in agriculture. My work in the University here is very largely executive, having to do largely with the Agricultural Experiment Station as well as arts. I give lectures in history. I don't know whether I ought to say it or not, but I take a great interest in agriculture. I was a farm boy and lived on a ranch before I went to college and did irrigating. I lived on a farm, as
1343 they always called them in Western Oregon, and then on a ranch in Idaho, on the Lost River Valley in the irrigation section. I was reared partly on a farm and partly in a little country town or village.

WINIFRED F. STUART, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell.

1344 I am Deputy Commissioner of Public Lands of Wyoming. The map which I produce correctly shows the Wyoming State Lands within the Laramie River drainage basin. The Carey Act lands are designated by black India ink with crosses. The State lands leased to various lessees are designated by yellow crayon. The lands sold are designated by red crayon, the lands owned by the State but not yet patented to it are designated by a red cross hatch.

1345 The lands in solid red have been sold by the State but there are payments still due the State.

The Carey Act lands on the map amount to 51,788.22 acres. The other lands amount to approximately 255,000 acres. The lands sold but on which payments are due the State are approximately 5,000 acres. All the balance are unsold. The minimum price to the State for leases of lands is five cents per acre per annum. Some of the State lands are leased as high as 30 cents per acre per year. Probably all of these lands are leased except those sold.

1346 Ten dollars per acre is the minimum price at which lands are sold. All lands sold under the Laramie Drainage System have been sold at the minimum except 600 acres at $12 per acre, and 640 acres at $15 per acre. The tract sold at $15 per acre was Sec. 16, T. 17, R. 74, Map offered in evidence, Exhibit P.

1347 The 600 acre tract is in Sec. 36, T. 14, R. 76.

1347 Cross-examination.

By Mr. Fred Farrar:

The minimum sale price of $10.00 per acre is fixed by the Constitution of the state. The minimum rental price for agricultural lands or natural hay lands is 25 cents per acre; for grazing lands 5 cents per acre per year. In my direct testimony, in explaining the legend on the map, I mentioned lands which were not yet patented to the State. I referred to lands that had not been patented

by the Government to the State, received in lieu of other lands exchanged in forest reservations and such. They are what are termed "lieu lands." Carey Act lands come under the jurisdiction of the State Land Board, the same as other state lands, but they are separate, of course, from our state lands. The direct interest which the state has in Carey Act lands is 25 cents per acre, which we receive when the land is sold. The two tracts of land which I mentioned as having sold for more than the minimum price are
1348 located, one adjoining or within the boundary of the Riverside Ranch of the Laramie River, and the second one between the Little Laramie and the Big Laramie Rivers, near the confluence.

Cross-examination.

By Mr. Delph E. Carpenter:

The very fine dotted lines on this map indicate the several drainage areas of the tributaries to the Laramie River. In the Chugwater drainage area the colors on the map indicate some compact bodies of state land; I could not tell you to whom they are leased. The Swan Land and Cattle Company have considerable areas of leased land. It is very probable that these large, compact bodies on the Chugwater are leased by the Two-Bar outfit.

Cross-examination.

By Mr. Fred Farrar:

The Commissioner of Public Lands did issue a list for the period ending September 30, 1910, giving a list (not a part of the general edition) of all the leases and lands leased, but since that time no list has been issued. Another one would not be issued before September, 1914.

GUY H. DAYTON, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell.

1350 The net number of country taxpayers within the Laramie River drainage district in Albany County for 1913, after deducting all duplications, was 1076.

Title was derived under the Union Pacific land grant to 556,487 acres of land within the Laramie River drainage basin in Albany County. The principal part of the City of Laramie is on U. P. land grant lands.

In 1913 Albany County paid to the State $45,923.54 in taxes.

1351 Cross-examination.

By Mr. Delph E. Carpenter:

Of this net of 1078 actual country taxpayers outside of Laramie City in the Laramie River drainage area, there is included non-resident, as well as resident tax-payers. Our schedules and books show

the proportion of this 1078 taxpayers who are residents and the portion who are not residents. My rough conjecture would be that between 350 and 400 of these taxpayers are not residents. Assuming that there are only 350 non-resident taxpayers, leaving 728 out of town taxpayers in the Laramie drainage basin in Albany County, it would mean that a great majority of these are on irrigated ranches. They have their ranches along some little stream. Most of the 350 taxpayers who are non-residents represent land which is not irrigated. These non-residents are mostly people who bought land through these irrigation concerns. As to the remainder I think the majority of those live on irrigated ranches. That includes, of course, people in the livestock business, as well as those who are attempting to farm.

I stated that figure $45,923.54 will be paid for state taxes,
1352 collected from all assessable property. The levy for state purposes is three miles. In my testimony on November 17, I stated that something over five million dollars of our valuation was on public utilities. These utilities consist of railroads. The Union Pacific is the main railroad. We also have the Laramie, Hahns Peak and Pacific. It is something over 58 miles long. The Union Pacific's business is primarily a transcontinental business. Laramie obtains some of its support from the Union Pacific Railroad but I don't think all of its support comes from the Railroad. It is a freight division. They have a small shop here. I don't believe they do a great deal of repairing, it is just light work. The main shops are at Cheyenne. A good many of the train crews stop here.

It is the terminus of the Hahns Peak Road. The Union
1353 Pacific has a tie-treating plant here. They have considerable trackage. There are four principal towns along the Union Pacific in Wyoming, a distance of about 400 miles; Cheyenne, Laramie, Rawlins and Green River. I can remember one time when they shut the shops of the Union Pacific in Laramie down and only ran the train crews, and the town of Laramie went right along the same way whether they kept their shops open or didn't. It might have been published that this was generally disastrous to the town, but it didn't kill the town.

1354 The last report of the payroll of the Union Pacific at this point, of which I heard, was in the neighborhood of $250,000 a month. The Union Pacific has other property not included in the five million dollar figure which I gave. They have unsold lands and unsold lots. They have an acreage of about 15,000 acres of unsold land; it is all grazing land. The assessed valuation of the Union Pacific per mile is $55,000 (corrected by later testimony $52,000.00 per mile). I believe there are 80.15 miles of this
1355 road in this county. Most of it is double track.

Cross-examination by Mr. Charles F. Tew:

There is a railroad division for enginemen from Cheyenne to Laramie. For trainmen, I believe the division point is Cheyenne and don't include Laramie as a division point. There is another

division that runs on the Union Pacific from Laramie to Rawlins. It is a freight division. The traffic on the railroad, transcontinental and otherwise, is very heavy through Laramie. I think there are fewer crews going east from Laramie to Cheyenne than there are going west to Rawlins; it is a shorter division. A number of the crews that work on the railroad on the division to the west, reside in Laramie also. I believe the principal portion of the crew
1356 reside in Laramie. I believe there were thirty men employed at the tie-treating plant when we made the assessment last spring. Some of the engine men on the division between Laramie and Cheyenne stay at Laramie. The monthly payroll of the Union Pacific varies, it is more in some months than in others. A part of the payroll is expended here by these men in Laramie. Part of it has much to do with the valuations of business and other property here in Laramie.

There is a State University in Laramie. It is patronized by students who come from all parts of the State. That is a source of revenue to the City of Laramie.

There is a source of increase in value to Laramie from the railroad other than that I have mentioned, for I believe they put up ice here in the fall of the year, for use on the railroad.
1357 They begin putting up ice along in the middle of December.

Cross-examination by Mr. Fred Farrar:

The railroads are assessed by the State Board of Equalization composed of the Secretary of State, State Auditor and State Treasurer. They do not assess property belonging to railroads and not used for railroad purposes. They do, however, assess everything directly connected with the operation of the railroad. I don't believe the State Board of Equalization assesses roundhouses, hotels and property of that kind. That doesn't go into their right of way, that is a separate assessment made by the county assessors. The State Board of Equalization assesses roundhouses, rights of way, stock yards, water tanks, section houses, ice plants and things of that kind. I do not know what method is adopted by the State Board of Equalization in arriving at the valuation of railroads in this state. The returns we receive from the State Board of Equalization shows there are 80.15 miles of railroad in the county assessed at $55,000 per mile (corrected by later testimony, $52,000. per mile). I believe it is 16.08 miles to Hermosa assessed at $20,000 per mile.
1358 There is in the neighborhood of 60 to 62 miles of railroad of the Laramie, Hahns Peak and Pacific Railroad. That is assessed at $5,000 per mile.
1359 We have a standard valuation on live stock fixed by the State Board of Equalization. They are: Class 1, cattle, thoroughbreds, coming yearlings, $25.00 per head; Class 2, bulls, thoroughbreds and other kinds, $50.00 per head; Class 3, cattle, calves, coming yearlings, $15.00 per head; Class 4, cattle, yearlings and over, $30.00 per head; Class 5, common milk cows, $35.00 per

head; Class 6, dairy cattle, used for commercial purposes, $40.00 per head; sheep, bucks and thoroughbred sheep, yearlings and over, $7.00 per head; sheep, lambs, coming yearlings, $2.50; sheep, yearlings and over, $3.50; Horses: pure bred and thorough bred stallions, $300.00; pure bred and thoroughbred stallions coming yearlings, $150.00; pure bred mares and grade stallions, $150.00; pure bred mares and grade stallions coming yearlings, $75.00, carriage horses, driving high grade mares and heavy draft horses, $125.00; common unbroke horses and mares, $30.00; ranch, dray work and livery horses, $65.00; saddle horses and cow ponies, $40.00; shetland ponies, $20.00; Mules: asses and large jacks used for breeding purposes, $200.00; heavy draft mules, $125.00; ordinary mules, $75.00; burros, $10.00; Swine: pigs under six months, $2.00; hogs, six months and over, $7.00; goats, $4.00.

Our returns show that under the 1913 assessment of Albany county there were 27,428 cattle, 90,922 sheep, 4,293 unbroken horses and mares, and 7,336 total horses, and 342 hogs.

1361 Cross-examination by Mr. Charles F. Tew:

I have examined the records in my office from which I am able to state the assessed valuation of the lands and improvements thereon of several of the ranches in Laramie Valley and Little Laramie Valley, in the County of Albany, for the tax year of 1913. The Hogue Ranch is owned by the Denver-Laramie Realty Co. On that ranch there are 45 acres of cultivated land assessed at $20.00 per acre. There are 1,569 acres natural hay land at $15.00 per acre. There are 1631 acres we term irrigated grazing land at $5 per acre. There are 5180 acres of pasture land at $3. per acre. The aggregate area of the Hogue Ranch is 8,225 acres. On the whole
1362 acreage there is one set of buildings, assessed at $4,000. Those buildings consist of barns and sheds. There are 13¾ miles of fence assessed on that land. It is valued at $31.20. That comprises the total assessment of this land.

In my classification I have one class at $15.00. That is uncultivated native hay. The 45 acres class at $20. per acre is cultivated land. That means it has been broken and is in alfalfa or grain.

The Iron mountain Ranch, also known as the Boughton Ranch, is partly under the Boughton Ditch and partly under the Laramie River. There are 24,020 acres in the ranch. I don't believe there are any cultivated acres. There are 2,000 acres of native hay land assessed at $20. per acre. The other class of land on that ranch is grazing, 22,020 acres assessed at $2.00 per acre. There is but
1363 one set of improvements on it assessed at $1,100. The fence is assessed at $360.00, I don't know how many miles. There is a small mileage compared with the number of acres.

I will give the total area of the lands assessed, the description of the buildings on each ranch, the classification into which the lands are divided for assessment, the number of miles of fence on each ranch and the assessed valuation fixed for each class of lands and the total assessed valuation of the improvements on the following ranches:

The Hart Ranch: buildings, $2,000; fence, $235; 600 acres cultivated lands, $20. per acre; 700 acres uncultivated lands or meadow lands at $20. per acre; 11,691 acres grazing land at $3. per acre; a total area of 12,991 acres.

Blackburn Ranch: Buildings, $5,600; fence, $500; 500 acres cultivated land at $22 per acre; 1,390 acres cultivated land at $25 per acre; 300 acres meadow land at $15 per acre; 60 acres meadow at $20 per acre; 75 acres irrigated grazing land at $7 per acre; 800 acres irrigated grazing land at $5 per acre; 2,295 acres grazing land at $2; 160 acres at $2.50; 4,370 acres at $3; 480 acres at $1.75; area, 10,430 acres. I will say in regard to the Blackburn ranch that that has been assessed part to the Laramie Development Company and some to L. H. Humphrey, James Morland, C. and A. Morrison, L. B. Pinton, W. A. Radcliff, O. Turnquist, G. Wessels, and H. Wessels.

Keystone Ranch: Buildings $2,000; fence, $600; 80 acres cultivated land at $23; 1,020 acres meadow land at $20; 1,920 acres irrigated grazing land at $10; 3,542 acres irrigated grazing land at $5; 6,562 acres total area. This ranch is also known as the Ernest Ranch.

Sprague Ranch: Buildings, $1,200; fence, $330; 640 acres meadow land at $20; 320 acres meadow at $23; 960 acres meadow at $21; 1,960 acres grazing land at $2; 9,927 acres, value $31,620 at about $3.25 per acre; 13,167 acres at $3.00; total area, 26,974 acres.

Estate of S. W. Gillespie: Improvements, $580; 100 acres meadow land at $20; 364 acres at $2.00; total 464 acres area.

Maggie Gillespie: 2,894 acres at $3.00.

Maggie Gillespie desert entry: Improvements, $550; 307 acres of grazing land at $2.00.

John McGill ranch, along the Laramie River: Houses, $1,500; sheds, $500; fence, $500, 200 acres meadow land, $4,000; or $20. per acre; 100 acres irrigated grazing land at $7.00 per acre; 2,143 acres grazing land at $2.00; total area 2,443 acres.

J. T. and T. B. Dodge: Barn, $100; house, $100; fencing, $120; 45 acres meadow land at $15; 799 acres grazing land at $2.

I have a portion of the Millbrook ranch; That portion lies on the Little Laramie River. It is the best portion, that is the meadow land and the grazing land that lies to the north and west. The Millbrook ranch is divided now so that there are several owners. The following several portions are assessed to the following persons and show the following improvements and assessments:

C. P. Arnold: 100 acres meadow land at $20 an acre; 60 acres at $2.00 per acre; 50 acres at $20; 2,562 acres at $2.

William Conyers: House and barn, $600; 180 acres meadow land at $20; 20 acres grazing land at $3.00.

W. J. Dallas: 240 acres meadow land at $20; 40 acres grazing land at $3.00.

William Irvine: Improvements, $1,000; 250 acres meadow land at $20; 70 acres grazing land at $3.00.

Bert Hoss: 120 acres at $20.

Knud Knudsen: 320 acres at $20; 80 acres at $3.00.

Millbrook Land & Livestock Company: Improvements, $3,100; 300 acres cultivated lands at $20; 170 acres meadow land at $20; 100 acres irrigated grazing land at $10; 13,765 acres at $51,300 value; 400 acres grazing land at $2.00.

Julius Puls: Barn and house, $500; fence, $100; 400 acres meadow lands at $20; 166 acres grazing land at $3.00.

Allen Scoville and estate of E. J. Bell; house, $500; fence $100; 193 acres meadow land at $20; 927 acres grazing land at $3.00.

Other ranches (not part of the Millbrook):

The Oscar Sodergreen ranch shows, house $1000; barns and sheds $600; fence $500; 350 acres meadow land at $20.00 per acre; 4750 acres grazing land at $3.00 per acre; total area 5,100 acres.

The Augusta Sodergreen ranch: 293 acres at $3.00.

Charles Benson ranch: House, $150; barns and sheds, $150; fence $100; 140 acres meadow land at $20; 280 acres grazing land at $3.00; 420 acres total area.

W. P. Shott ranch: This is a part of the Fisher and Popp place; fence $30; 35 acres cultivated land at $25; 80 acres meadow land at $18 per acre; 40 acres meadow land at $20 per acre; 1,005
1366 acres grazing land at $3.00 per acre. 1,160 acres total area.

John Biddick: house $300; barn $100; fence $100; 100 acres meadow land at $20; 260 acres at $3.00; 360 acres total area.

H. R. Ingham: 150 acres meadow land at $20; 690 acres at $3.00; 850 acres area.

H. R. Ingham was once assessor in this county.

Estate of M. A. Carroll: Improvements $500; 200 acres meadow land at $20; 440 acres grazing land at $3.00; total area 640 acres.

Carroll and Ingham: 2,940 acres at $3.00 per acre. The last three include the Ingham ranch.

The John A. Fischer tract of land has been sub-divided into different tracts to different people. The first tract is Sec. 7, Tp. 14, R. 75 W., and is included in the assessment of W. P. Shott as already given. All of Sec. 8 is owned by C. L. Brinkerhoff: 25 acres cultivated land at $25.00 per acre; 200 acres meadow land at $20 per acre; 595 acres grazing land at $3.00 per acre. All of Sec. 9 assessed at $3.00 per acre, 640 acres, and all of Sec. 17.

H. and B. M. Grable: house $500; barns $500; fence $20; 20 acres cultivated land at $25 per acre; 50 acres meadow land at $20 per acre; 555 acres irrigated grazing land at $5 per acre.

The north half of Section 21, A. M. Lunt: improvements $1,000; 160 acres cultivated land at $20 per acre; 160 acres grazing land at $3.00 per acre. This is all in Tp. 14, R. 75 and is the Fischer ranch.

Yesterday I stated the assessed valuation of the Union Pacific by the State Board of Equalization was $55,000 per mile. That is an error, it is $52,000 per mile. There was an assessment by the State Board of Equalization of the Laramie and Hahn's Peak and the Union Pacific. The Union Pacific Company, 80.15 miles at $52,000 per mile, the value would be $4,167,800. The Union Paci-

fic Railroad Company, Hermosa Cutoff 16.08 miles at $20,-
1367 000 per mile, $321,600. Laramie, Hahn's Peak and Pacific Railroad Company, 67.47 miles at $5,000 per mile, total $337,350.

Of the several branches which I have described, I am generally acquainted with the character of each. I have been on the Millbrook Ranch and the Ernest or Keystone Ranch; also the Blackburn Ranch. I would think that the Blackburn Ranch differs from the other ranches in the fact that the greater portion of it is devoted to agricultural use and the raising of crops than is general in the Laramie Valley. It is the best farmed ranch in the Valley. It is therefore a ranch of higher value than the general valuation of ranches throughout the valley. I would also call the Ernest Ranch and the Millbrook ranch high-class ranches. These two ranches are more largely devoted to hay culture than the average ranch in our assessment in the Laramie Valley. They have the biggest area of hay land. They have the largest area relatively, and therefore are the most valuable of the ranches. John Ernest was the owner of the Ernest or Keystone ranch. He is now
1368 a member of the Board of County Commissioners. He has disposed of the ranch. The Board of County Commissioners sitting as a Board of Equalization raised the assessment of the old Ernest Ranch 1,920 acres to $10 per acre and 3,542 acres at $3.00 to $5.00 per acre. The other ranches that I described this morning, other than the Millbrook, Keystone and the Blackburn, are ranches of the general character throughout the county. Some of these run better and some not so good as the three I have named. The Hart Ranch is an example of one of these. There is raisd a little alfalfa on this ranch. It is one of the very best ranches.

The Hart Ranch is known as the best alfalfa ranch in the valley. The Sodergreen place is among the best of the hay ranches.
1369 The ranches I have given are particularly up to the average.

In Albany County, according to my abstract of assessment, we found a total of approximately 53,000 acres of natural hay meadows. Of that there are 48,000 acres which are ranches containing hay meadows irrigated from the Laramie River and tributaries, including Sibylle Creek and all tributaries of the Laramie River in Albany County. Also the drainage basin of the Little Laramie.

Redirect examination by Mr. N. E. Corthell:

1369 Some of the assessments to which I have testified in cross examination were made by me, but not all.

1370 The assessments for property of non-residents were made in the office. The list of assessments I have testified to was made up under direction of attorneys for defendants after an inspection of the assessment schedules. I looked up and testified concerning such assessments as I was requested specially to mention.

1371 These assessed values have very little relation to the price paid upon sales of these properties.

The Sprague ranch is assessed at $59,150. I believe it sold within the last two years at $6.00 per acre.

Recross-examination by Mr. Charles F. Tew:

1372 We try to have our assessment throughout the valley uniform for these hay ranches. These ranches which I have described show assessments which are alike in character to the other assessments I have placed on other ranches for this tax this
1373 year.

Yesterday when counsel visited our office they were there but for a very few moments. They did not go over the entire assessment to pick out particular assessments. It is true that I was requested to pick from the list that was handed me, the assessment of ranches that would be fairly expressive and descriptive of the character of assessment of hay ranches throughout the Valley. I was cautioned to do that. It was brought to my attention to choose some of the very best ranches, for example the Blackburn ranch. It was asked of me if that was one of the best. The same is true of the Millbrook, the Hart and the Keystone ranches. I did choose some of the very highest classes of ranches to give my example here. The time that I had to give was that limited that I could not give all of the assessments in the whole valley. Consequently counsel gave me instructions to pick throughout the valley in different portions so as to give a fair sample of the average assessments. I did that.

The total value of lands or properties assessed against the Union Pacific Railroad, exclusive of the trackage and outside the City of Laramie in the year in question is $234,475. These lands
1374 are in the main open lands, that is lands not used for hay meadow, but range lands. All the land the Union Pacific has in the county are rangelands. It is open land which the stock runs over. The same is true of a large amount of the lands of the state, as well as public domain that lies adjacent to the ranches, the assessments of which I have spoken of. Most of the ranches we have described are in the cattle business. The persons occupying these ranches graze stock not only over the areas which I have described as assessed to them, but enjoy the use of this open public range adjacent to their lands. The cattle business of the men consists of these ranches up and down the river used in conjunction with these open lands. I do not believe that the owners of these ranches limit their operations to the particular area I have given. The cattle and sheep and horses and stock range remote from the ranch house and ranches many miles. We have some farm-
1375 ers here, but speaking generally of the country, the whole country is a cattle, sheep, horse and ranch country.

The complainant then rested its case.

(End of Transcript, Vol. 3, Complainant.)

In the Supreme Court of the United States.

In Equity.

No. 8, Original.

1376 THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation; The Laramie-Poudre Reservoirs and Irrigation Company, a Corporation, Defendants.

The Complainant having rested its case in chief in the above-entitled action the following evidence was introduced before Newton C. Garbutt, Special Commissioner, by and on behalf of the defendants, commencing December 15, 1913.

Appearances:

For the Complainant: D. A. Preston, Esq., Attorney General of the State of Wyoming; N. E. Corthell, Esq., John D. Clark, Esq.

For the Defendant, the State of Colorado: Fred Farrar, Esq., Attorney General of the State of Colorado.

For the Greeley-Poudre Irrigation District: Delph E. Carpenter, Esq., Charles F. Tew, Esq.

For the Laramie-Poudre Reservoirs and Irrigation Company: Julius C. Gunter, Esq., Denver, Colorado.

1376 JOHN E. FIELD.

Direct examination by Mr. Fred Farrar:

I am a civil engineer. Was born in Colorado in 1867. I am the present State Engineer and Engineer of the Land Board. As State Engineer, I have supervision of the distribution of water supply, particularly: also the compilation of data in regard to water supply and the examination of ditches and dams and any other engineering work that the State happens to undertake. Under the law of Colorado the State Engineer is at the head of what you might call the irrigation department, which includes water commissioners and superintendents of irrigation. The sub-ordinate officials having charge of the distribution of water are five division engineers, and the water commissioners. The division engineers, each one having charge of a main drainage area, are directly responsible to the State Engi-
1377 neer. The division engineers are over the water commissioners; there are sixty-seven of these in the State, and, of course, each water commissioner has one or more deputies.

I assumed office of State Engineer April 1, 1913. I was State Engineer before from April, 1897, until April, 1899, and was deputy state engineer from December, 1900, until April, 1903. I was educated in the public schools in Denver, graduated from the high

school in 1885 and then went to Sheffield Scientific School of Yale University, where I graduated in 1888, from the Scientific School and the engineering division. After I graduated I took one year of post-graduate work, finishing in 1889. During my college and post-graduate courses I made a specialty of hydraulics. As to my experience both from a practical and professional standpoint in irrigation matters, I will state I was born in the State of Colorado on a farm which was irrigated, and during my entire life up to the present time I have been engaged more or less with irrigated farms, especially after I graduated from college. As early as 1879, my father, who was a civil engineer, taught me the use of the instruments and that sort of thing. I worked with him during two or three summers on the ranch. The rest of my vacations were al-
1378 most entirely spent on the farm, where I learned irrigation, in a practical way, and that, coupled with my ability to run the instruments so qualified me that I laid out ditches and built some few reservoirs, even before I went to college. After I graduated from college, I went into the mines at Aspen, where I had some experience in tunneling, and general mining operations. In 1893, the depression in the mining field was such that I returned to Denver, and from that time until 1903 I had charge of the several farms which belonged to my father, one consisting of 400 acres in Boulder county. That was an irrigated farm. He had two farms also on the Arkansas river near Swallows, about seventeen miles west of Pueblo; and he also had several hundred acres of land south of the city of Denver under the City Ditch, and it was my duty to relieve my father to a large extent, in the operation of those farms. Between the years 1893 and 1897, I was chief examiner in the office of the United States Surveyor General for the District of Colorado, and during that time I made ditch surveys to help out in making a living. During the two years that I was State Engineer, the duties were almost entirely devoted to the settlement of dispute of the distribution of water in the State. During the two years inervening between the time I was State Engineer and Deputy State Engineer, I constructed the storm sewers in the City of Denver in what is known as the Capitol Hill District. After my term of Deputy State Engineer in 1903, I went to work for the United States Reclamation Service under the Reclamation Act. I was with them until August, 1907, and during that time I made investigation of the Sweet Water Project.

1379 The Sweet Water is a tributary of the North Platte River, enters the North Platte River some fifty miles southwest of the town of Casper, in the State of Wyoming. The Sweet Water reservoir was intended at that time to furnish water if different Government projects should be built upon the North Platte river in Wyoming and Nebraska. I discovered that the water supply there, however, was insufficient. In July, 1903, I started out to find some other reservoir site. I had been informed that there was a reservoir site on the North Platte river. I sought that out, and the site which was located by me for that is now known as the Pathfinder Reservoir.

I continued in charge of that work until the laying of the masonry began, that is, I made the surveys and the calculations, etc., in reference to the Pathfinder; made investigations as to a dam site, built the tunnel, and did the preliminary work. During this time, also I investigated the North Platte river in Wyoming south of the Pathfinder Reservoir, that is to say, in the vicinity of the town of Saratoga, Wyoming, on behalf of the Government I examined two projects, each of which contained something over 50,000 acres. I also investigated these lands and the possibilities of ditch building between the Pathfinder Reservoir and the Wyoming-Nebraska State line. I had surveys run on both sides of the North Platte river beginning above Casper and extending, as I say, clear to the State line, and even beyond into the State of Nebraska. I made an examination of what is known as the Goshen Park Project; had those surveys and investigations made. Also the project practically completed, the Interstate project, which canal heads in the State of Wyoming just below the town of Guernsey and extends for a distance of about 50 miles through the State of Wyoming cover-
1380 ing perhaps 40,000 acres of land in the State of Wyoming. This canal extends still farther eastward into the State of Nebraska and in original plans was to cover about 160,000 acres of land in the State of Nebraska, on the north side of the North Platte river. The Goshen Park project contemplated the irrigation of some 200,000 acres of land on the south side of the Platte river. I left the Government service in August, 1907, returned to Denver and opened up an office for private practice.

My investigation of these Government projects led me into a study of the tributaries of the North Platte river. I made investigation of the Laramie River and all of the Wheatland country at that time, with the particular object of ascertaining the water supply and what effect the development along the North Platte might have. I concluded at that time that the Laramie river valley was very well covered by private enterprises, and that its development would proceed and that there was no necessity of the Government going into the Laramie Valley at that time, and that though we might use all of the waters of the North Platte river, that it would in no way interfere with the irrigation of the Laramie Plains; further, that the waters from the Laramie, although they might be used by diversions above the mouth of the Laramie, would not interfere with the development on the North Platte river. In my private practice I have also had occasion to examine numerous projects in the State of Wyoming; the Eaden project, north of Rock Springs, and the Riverside Ranch. I made a particular investigation of this ranch on the Laramie river, some twenty miles above the town of Laramie. I have also done quite a little work in the vicinity of Sheridan and Clear Creek and Little Goose and Big Goose
1381 Creeks, in Wyoming. The diversions from the Tongue river over into West Pass and East Pass from the Parkman Irrigation District. This district lies in the State of Wyoming, along the Wyoming-Montana line. Also in my private practice,

since 1907, I have examined and reported on projects in Oregon, Texas and New Mexico. These were irrigation projects.

In answer to your question directing me without further interrogatory to give a general geographical and topographical review of the States of Colorado and Wyoming, giving particular reference to the Laramie and the Poudre rivers, I think it is well, at first, to state the general location of Colorado and Wyoming, with reference to the rest of the country.

Colorado occupies a rather unique position in the inter-mountain region which includes within its boundaries a portion of the crest of the continent. This continental divide extends from the Canada line to the Gulf, and Colorado caps the pinnacle of this divide. This continental divide is popularly known as the Rocky Mountains. In Colorado it is divided into several mountain ranges, beginning on the north and west of North Park as the Rabbit Ear Range, it swings around the south end of North Park south some fifty miles to the point where it joins the Medicine Bow Range, which is the dividing range between the Laramie river and the North Platte river. It is also the point where the headwaters of the Cache la Poudre are separated from the Laramie river; and the point where the headwaters of the Grand river are separated from those of the North Platte, the Laramie and of the Poudre. At one point practically all of these streams separate, part of the water flow-
1382 ing to the Pacific, and part into the Gulf of Mexico. The Continental Divide extends further south and is known as the Green and the Front Range and in Central Colorado as the Williams Mountains. In the extreme south it is known as the Cochetops.

There are perhaps three mountain ranges extending more or less continuously through the width of the state of Colorado, and between these mountain ranges are mountain parks. The most northerly in Colorado is known as North Park, then further south Middle Park, South Park and the San Luis Valley. The Laramie Plain in Wyoming might also be considered as one of these parks inclosed by high mountain ranges.

The drainage in the State of Colorado flows in all directions and there is almost without exception, no stream entering the State of Colorado from any other state. A few small streams, dry during part of the year, cross the northerly boundary of Colorado from the State of Wyoming, such as Lone Tree and Crow Creeks. A partial exception to this rule might be the Little Snake river which heads in both Colorado and Wyoming. The greater run-off, however, I believe comes from the State of Colorado. The Mountains in Colorado being higher and I believe the precipitation greater. The Little Snake river itself crosses and re-crosses the Colorado-Wyoming boundary line, finally entering the State of Colorado and is tributary to the Yampa or Bear river which, in turn, is tributary to the Green and of the Colorado, which flows into the Gulf of California.

On the other hand the North Platte and the Laramie rivers flow from Colorado northward into the State of Wyoming. The North Platte discharges into the State of Wyoming probably something in

excess of one million acre feet, while the Laramie river and
1383 its drainage discharges into the state of Wyoming about a quarter of a million acre feet annum. On the western side of Colorado and the eastern boundary of Utah is the Green river which rises in Wyoming, passes through a corner of Utah, loops into Colorado for a short distance and finally enters the state of Utah and forms one of the tributaries of the Colorado.

The Yampa, sometimes also called the Bear river, the White, the Grand and the Dolores, also flow from the State of Colorado, westerly into the State of Utah, and they contribute to the streams of other states an aggregate of about eight million acre feet per annum.

On the south are the La Plata, Las Animas and San Juan, which cross the southern boundary of Colorado into New Mexico and ultimately join the Colorado river in Utah. These streams discharge about two million acre feet per annum.

The Rio Grande river drainage also crosses south. It arises in Coloardo east of the Continental Divide and it and its tributaries discharge about a million acre feet per annum on the average from Colorado into the state of New Mexico.

On the easterly side of Colorado are the South Platte, the Republican, the Arickaree and the Arkansas. These streams discharge water into Nebraska and Kansas in amount probably one million acre feet per annum.

It appears, therefore, that the streams in the State of Colorado discharge into other states something over thirteen and one-half million acre feet per annum at present.

The State of Wyoming is situated similarly to the State of Colorado. Its average elevation is greater than Colorado, though its mountain peaks are generally not quite so high. We find within its boundaries the tributaries of the Missouri, the Yellow-
1384 stone, the Big Horn, the Tongue and the Powder rivers crossing into Montana. To the west the Snake river and its tributaries pass into the State of Idaho, and to the south the Green river flows into the state of Utah. To the east, the North Platte and Niobrara flow into the state of Nebraska, while the Belle Fourche and the South Fork of the Cheyenne flow into the state of South Dakota.

Both the state of Colorado and Wyoming are in the semiarid region where irrigation is necessary to successfully grow agricultural crops, and these two states furnish a large part of the water necessary to the agricultural land of the adjoining states and to states as far distant as southern California, south-western Arizona, Old Mexico and Texas. On all of these interstate streams there is the question of relative rights of the states, and the rights of the individuals within the states. Colorado on account of its geographical and topographical location and elevation is made defendant in all interstate suits, while Wyoming is made defendant in all suits with other states with the exception of the state of Colorado. When I say defendant, I am speaking in the abstract rather than the concrete. By defendant I mean it defends the right to use all water within its

borders. Already Colorado has had litigation with the state of Kansas. A suit has also been filed concerning the waters of the Republican river by citizens of the state of Nebraska. And, in my opinion, unless one of the suits now pending is settled definitely there will be litigation on all interstate streams and questions will arise in reference to the waters claimed by New Mexico, Texas, and Old Mexico on the Rio Grande, and of Arizona, California and Utah, regarding the tributaries of the Colorado river in the state of Colorado, and of Nebraska in reference to the waters of the
1385 South Platte river.

The Continental Divide is near the center of the State of Colorado, the western portion of the state is mountainous and very broken. In the extreme western portion what was originally a very high plateau, has been so eroded that the amount of agricultural land is small and the valleys are proportionally narrow. To the casual observer it is what would be called a mountainous country, while east of the Continental Divide we have the Great Plains where the country is rolling and quite level. The elevation of these plains varies from four thousand to a little over five thousand feet, while on the western slope only the valleys are below five thousand feet.

The distance from the eastern edge of the mountains to the state line is something over two hundred miles. Of the four streams flowing to the east; the South Platte, the Republican, the Arickaree and the Arkansas, the Republican and the Arickaree head on the Great Plains and are quite small. The South Platte and the Arkansas both head in the Continental Divide and are streams of consider-
1386 able magitude. With reference to these streams which run to the east, there is some accretion aside from seepage and return water from irrigation. The plains region, however, does not furnish a very great run-off, and that portion or the Great Plains tributary to these streams, probably does not discharge much over 1/10 of a foot of water in depth over the water sheds into the streams; that is to say, from a section of land of 640 acres, probably 64 acre feet would represent as much as is discharged on the average into these streams.

The South Platte and Arkansas Rivers decrease, under natural, normal conditions, as they cross the plains on the eastern side of Colorado after they leave the mountains, except at such times as when very heavy rains discharge large amounts of water into the streams, when we would have what we call a flood or a cloud burst. These conditions differ by contrast from the streams in the eastern portion of the United States, especially out of the arid region, where there would be a gradual increase in the streams naturally. In these streams there would be a natural decrease until they reach the area of increased precipitation, except for those er-atic cloud bursts I speak of. The next result probably would be a very considerable loss of water after the rivers reached the plains region out of the mountains and out of the foothills.

1387 This condition is modified by irrigation, there is a very considerable return of water on account of irrigation. The result is to materially increase the low flow of the streams. The short flow period is decreased. On the South Platte river the return

seepage is such that it is estimated that one-third of all the water which is diverted from the stream returns in the form of seepage and return water. Those return waters furnish about the entire supply of the river after it leaves the hill region. Its line of demarcation would pass about through Denver and the town of Greeley and the town of Cheyenne. From that point east, by far the greater part of the water used for irrigation is from return and seepage water. I am not able to state from personal knowledge whether or not there is more or less water flowing in the streams at the eastern end of the state, except during the flood seasons, than there was before irrigation commenced, but records, however, can be consulted, and from my reading of the historical accounts of the early experiences along the South Platte, I am led to believe that the amount of water which crosses the Colorado-Nebraska line is very much greater during the low flow than it was before. The area involved in this suit lies in both Colorado and Wyoming.

1388 The waters in controversy arise in the State of Colorado, but the areas of land which are involved are in both states.

The Laramie Valley in Colorado lies about the center of the northern boundary of that state. The drainage area of the headwaters of the Laramie river and the headwater- of the Cache la Poudre are adjacent and interlaced, for the Continental Divide, crossing the Colorado-Wyoming line west of the North Platte river drainage, swings east more than fifty miles around the south side of North Park and joins the Medicine Bow Range and the Green Mountains at about the same point, the Green Mountains being the mountain range separating the Laramie river drainage from the Cache la Poudre drainage. At this point the range swings to the south and is known as the Front Range and divides the headwaters of the South Platte from those of the Grand river; that is, it divides the waters of the Atlantic from those of the Pacific slope so that at this point we find the divide separating the headwaters of the North Platte and Laramie river, a tributary of the North Platte, and the Cache la Poudre, a tributary of the South Platte, as well as separating these branches from the Grand river drainage which flows into the Pacific.

1389 From a position at the head of the Big Laramie river in Colorado, looking to the north, there lies in front of the observer the Laramie river valley extending nearly due north until it crosses the Colorado-Wyoming line. The valley in Colorado is very narrow with bottom lands mostly growing wild hay. These meadows are scarcely more than a mile in width and are bordered by mesa or bench lands extending back to the hills on both the easterly and westerly border of the valley. The valley is possibly less than one-half mile wide at its upper end and widens gradually to the state line, being in some places two miles in width. At the state line the Laramie river enters a narrow cañon which ends in the vicinity of Woods Landing, some ten miles north of the Colorado line; thence the river flows in a northeasterly direction traversing the Laramie Plains proper to their northerly extremity, where it turns abruptly to the east, breaks through the rim of the valley,

drops some two thousand feet in elevation, passes through the ridge and skirts the northerly edge of the Wheatland country and enters the North Platte river at Old Fort Laramie.

Old Fort Laramie was almost the first settlement made upon the Laramie or upon the North Platte river. It was founded about 1838, was purchased for a Government Post, and in 1848 was one of the most important outposts and stopping places for the gold seekers of California, the Mormon immigrants, the Oregon settlers and other westward bound people. So that this section at least, was well known in the earliest days.

To the observer standing at the head of the Laramie river, there appear two ranges of mountains diverging one to the west and extending in a northwesterly direction, forming the watershed between the Laramie river and the North Platte drainage, and the other extending northerly and in a slightly easterly direc-
1390 tion, forming the watershed between the Laramie and the Cache la Poudre rivers.

The watershed between the Laramie river and the North Platte river is known as the Medicine Bow Range and extends northward into Wyoming about 50 miles. By watershed I mean divide. It divides in Wyoming into several spurs, the more promient of which are the Sheep and Centennial mountains. Many of the peaks of this range in Wyoming reach an elevation of more than ten thousand feet. Clark's Peak in Colorado reaches an elevation of about 13,000 feet. Medicine Bow Peak in Wyoming is credited with an elevation of from 12,005 to 12,231 feet, depending upon the authority consulted, a few of the lower peaks are less than 10,000 feet and throughout Wyoming the range appears to have an average elevation of almost 10,000 feet. The passes in both Colorado and Wyoming are close to 9,000 feet in elevation. This range in Wyoming, including its spurs, is somewhat wider than in Colorado. the Laramie and North Platte rivers diverging somewhat as they flow northward. Numerous tributaries of the Laramie and of the Little Laramie rivers head in the Medicine Bow Range. They flow in a northeasterly direction in Colorado and in a general easterly direction in Wyoming.

Beginning at the southerly end of the drainage area, the following tributaries of the Big Laramie discharge water into the Laramie on the west side: West Fork, Mill, Fall, Rapid, Springer, Rawah, Link Creek, Stub, McIntyre, La Garde, Forrester, Grace and Stuck. Those reach the Laramie river before it crosses the Colorado-Wyoming line and above the gauging station known as Boswell, State Line or Jelm Station.

1391 Those reaching the Laramie river in Wyoming and heading in the State of Colorado, are Johnson and Beaver creeks. Those rising in Wyoming are North Branch of Beaver Creek, Bear, Wood and Fox creeks.

The Little Laramie river has the following tributaries, all, of course, in the State of Wyoming, and heading west of the Laramie Plains, and in the Medicine Bow range and its spurs; Buckeye,

Hecht, South Fork, Middle Fork, Mallen, Liby, Nash, North Fork and Mill creeks.

North of the Little Laramie drainage the streams which head in the Medicine Bow range or its spurs are Seven Mile, Four Mile, Cooper and Dutton creeks. All of these streams are quite permanent in their character, and derive their waters either from the snows of winter or from the summer rains which are abundant throughout the Rocky Mountain regions in the months of July and August.

A remarkable condition exists at the head of the tributaries of the Little Laramie river. Near the head of Nash and Libby creeks, tributaries of the Little Laramie, there are a great many mountain lakes fed by the snows of the high peaks, causing a natural equalization of the flow of the creeks.

On the easterly side of the Laramie Valley the mountain range or divide between the Cache la Poudre and the Laramie rivers is known—in its southerly extremity—as the Green Mountains, the latter being sometimes called the Laramie Mountains, and extending to the cañon where the Laramie river cuts through the ridge. These mountains extending north of the Laramie river are generally known as the Laramie mountains, terminating in Laramie Peak.

1392 The Mountain range bounding the Laramie Valley on the east, in the State of Colorado, discharges a considerable volume of water into the Laramie basin. Beginning at the southerly terminus of the Laramie Drainage area the most important tributaries flowing into the Big Laramie are: Half Mile, Springer, Brinker, Porter, Deadman and its tributaries, Nunn Creek and Jimmy Creek; all reaching the river in the State of Colorado.

The most important tributary of the Big Laramie river from the east is Sand Creek. This creek obtains practically all of its water supply within the State of Colorado from the westerly slope of Green Mountains and Boulder Ridge, but it flows northerly and does not enter the Big Laramie river until within some eight miles of the town of Laramie. It has several tributaries such as Shell Creek; Antelope Creek might also be considered as a tributary, though it generally discharges into Hutton Lake.

In the drainage area of Sand Creek are situated the Hutton and Creighton Lakes, which lakes tend to diminish the amount of water reaching the river and their evaporation and their losses are supplied from water from Sand Creek and other sources, which waters formerly reached the Laramie river. These lakes have not been used heretofore for irrigation and the waters flowing into them are practically wasted. With the exception of Fish Creek, Five Mile and Soldier Creek, scarcely any waters reach the Big Laramie river from the east below Sand Creek, until after it has reached a point below the Wheatland Reservoir.

As the Laramie river passes through the Black Hills. or Laramie Mountains, in its escape from the Laramie Plains, it receives water

from the following creeks from the north: Big Springs,
1393 Dodge Creek, Duck Creek, McFarland, Luman, Dry Laramie, and North Laramie. The latter is one of the principal tributaries and drains the country around Laramie Creek. On the south it receives practically no water while passing through the cañon, but below the mouth of the cañon several important tributaries enter the river of which the more important are: Slater Creek, Sybille, and Chugwater creeks.

From the point where the Laramie river enters the Wheatland reservoir, which is near the northerly terminus of the Laramie Plains, there is little land cultivated or irrigated with the exception of the Wheatland area. Detached areas are found widely separated and are generally irrigated from the tributary streams or springs, and consist principally of bottom meadow lands where native grasses are raised. The area, other than the detached portions mentioned, consists of rough, broken, hilly and mountainous country and high table lands which are not susceptible of irrigation, and whose use is confined almost entirely to the grazing of live stock.

The drainage of the Cache la Poudre river is bounded on the southwest by the Front Range of the Continental Divide, beginning at Mount Richtofen, which is the southerly extremity of the Medicine Bow Range, running thence southerly to Specimen Mountain. The southerly portion of the drainage area consists of a lower range of mountains extending from Specimen mountain to Signal Mountain, which has an elevation of about 11,450 feet. The Green
Mountains and Boulder Ridge form the westerly and north-
1394 westerly boundaries of the drainage areas. The elevation of this mountain range in its southerly extremity reaches 13,000 feet and gradually decreased to the north until at the state line it does not exceed 9,000 feet. The Cache la Poudre river heads in Chambers Lake, which in turn is fed by the waters of Joe Wright Creek and Trap Creek. These enter the lake from the south. Below Chambers Lake, tributaries enter the river from the south above the mouth of the cañon, and the principal ones are: South Fork, Sheep Creek, Bennett Creek and the Little South Fork. The tributaries entering these streams below Chambers Lake from the North are: Tunnel Creek, Roaring Fork, Seven Mile, Elkhorn, Gordon and the North Fork of the Poudre. The Cache la Poudre river at the gauging station above Fort Collins has a drainage area of 1060 square miles. The North Fork of the Cache la Poudre has a drainage area of 550 square miles. The Cache la Poudre river proper after leaving the highest portions of its drainage area flows in an almost due easterly direction, while the Laramie river flows in an almost northerly direction, or at right angles to the Poudre river.

The course of the Cache la Poudre river is at right angles to the general trend of the mountain range. It leaves the mountains just above Fort Collins. From thence it flows through a plains country
and has a considerable fall to the east. It is a tributary of the
1395 South Platte river, which in turn is a tributary of the Platte river. The North Platte river and the South Platte river join at the town of North Platte in the state of Nebraska, to form the Platte

river, which, in turn, flows into the Missouri, then to the Mississippi, and then on to the Gulf of Mexico. The town of Greeley, Colorado, is near the junction of the Poudre and the South Platte. From Chambers Lake to the point where the river leaves the mountains, it flows in a narrow mountain valley, or generally a cañon.

At the point where the Greeley-Poudre Irrigation District has constructed its tunnel for the purpose of bringing the waters of the Laramie river over into the Valley of the Cache la Poudre, the two rivers are separated by the Green Mountains. The distance between the two rivers being about two and one-quarter miles. From this point the rivers flow at right angles never again approaching. Nor do their tributaries approach. So that it is impossible, or rather impracticable, to build any tunnel at a point lower on the streams.

Surveys have also demonstrated that it is impracticable to take water from the Laramie river at any point lower than the intake or tunnel and conduct it into the Cache la Poudre drainage. The system of the Greeley-Poudre Irrigation District represents, therefore, the final development of the waters of the Laramie river for the lands in the State of Colorado, other than the small areas along the Big Laramie river and its tributaries.

It is of interest at this point, that water is now and for many years past has been diverted from the Pacific slope to the Atlantic slope and used on the Great Plains. This diversion is commonly
1396 known as the Grand River Ditch as it carries water from the Grand river and its tributaries to those of the Cache la Poudre. Similarly water has been for many years diverted from the headwaters of the Laramie river through the Sky Line Canal and stored in Chambers Lake, discharged thence into the headwaters of the Cache la Poudre and used in the Cache la Poudre Valley for purposes of irrigation. These two diversions are made by The Water Supply and Storage Company, which diverts these waters from the Cache la Poudre river in the vicinity of the town of Fort Collins and irrigates land on the north side of the river and adjacent to the southwesterly portion of the Greeley-Poudre district. This land lies immediately adjacent to the Greeley-Poudre Irrigation District. This system, now known as the Water Supply & Storage Company system, was formerly called the Larimer County Ditch System. The system of the Greeley-Poudre District also diverts water from the Laramie river drainage into the Cache la Poudre drainage for the purpose of irrigating lands on the Great Plains to the north and east of the town of Greeley. It is intended to so divert the water.

The diversion works on the Laramie River are at a consider-
1397 able less elevation than the Sky Line Canal. I refer to the diversion works of the Greeley-Poudre system. These works are at a point where the west fork and east fork of the Laramie river join, both of which forks are intersected by the Sky Line Canal, and with their tributaries, furnish the entire supply of the Sky Line canal. These streams tapped by the collecting ditches of the Greeley-Poudre District are none of them very large. McIntyre Creek, the largest of the tributaries, is tapped about one mile below the crest of the divide and the drainage area is less than 2 square miles, so

that the collecting ditches can only secure such supply as is furnished by those 2 square miles. Rawah and Spring creeks have a drainage area of about 11.3 square miles, Rapid creek 3½, Fall Creek 1½ square miles, Mill Creek 2 square miles, and West Fork of the Laramie 1½ square miles; these areas being exclusive of that tapped by the Sky Line Canal, a total drainage area intercepted by the collecting ditches of 24 square miles. The east fork of the Laramie River, exclusive of that tapped by the Sky Line Canal has a drainage area of about 5 square miles. Other streams from the east and intercepted by the east side collecting canal are Half Mile, the drainage area is 2½ square miles; Springer Creek, 4½ square miles, Brinker Creek 2 square miles, Porter 2 square miles, Nunn Creek 12 square miles, Deadman Creek (exclusive of that tapped by the Wilson Ditch) 11 square miles, a total of 39 square miles and a total for both sides of the valley of 63.5 square miles ex-
1398 clusive of the territory tapped by the Sky Line and Wilson diversions.

The Wilson Creek Diversion is a trans-mountain diversion similar to the Sky Line and Grand River ditches. Its collecting ditches, which intercept the waters of Deadman Creek, carry the water into Sand Creek, it flows down this Creek for a short distance and is diverted into a tributary of the Cache la Poudre river, known as Sheep Creek; it flows down Sheep Creek and is diverted later from the Cache la Poudre river by the Eaton ditch and others.

This Wilson ditch which I mention is near the top of the divide between the Laramie river and the Cache la Poudre river. I might say that the Sky Line drains an area of about 15 square miles. It has been variously estimated at from 10 to 20 square miles, and I am not able to say which is the nearer figure, there seems to be so much discrepancy in the maps which are available. The Wilson ditch is not a very large diversion, although it is capable of diverting as much, possibly a little more than 200 cubic feet per second. I should state here that some of the water originating on that portion of the drainage area above the Sky Line and the Wilson ditches reaches the Laramie River. There is a certain amount of seepage from the ditches, and at certain periods of the year the water is not diverted, and some of the water gradually forms springs. By deriving water from territory above the ditches, it forms springs below the ditches. There is a gauging station at Glendevey, which is several miles below the entrance to the Greeley-Poudre tunnel. It has a drainage area of about 102 square miles.

1399 Deadman Creek and its tributary, Nunn Creek, enter the Laramie River at Glendevey. I am now having compiled the record of the discharge of this station. These are not quite complete at present but the discharge at this gauging station appears to be from sixty-five to seventy thousand acre feet per annum, exclusive of the water which has been diverted by the Sky Line and Wilson ditches. In my judgment, about one-fourth of this water enters the river below the tunnel entrance and comes from the territory below the collecting ditches. The result being probably about

only 75 per cent of the water shown at the Glendevey station is available for diversion at the Greeley-Poudre tunnel.

Glendevey is about fourteen miles south of the state line, by an air line. The distance by meander of the stream would be considerably greater. I wish to say at this point that at a later date other witnesses, and perhaps myself, will present in detail such matters as the drainage area, run-off, water supply and related subjects, also a more minute description of the Greeley-Poudre system. It is well at this time, however, I think, to give a brief description of this system if I can find my notes.

Before taking up a description of the Greeley-Poudre system, I wish to state that by an extension of the west collecting ditch of that system in a northerly direction, it can tap the McIntyre
1400 creek at a lower elevation that it is tapped at present. The extent of the territory which would be tapped by such an extension being approximately 36 square miles.

I do not intend to state that a further diversion other than the tunnel, could be made from the Laramie. The Water would necessarily run down hill from the point where it would tap the McIntyre southerly to the entrance of the tunnel.

As previously stated, the Greeley-Poudre system consists primarily of diversion water from the Laramie river drainage and that of the Cache la Poudre. In order to obtain as much water as possible, collecting ditches, so-called, have been constructed along the slopes of both the Medicine Bow and Green Mountains. The canal of the Medicine Bow slope, called the West Side Canal, taps the stream headwaters of McIntyre Creek, intercepts Rawah Creek well towards its mouth and also West Springer, Rapid, Fall and Mill creeks near their mouths, and flowing southerly terminates near the Greeley-Poudre tunnel. The canal on the Green Mountain slope known as the East Side Canal, begins by tapping the waters of Deadman Creek within about a half mile of its mouth; it intercepts Nunn Creek, Porter Creek, Springer Creek, Half Mile Creek, flowing south also to the mouth of the tunnel where its waters join the waters from the West Side Canal and from the West and East Forks of the Laramie River.

These ditches are technically known as collecting ditches, as they collect the water flowing down from the mountain sides and
1401 carry them to a common point which in the present case is the westerly portal of the tunnel. These two ditches, in fact, carry the water along the side of the ranges forming the walls of the Laramie Valley, and in effect take it upstream with reference to the flow of the Laramie river.

The tunnel has been driven through the Green Mountain Ridge for a distance of two and a quarter miles and discharges the water into the Cache la Poudre river, from thence, it flows down that stream to one or more reservoir sites located in the Cache la Poudre river channel, provided or to be provided for its storage. After having been stored in the river reservoirs, the water will be again discharged into the river and flow to the headgates of the Greeley-Poudre Irrigation District Canal, which canal heads just inside

the mouth of the canon of the Cache la Poudre. The water after being taken into this canal is carried to the lands of the Greeley-Poudre Irrigation District and to numerous reservoirs under the canal, where it will be again stored and conserved for future use when not needed for immediate use.

By means of this system of tunnel, canals and reservoirs, the water diverted in part during the non-irrigating season will be reserved for use when needed and will supplement the supply received from the Cache la Poudre river when the floods of that stream are insufficient to furnish the priorities of the district with water.

Without this supplemental supply the flood waters would be of practically no use to the district or to any other development, for the reason that the structures necessary for its conservation would necessarily be of such cost and magnitude as to make it prohibitive, considering the then necessarily limited amount of land that would be served. These floods would be difficult of conserva-
1402 tion for the further reason that after the normal flow and the smaller floods are used and diverted, the remaining large floods are uncertain, variable and erratic in character. It is only during abnormally large supply of water that the district can claim water from the Cache la Poudre river. The matter of the cost and expenditures of the District will be given later by another witness.

In the development of the agricultural resources of Colorado, as has been stated by numerous writers upon the subject, the first efforts were individual and the lands reclaimed were almost exclusively the bottom lands immediately adjacent to the streams. Colorado, east of the Continental Divide, was particularly fortunate in having streams with a rapid fall which enabled the builders to divert water without very great expense, and it was also fortunate in the almost unlimited acreage of fine prairie land.

The original incentive to agriculture in Colorado was to furnish hay, grain and other farm products to the mining districts, which prior to the discovery of silver at Leadville, were principally the mines at the head of Boulder and Clear Creeks. The ore was transported by means of teams, as was also the lumber and all other products of the mountain districts. This required a large amount of feed for horses, and it was to supply this need that the bottom lands were taken up and the hay irrigated and cut. The growing of oats naturally accompanied the growing of hay, and later wheat was grown to furnish the flouring mills which were built at several points in the farming districts, the first being probably at Littleton, above Denver, known as the Rough and Ready Mill, which was built about the year 1860. Another flouring mill was
1403 built on Boulder Creek, the grist mill on that creek was built in 1861, and the flouring mill in 1866.

After the individual effort at building ditches had practically exhausted the very easy developments, associations of individuals or communities banded together to build larger and more extensive canals. Typical of this development are the canals built in and

around the town of Greeley by the Greeley colonists. These canals are known as Union Colony No. 2 and Union Colony No. 3.

Succeeding the community enterprise, and beginning with about the year 1878, incorporated companies were formed which secured a large part of the necessary funds for the construction of irrigation systems from outside of the state. Typical of this development was that of the Northern Colorado Irrigation Company which constructed the Loveland Lake and the Loveland-Greeley Canal, now known as the Greeley and Loveland Canal, and the High Line Canal in the vicinity of Denver. The corporate enterprises flourished until about 1893, when the panic of that year stopped nearly all of the irrigation development.

During the latter part of the 80's and the early 90's a shortage of water for the late crops, such as potatoes, cabbage, beets, etc., occasioned the construction of numerous storage reservoirs for the conservation of winter flow and of the flood waters. The builders of these reservoirs were companies made up largely of farmers using such waters under already constructed ditches. By these reservoirs, most of the available remaining water in the Cache la Poudre and other valleys, was appropriated and applied to a beneficial use.

About this time, also, the so-called Carey Act was passed, which contemplated the reclamation of the arid lands by the states. Generally, however, under this Act, the states have delegated the construction to corporations.

1404 The next step in development was under the National Reclamation Act which was passed in 1902, which Act again centered attention upon irrigation development, and this act is largely responsible for the very rapid growth of irrigation development during the last decade. In the meantime, the District Irrigation Law of California had been passed and tried. Its defects had developed and it was thought that they could be corrected. Accordingly, in 1905, the Colorado District Irrigation Law was passed similar in many respects to the so-called Wright Law of California, and under the provisions of this Act, the greater portion of the development of Colorado has been accomplished since its passage.

These excessive methods of development indicate clearly the constantly increasing cost of development and they made possible the overcoming of physical difficulties which neither the individual nor the community enterprises could cope with. The most difficult and expensve development undertaken is probably in the class of trans-mountain diversions. Here it is necessary to build canals in regions remote from labor and materials, markets, through comparatively unoccupied territory and over lines where a large part of the work is through rock and along steep hillsides, where the seasons suitable for construction of canals are short and labor hard to obtain, where the most substantial construction is necessary, and where the utmot care must be exercised in the selection of the route and in the performance of the work. The ice and snow conditions of winter must be provided for and guarded against and tunnels of greater or less extent are generally necessary.

The Greeley-Poudre District has about 20 miles of collecting

canals along steep hillsides, largely in rock, and the con-
1405 struction of the Greeley-Poudre tunnel two and one-quarter miles in length, required the transportation of labor and materials by men and teams for a distance of about 78 miles from Laramie, Tie Siding or Fort Collins, and it was an engineering feat worthy of the attention of the best engineering talent and required the expenditure of a large amount of money and time. While the time consumed in the actual construction of the tunnel is not great, its location and necessary preliminary examination of almost the entire mountain ridge to determine the probable water supply and the raising of capital, necessarily consumed a number of years.

The shortage of water in the Cache la Poudre began to be felt in the early 80's. Chambers Lake Reservoir was built in 1882, and the Sky Line Canal in 1891. As the cost of development increased, economy of water was forced upon the users, so that today in the valley of the Cache la Poudre we have probably the highest duty of water in the inter-mountain region; but notwithstanding this, additional lands are being brought under cultivation and the prediction, that a still higher efficiency in the use of water will be attained, is justified. It appears here, as elsewhere, that only through necessity can the economical use be enforced.

To date, there has been no necessity for the economical use of water from the Laramie river, especially on the Laramie Plains. As a result, one should not be surprised to discover that the methods of use and application of water on the Laramie river are, generally speaking, crude, inadequate and poorly managed. Contrasted with the extensive development upon the Greeley-Poudre Irrigation District are the more recent developments upon the Laramie Plains and at Wheatland. We find on both the Laramie and
1406 the Little Laramie rivers an almost innumerable number of small irrigation ditches, poorly located and constructed, and without substantial headgates, dams or controlling devices. A small pile of rock and brush and unhewn log cribs are typical of the dams in the river. Until recently even the Pioneer Canal, one of the largest in the District, and the Oasis, were not adequately provided with means of diverting the water. A very recent construction, the best in point of efficiency, permanence of construction, adequacy of capacity and facility of operation is the system of the Laramie Water Company.

The development of this system was comparatively inexpensive. The Company's reservoir, Lake Hattie, was a natural basin requiring a rather low dam of moderate length. The inlet canals from both the Big and Little Laramie rivers were comparatively short and inexpensive. The outlet canals and the laterals were across the prairie where little rock or difficult construction was encountered. In fact, the system is singularly free from flumes or other expensive structures. Furthermore, the system is such that work could be carried on on all of its several parts simultaneously, so that neither a very grea' expenditure of money, or of time was necessary.

The earlier development of the Wheatland area involved more engineering skill and a greater length of time in the laying out of

the general plans. The construction of a rock fill, timber crib dam in the Laramie river was necessary to divert water into the tunnel connecting the Laramie river with the Blue Grass. This tunnel, however, is only about 3/5 of a mile in length, and the water after passing through the tunnel, flowed down the Blue Grass creek
1407 some 14 miles into the Sybille, and down the Sybille for a half mile into headgate No. 1 six miles further to Canal No. 3, and five miles further to Canal No. 2.

The upper portions of the canals are along hillsides and encounter some shale rock, but the remaining portions are of comparatively easy construction and are free from any expensive structure.

On the Wheatland tract, there is one reservoir of considerable size, said to contain about 7,000 acre feet, into which any surplus water which may have been transmitted through the tunnel may be stored for future use. After the system described had been constructed for the Wheatland area, and after considerable land had been put into cultivation, the water users found themselves somewhat short of water during the low flow of the river, and during the latter part of the irrigation season. This necessitated the construction of the Wheatland Reservoir, which is located near the northerly extremity of the Laramie Plains, in a natural depression, adjacent to the river. It is just above the canon, where the Laramie river breaks through the Black Hills.

The reservoir is credited with a capacity of 126,000 acre feet. The dam itself is only about 35 feet in height, and is of moderate length. No great expense of riprapping was necessary, and, as shown by the evidence heretofore adduced, the cost was very moderate.

The reservoirs constructed on the Laramie Plains, are also remarkable for the cheapness of their construction. The Wheatland Reservoir, James Lake, and Lake Hattie do not average in cost per acre foot more than one dollar. The Pathfinder reservoir, with which the witness was connected for several years, was the cheapest
1408 in his experience. The cost of this reservoir was $1.50 per acre foot, while the Terrace Reservoir, with which he was also connected, cost $20.00 per acre foot. The Halligan Reservoir in the North Fork of the Cache la Poudre river, cost about $32.00 per acre foot, while Lake Cheesman cost about $20.00 per acre foot.

These three reservoirs are considerably larger than the average reservoirs in northern Colorado. The Wheatland Reservoir, Hattie Lake and James Lake would be considered very large reservoirs in northern Colorado. I might say the construction of reservoirs in Colorado at present which have a cost per acre foot as low as $10.00, are considered very cheap reservoirs and very desirable ones at that.

The drainage area of the Big Laramie river at Boswell's ranch, which is at the point where the Laramie river crosses the Colorado-Wyoming line, is about 365 square miles, all in Colorado. The greater part of this drainage area is high mountainous country, furnishing a considerable run-off per square mile. The balance, the Sand Creek county, 81 square miles in Colorado, is mostly rough, broken mountains and hilly country. The valley of the Laramie itself should be classed as mountainous territory. In Wyoming, the

mountains to the west of the Laramie Plains, contributing water to the Laramie river, between the Colorado-Wyoming line, and the Little Laramie river, covers about 84 square miles. This territory also furnishes a good supply of water. The mountain and hill country at the northern end of the drainage basin of the Laramie river, including that which contributes to both the Big Laramie
1409 and the North Laramie rivers comprises some 17 townships and a portion of the Black Hills, which contribute to the Laramie drainage in the Laramie Plains about 180 square miles.

In the Laramie Plains, exclusive of the areas mentioned, are 132 square miles, and in that portion of the drainage area is the Black Hills, comprising the watersheds of the Blue Grass, Sybille, Chugwater, etc, are 1476 square miles. From this latter area, there is considerable run-off as shown by the records of the flow of the Sybille, and the Chugwater. These two streams furnish water for the lands along their border, and discharge some water into the Laramie river, after the needs of the farms and ranches have been supplied. The Laramie Plains area, outside of the mountains furnishes little water, as does also that portion of the Black Hills which drains into the Laramie Plains.

The drainage area of the Little Laramie river above the gauging station at Filmore, on that stream, is about 155 square miles.

The discharge of the Big Laramie from an area of 365 square miles, is about 250,000 acre feet per annum. That is inclusive of the diversion made by the Sky Line and Wilson ditches. The Sand Creek Drainage in Colorado is about 81 square miles, and I estimate there is about 10,000 acre feet. The Little Laramie River furnishes about 150,000 acre feet at the Filmore Gauging Station. Other streams flowing from the west, from 85 square miles, are
1410 estimated at 70,000 acre feet. From the Laramie Plains area itself the run-off is estimated at .05 of a foot in depth over the entire drainage area, or from 1560 square miles, 48,000 acre feet per annum, making a total of 528,000 acre foot tributary to the streams above the Wheatland Reservoir. The discharge on the North Laramie is very largely consumed in irrigating land along that stream, as are also the waters of the Chugwater and other streams, so that these areas need not be considered at this time.

Near the Wheatland District are two other irrigation districts, of very recent construction, called the Bordeaux and the Sybille Districts. The canal has been constructed for the Bordeaux tract but very little land has been cultivated or has had water used upon it. The land in this district in general appearance is quite rough, consisting probably originally of mesa land of moderate height, though the waters in the course of time have erroded innumerable draws, gulches, canons and arroyos, so that the irrigable lands today consist of mere strips of these arroyos and seggregated tracts on the top of the original mesa.

The Sybille tract which lies to the west of the Wheatland Tract and at a somewhat higher elevation than the Wheatland Tract has a mesa divided into two portions surrounded and separated from each other by high hills. A considerable portion of this land is irrigable.

The main canal is in part constructed, but no water has as yet been applied to the land.

The development of these two tracts appears to have been an afterthought on the part of the projectors of the Wheatland Colony, with the belief that with the Wheatland Reservoir there was
1411 an ample supply of water not only for the Wheatland Tract but also for these two tracts.

The unfinished condition of these two projects, the absence of settlement anticipating the availability of water, seems to indicate that it will be a very considerable time before these two tracts are settled. The lack of settlement under the Laramie Water Company's project, notwithstanding the completion of its reservoirs and ditches, also seems to indicate that settlement will be slow, as it has been in the past.

On the Talmadge-Bunton Project, being the land supplied from Lake James and that system of ditches, there has been some settlement, but most of the settlers after building their houses, plowing the ground and fencing, have deserted it, so that there are today fewer people than there were a few years ago. To the observer this indicates that the conditions at present are such that farming operations are not justifiable in the Laramie Plains and that the only justification of what settlement there is on the Laramie Plains today is the fact that a certain amount of supplemental farming operations are necessary to properly conduct the live stock industries. In fact the Laramie Plains have been, since the first settlement, a livestock district devoted principally to breeding purposes and summer range rather than the production of the finished product.

The tract of land known as the Laramie Plains is bounded on the north by a rough and broken mountain country, which is the northwesterly continuation of the Laramie or Black Mountains. It is bounded on the northwest by the divide between the Little Medicine Bow river and the Laramie river; on the west by the Medicine Bow mountains or rather, by their easterly outposts, the Centen-
1412 nial Mountains, Sheep Mountain and Jelm Mountain; to the south, the valley is bounded by Boulder Ridge and to the east by the Black mountains. It has a length in Wyoming of about 60 miles and a width exclusive of the mountain parks at the head of the Little Laramie river, of perhaps 25 miles. Viewed from a distance, this tract appears to be a vast level plain, but on closer inspection it is found to be a rolling country and covered with a growth of short native grasses. The absence of trees from the entire area of the plains is remarkable.

Along the Laramie river above the town of Laramie there are groves of cottonwoods, but below Laramie, even these trees are almost entirely absent. Along the Little Laramie river outside of the foot hills, also, there are no trees except occasionally a few scrub cottonwoods. In the late spring and early summer the impression is favorable and the possibilities of grazing cattle and sheep appeal to one; and were it not for the almost continuous cold winds that sweep the plains with considerable velocity throughout the year,

the general impression would be quite favorable at this time of the year.

To one unaccustomed to the country, the sparseness of settlement, the great distances between the ranch houses, the scarcity of grazing cattle or sheep, the few travellers met upon the road, the apparent newness and barrenness of the view is discouraging, especially when it is considered that this district has enjoyed railroad facilities longer than almost any other portion of the inter-mountain region. It should also be borne in mind that through these plains some of the great highways were used even before the advent of the railroad, and that the Laramie river country was at that time as well known as any district of the west, and that along the banks and on the head-
waters of the Laramie river the early trapper and hunter
1413 found great quantities of fur-bearing animals. The traveler further observes that many of the ranch houses have been deserted, that there is apparently on the part of those living there at present, other than with the elder stock ranchers, no effort to make a comfortable, pleasant and permanent home. The absence of trees, of lawns, of yards, of those things which go to make a pleasant home for the women folks, lead the observer to believe that even those people who reside there at present are there only temporarily and are living only with the hope of leaving.

When he observes the new irrigation projects, he wonders whether the projectors have been competently advised, and whether it is not spoiling a good ranch country to make a poor farming country, which is destined ultimately to failure.

This impression I received when I first went in there and it has been borne in upon me ever since; every time I go up there.

In the valley of the Cache la Poudre, on the other hand, one is surprised with the development, though as compared with the Laramie Plains its railroad facilities have been of more recent development and its history newer. The whole valley of the Cache la Poudre is dotted with reservoirs where the natural topography of the country has been taken advantage of, and in which almost the entire available water supply can be conserved. While on the Laramie Plains, though enjoying more and cheaper natural advantages for reservoir building, there are only a few reservoirs, and these of recent construction. The natural basins in the Laramie Plains at present used principally as a dumping ground for the surplus waters from the irrigation canals where the waters waste by evaporation, or other depressions are alkali lakes which have remained undrained or are
wet seepage lands which have remained unreclaimed.

1414 In the valley of the Cache la Poudre there are 65 decreed ditches, which served in 1911 more than 248,480 acres, and were capable of serving 376,750 acres if there had been a sufficient water supply. The valley of the Cache la Poudre under the ditches outside of the foothills, is about 35 miles in length, runs in a northwesterly and southeasterly direction, and has an average width in excess of 12 miles exclusive of the Greeley-Poudre Irrigation District. Outside of the Cache la Poudre valley proper, is a very considerable territory lying north and east of the town of Greeley, and also lying

in the watershed of the Big Thompson and South Platte rivers, which are irrigated from ditches deriving their supply from the Cache la Poudre river.

Broadly speaking, probably more than eightly per cent of the land under the ditches is in acual cultivation and on which the more valuable crops such as sugar beets, potatoes, grain, garden truck, etc., are raised. Alfalfa, of course, comprises the greatest acreage of any one crop. In 1913, it was reported by the Water Commissioner, who was required to make such report, that some 54,000 acres lying in the Cache la Poudre valley were in alfalfa; that there were only 7028 acres in natural grasses, nearly 85,000 acres in cereals; 2370 acres in orchard; 1574 acres in market gardens; 30,410 acres in potatoes, 38,450 acres in sugar beets; and nearly 6,000 acres in other crops. The 7028 acres reported in natural grass are those which are under irrigation.

These acreages as reported by the Commissioner, represent only a portion of the land in cultivation under the ditches and do not represent all of the land cultivated, especially it does not show the acreage under the dry farming operations. Furthermore, it only represents that part on which the Commissioner reports, and
1415 where the acreage is probably considerably greater than given.

The valley of the Cache la Poudre is recognized as the most advanced agricultural district in the inter-mountain region. It has reached a higher stage in the growing of crops and in the utilization and conservation of its water supply.

The average discharge of the river at the mouth of the river is about 322,000 acre feet, which is less than one acre foot per acre for the 375,750 acres under ditch. This, of course does not represent the total water supply, as there are a few tributaries bringing water into the district below the gauging station where the measurements were taken. Further, this supply does not show the return and seepage waters which are used and re-used, but it does show that less than one acre foot of water as measured at the canon's mouth will be used and re-used to serve an acre of land. The total amount diverted by ditches as reported by the Water Commissioner in 1912, was 419,368 acre feet, of which about 100,000 acre feet was carried over and used in the dry season of 1913. The Water Commissioner also shows that for 1911, 233,653 acre feet were all that was diverted.

On the same basis, and assuming that there were 400,000 acre feet in the region south of the Laramie river and its tributaries that were properly conserved and economically used, that would be sufficient water to irrigate 400,000 acres of land on the Laramie Plains and from the Laramie river.

The Wheatland area is quite different from the Laramie Plains proper. Here the country is better protected, it is more than 2000 feet lower, and although comparatively a new settlement, it has the appearance of permanence and prosperity, especially on the portion of the project which is in cultivation and amounting—according to testimony previously given in this case—to 35,000 acres. The

farm buildings on the Wheatland area are more permanent,
1416 comfortable, substantial and are generally surrounded with trees, and though the growing season on the Wheatland area is shorter, on account of its altitude, than the growing season on the Cache la Poudre, it has many characteristics in common with that valley.

The general appearance of the Wheatland area is the same as the Cache la Poudre Valley presented in the middle 80's about the year 1885; while the customs, habits, industries, and especially the methods of irrigation on the Laramie Plains, are about such as were found in northern Colorado between the years 1870 and 1880, which methods still obtain in some degree in those parts of Colorado where there is still and abundance of water.

There is but one town on the Laramie Plains, the town of Laramie, which, according to the last census had a population of 8337. There is but one town in the Wheatland District, the town of Wheatland, accredited by the census with 400. On the Cache la Poudre there is Fort Collins, which by the census had 8210 population: Timnath, 175; Windsor, 935; Severance, 150; Greeley, 8179. These towns are adjacent to the river itself, while in the valley are Eaton with 1157 inside of the corporate limits and 2000 in the city and immediate vicinity; Wellington, 459; Evans, 500; Lucerne, 100; Ault, 569; and Pierce, 175 people.

DENVER, Dec. 16, 1913.

JOHN E. FIELD, recalled.

Examination by Mr. Fred Farrar:

None of the towns in either the Laramie Valley or Poudre Valley would be considered as commercial centers, other than supplying the needs in their almost immediate vicinity, tributary almost exclusively to them.

The difference between Laramie and the towns in the Cache la Poudre valley is that the towns in the Cache la Poudre valley are agricultural towns. They are dependent almost exclusively on the trade which they have with the farmers. They supply the farmers with whatever they need, of course, and also help the farmer in the disposition of his products. They are, you might say, strictly farming communities, while the town of Laramie would be considered, I think, a railroad town. Scarcely any of its support comes from the farming community. That is, the greater part of its support comes probably from the railroad and the presence of the University. The amount of money spent in Laramie, for instance,
by the railroad, according to the evidence heretofore ad-
1418 duced, amounts to several million dollars a year.

There are small factories in the towns in the Poudre Valley, which manufacture some machinery, headgates and steel structure works for ditches and reservoirs. That industry is not very great. The manufacture of sugar, of course, is carried on in most of these towns, and their influence is very considerable; but both of these main manufactories are directly associated with the farming ele-

ment in the vicinity. Sugar factories are located in Ft. Collins, Greeley, Eaton and Windsor. I am under the impression these factories vary from 600 to 1200 tons per day. The 600 ton plant would be a small one, while a 1200 ton plant would be a large plant. The raising of sugar beets constitutes one of the great industries of the Poudre Valley.

Speaking of railroad facilities, at Laramie there is a trans-continental road, the Union Pacific, which crosses the Laramie Plains, and there is also the Laramie, Hahn's Peak and Pacific Railroad. The line of the Union Pacific barely touches the agricultural area of the Laramie Plains until the railroad gets to the town
1419 of Laramie. It passes over little agricultural land after leaving the town of Laramie going west. Immediately after leaving Laramie the road runs north until it reaches the town of Bosler, and it does not cross a very great amount of agricultural land. It crosses the land along the Oasis Ditch. I might say that this road skirts, rather than traverses the irrigable area. The Laramie, Hahn's Peak and Pacific runs on a ridge of practically uncultivated land through its entire length to the west of the town of Laramie. Those are the only two roads with which the town of Laramie is supplied. There are no spurs or feder lines running into the agricultural districts. The Union Pacific is strictly a trans-continental line. The Laramie, Hahn's Peak and Pacific taps the Little Laramie Valley and brings some of the products of that valley to the Union Pacific Railroad. The original intention was for it to tap North Park in Colorado more particularly. At Wheatland there is one railroad called originally the Cheyenne Northern. It passes through the district which is irrigated. I think it is now a branch of the Colorado & Southern. It has no branch line or feeders.

1420 In the Poudre Valley the main line of the Union Pacific railroad between Denver and Cheyenne crosses through the lower portion of the valley. It passes through the town of Greeley, Eaton, Ault, Pierce and Lucerne. It has also a branch line starting from Denver, running northerly from Denver until it reaches the Poudre Valley, and then going up the Poudre Valley to Fort Collins. There are in the vicinity of Greeley several of what are locally called Beet Roads,—roads for the hauling of produce to the main line and to the sugar factories located in the different towns. One of these feeder systems runs into the Greeley-Poudre Irrigation District. The line starts about a mile south of Lucerne, runs east four or five miles, where it branches. One branch goes north about 13 miles to Hungerford; and one east and northeast about 18 miles to Briggsdale. Briggsdale and Hungerford are in the Greeley-Poudre Irrigation District.

The sugar company has and operates a beet road under the name of the Denver and Great Western Railroad, circling through the irrigated district. It starts at Loveland, on the Big Thompson river, which is the next valley south of the Poudre, runs to Johnstown and to Mead. The second branch runs from Loveland to Windsor, which is on the Poudre river, and then northeasterly

to the town of Eaton, where it joins the main line of the Union Pacific Railroad. At Loveland and at Windsor it connects
1421 with the Colorado & Southern.

At Fort Collins the Colorado & Southern railroad has three main lines. One runs from Fort Collins to Cheyenne; one running from Fort Collins southerly to Denver and one running from Fort Collins southeasterly. The latter branch is practically parallel with the Poudre river the entire distance. There are also branches of this road which are called Beet Roads, one spur running over into Black Hollow, which is about ten miles east of Fort Collins in the most direct line. There is also a branch road running from Fort Collins up the river to Bellvue, Ingleside.

There is one other road in the lower end of the Poudre Valley that I forgot to mention, the Denver, Laramie & Northwestern Railroad, which runs between Denver and Greeley. There is a branch of the Colorado & Southern railroad running from Wellington to Waverly. This branch is about ten miles north of Fort Collins. All of the towns that I have mentioned, with the exception of Loveland, Johnstown and Mead, are in the Poudre valley.

The Poudre Valley is very well supplied with railroad facilities. It is generally desirable in raising beets and potatoes, to be
1422 within three miles of a railroad. This condition is practically accomplished in the Poudre Valley.

I have prepared a sketch map showing the drainage areas in Colorado and Wyoming and of adjoining territory.

(Sketch map marked defendants' Exhibit 21 and offered in evidence.)

Cross-examination of Mr. Field temporarily waived with the understanding that there would be other detailed testimony by the witness later.

LOUIS G. CARPENTER, Denver, Colorado.

Direct examination by Mr. Delph E. Carpenter:

I am an engineer by profession, a graduate of the State Agricultural College of Michigan, class of 1879, and subsequently
1423 a student and post graduate at Michigan University and at the Johns Hopkins University at Baltimore. I specialized in connection with irrigation. I have so specialized since I came to Colorado in 1888. I had been interested in it somewhat and for several years before that from the time I first visited Colorado in 1884. In 1884 I came here to act as professor of mathematics and engineering at the Colorado Agricultural College at Fort Collins for a short vacancy during my own vacation, and while here I met various people, farmers, engineers, and the then State Engineer of the state, Mr Nettleton, whom I visited a number of times while I was in the state. Mr. E. S. Nettleton was at the head of the U. S. irrigation survey that was instituted; but that was prior to the Reclamation Service and prior to the Reclamation act. He was chief engineer of that and in connection with the Department of Agri-

culture, for several years during which that work existed. I came west permanently in 1888 as Professor of Engineering and Physics, at the Colorado Agricultural College, and also had a position in the Experiment Station, a department of the college that was somewhat independent in one way in its funds. The experiment station is maintained by the United States appropriations and for the scientific investigation of questions relating to agriculture.

1424 A course in irrigation engineering was established at the State Agricultural College almost immediately after I came, or about a year later. It was the first in the United States. I was at the head of the department and organized the course of instruction and had charge of it through my connection with the institution. The first class began in 1889 and graduated in 1892.

I did work outside of the school in connection with the experiment station. That brought me in touch with the irrigation work throughout the whole state. The scope of the Experiment Station was not instruction, and the investigation of questions that I took up in connection with it took me around the state a good deal and also some other questions that were brought to me, because the matters were of interest to the United States. For instance, in 1889, I visited a great many canals in the state with superintendents and engineers in the Arkansas and San Luis Valleys and the streams nearby like the Poudre, and spent a good deal of time in the field in that and a good many subsequent years.

I was field agent for Colorado and Wyoming in the artesion well investigation for the United States in 1890, having charge of the field work in these two states, which were then one state and

1425 one territory. It was an investigation started and ordered by Congress and was apparently started with the idea of its bearing on irrigation. It involved a study of the conditions in these two states, especially in relation to subterranean waters. I went over both Colorado and New Mexico and had a great deal of correspondence. The first trip to El Paso, for instance, and the southern part of New Mexico.

In connection with my various duties, I traveled generally over the arid west and foreign countries. Perhaps it might not all be said to be in connection with my duties, but in connection with my duties I wanted to become conversant with the irrigation conditions in the West. Outside of Colorado I visited, in 1891, California and spent some time in the summer in the San Joaquin Valley in the southern part of the State, and some in Nevada and came through Arizona and saw this region for the first time. I first made investigations of irrigation systems in Utah in 1890, for a limited time and have been there two or three times since for short trips.

I spent the summer of 1892 abroad, especially going to see the irrigated regions of southern Europe, designing to go especially to France, Italy and Spain. As it happened, I did not visit the latter because of the fact that cholera was prevalent, and the period that would be lost at the borders in getting in and out was deter-

1426 rent, and I went instead to Algeria, largely because some of the government officials of France asked me to do so. I had

special opportunities in all these regions, both because of perhaps several letters, for instance, from the Geological Survey, Secretary of Agriculture, Secretary of the Interior, and Secretary of State. I think I also had one from the President. So that they gave all the facilities they could in Northern Italy. And they took especial pains in putting me in touch with their conditions in France and Algeria, and put their department engineers at my service so far as could be, with special instructions, so that I came in contact with the conditions in northern Italy and in France and Algeria quite thoroughly. That was then extended with the literature I got in touch with there and subsequently had an opportunity to study and keep in touch with.

The French Government had asked me especially to look into some of their methods in Algeria on their dams, and questions of silt management and disposal. Afterwards, the French Government gave me what they call a Decoration, probably on that account; a gold medal. The decoration was Chevalier du Merile Agricole. In 1898 or 1899 I was made irrigation expert of the United
1427 States Department of Agriculture. Subsequent to 1899, in addition to the other positions and duties at the Agricultural College, I became director of the Experiment Station. The Director is the administrative or executive officer of the Experiment Station, having certain duties under the laws of Congress and regulations established by the Department of Agriculture. In accordance with those laws and having general charge of the scientific work and investigations of the Experiment Station. It is a part of the College administration, and yet separate in some respects. There was then the fund from the United States amounting to $15,000.00 per annum at least, the Hatch Fund so called, for investigation, and a few years later this was doubled by what is called the Adams Fund, which is given for research, rather than for investigation, making a distinction between those two classes. There were various other funds from the United States, somewhat temporary, and also from the State, so that at the time of my withdrawal eleven years later, the income from the funds was in the neighborhood of $60,000 to $100,000 per year for the Station and in the neighborhood of forty or fifty people who were giving their entire time, or a portion of their time to the work under that administration.

1428 This work, I might say, was not only carried on at Fort Collins, but was carried on throughout the whole state, certain phases of it, at least, and that of course, had been true of the irrigation work, which had been under my direct charge as head of the Experiment Station, while the whole scientific work was under my general charge whatever its character.

Investigations with regard to return and seepage waters and irrigation were carried on at the institution directly by myself, initiated by me in the Experiment Station, under the United States funds. Among them were considered measurement of stream flow, especially on the Poudre. There had been prior to that time some investigations by the State Engineer, but he dropped them and took them up along I think in 1889 and continued those measurements

up to 1909 and 1910. The seepage measurements were started by me I think in 1889, first on the Poudre river for a distance of about fifty miles and then as funds permitted in later years, they were carried on down the South Platte river in Colorado, either the whole length, or more generally from Greeley at the mouth of the Poudre down to the State line. I also carried them on on the Arkansas river for a distance of 200 of 250 miles for a series of years; also on the Big Thompson, St. Vrain, and nearly all the mountain streams. These were carried on generally annually, sometimes more frequently, and the reason for taking them up was to get the actual conditions which had begun to develop with the spread of irrigation, and which had begun to be noticed; that is, the appearance of water in the stream, and also because the funds then available were small
1429 and that was within our reach financially. The Rio Grande was also taken up in detail and the study of the irrigation system of the Rio Grande. In those general connections, an attempt was made to get a good deal of data collected with regard to the rain fall in the mountains, where at that time there were no observations. I had had quite a system of observers, who started and some of whom persisted who have kept records for twenty or twenty-five years, but many of them fell by the wayside.

One of these stations was maintained at Long's Peak post office on the Big Thompson; started in 1893 and is still continuing. One was at Water Dale, near Arkins, at the outlet of the mountains, started at the same date or a little prior to that time that is still operating. One at Gleneyre on the Laramie was active I think for about 10 years; with the moving away and sale of property by the then owner, that ceased. There was one in North Park near Walden that continued for fifteen or so years and ceased last fall and others in various places running from two to six or eight years, some in the mountains. There were not many people living there in the first place and secondly there were not many interested in that kind of work who had the stick-to-it-iveness necessary.

During these years I spent a good deal of time in the
1430 summers, when there was a vacation of the instructional part of the college, in the field with canal superintendents, with water commissioners, with engineers of canals, and those who know the local conditions, and were acquainted with the conditions of the canals, so that I went over most of the valleys of the State and most of the ditches of the state quite in detail during that time, and many of them repeatedly, and often with their aid carried on observations and made records and got many of them started in keeping records.

During that time I suggested various improvements both in works and in methods of applying water. Naturally the lessons of experience learned or gleaned from the superintendents of the various canals were made available for the officials of other canals. And along that line one year we had a short course, I think it was called, for Water Officers, held at Fort Collins, in which we brought together a great many of the officers of the state, canal superintendents and so on, quite a good many of them, and got their experiences together.

During these years when occasion and opportunity arose, I gave to the irrigation systems of my region the benefit of my travel and studies. It certainly led to a very large correspondence and a very large mass of questions, but whether they were put into operation or not is another matter. In fact, I have some doubt, and in some cases the advice was not always followed, of course, I thought to their detriment. I became state engineer of Colorado in 1903,
1431 to serve one term, which terminated in April, 1905. The duties of that office brought me in even closer connection with all the officials and irrigators throughout the State, as well as those of other states. That position had executive charge of enforcement of the laws of the state, supervision of the development of water, and a host of duties relating to the water laws of the state. It had at that time in addition, the charge of the construction of roads which were provided for by the legislature, and it had the supervision of dams, passing on their plans of construction, and supervision during construction, all of which duties are such as the office has now. And the office has, through its subordinate officers of water commissioners, direct charge of the distribution of water throughout the state, reports of course were received and some of them were inaugurated at that time, attempting to make the system more effective. Water users of the state were inclined to bring their troubles direct to the State Engineer's office, whether they ought to or not. This all extended and perhaps perfected the acquaintance that had been growing for years before. It of course aided in increasing the perfection of detail information with other states. I don't know as it made more than a normal growth, that would come with the interest and years.

While I was state engineer in 1903, the case of Kansas vs. Colorado, in the Supreme Court of the United States, was pending. It was started before that time and I had formerly had some connection with it. As state engineer I had an ex-officio relation to it, at least
1432 I acted as general engineering expert in preparing the case, as in fact I had before I became state engineer, and on leaving the office of state engineer, I continued my relation with it, and in that case had the direct relation of consulting engineer and expert for the state and carried that relation through to the termination of the case.

I was a member of the Irrigation Commission of the Province of British Columbia. That Commission consisted of the Commissioner of Land, and myself. I was looked upon as the working member. My duties were rather of a broad character, appointed under the authority of the Provincial Parliament, and with a very broad injunction to investigate the irrigation system of British Columbia and with the purpose, for one thing, of recommending a system of laws in regard to water that should be put in force. This was in 1907 and 1908. The Province of British Columbia, as at many other
1433 places, had had a system of conditions developing without any special set of laws fitting the conditions. They had then found these laws inadequate to suit the conditions with the

greater growth of population and the settlement that was then coming into the Province, and the old system was hampering them very materially, so it was then to find and recommend what laws should be put in force, and to determine the principles. Of course, that led to a study of the conditions as they were, before recommending any laws. The Commission had power to hold sessions, to take testimony under oath, and practically had quite a wide latitude. The Commission was sworn in under General Laws and then went over all the irrigated sections of the Province and looked very thoroughly into the old records from the time of the first settlement of the Province in 1843, and of such cities as Kanloopa, and so made a very complete canvass of the situation as it then was in order to intelligently build on that with a new set of laws. Such a law was then passed in the next session of Parliament.

I recommended a general foundation for and had something to do with the preparing of the Code. I could not say I prepared it, but I assisted in preparing it. The general principles I recommended in quite a number of specific things, and then the carrying out and putting them in form of a statute was largely due to the other member of the Commission. My duties terminated in 1908.

I was called as an expert in the litigation known as the Colorado Springs Electric and Power litigation. I was first appointed as a joint arbitrator selected by the two parties in the controversy. I had been consulting engineer for the city and also for the other interests in their other matters and when the dispute arose as to interpreting the contracts affecting both of them, they united in asking me to serve as a joint arbitrator. In addition to that each party selected one independently, so there was a Board of Arbitration of three, of which I was the chairman, to determine the conditions that were in dispute. There was some involved questions of the applications of science to electric lighting, especially, which was the province of the Board of Arbitration, in connection with that, testimony was taken from a large body of experts from all over the United States, probably as large a body of electrical experts as ever met together, and that case, I think, has since been the leading case as settling that class of controversies.

In the case of the United States vs. Rio Grande Dam Co., I was notified to take part in that case by both sides of that controversy, that is, the United States on one side and the Elephant Butte on the other, and took part so far as it could be considered personally, in representing the Elephant Butte People, for I thought justice was on their side, and was present throughout that case. That was a case involving directly some interstate matters, and also indirectly,
1435. The international matters involved were the rights of certain Mexican appropriators. Those were involved in a way but not directly asserted. It involved the right to divert water from the Rio Grande river, and there had been some fear by certain interests in El Paso, that it might interfere with matters in Mexico, that is, they took more than a friendly interest in the situation in Mexico, while nominally their interests were over in El Paso.

I resigned as director at the Agricultural College at Fort Collins in June, 1909, and when I ceased my connection in other capacities in December, I had an office in Denver, as consulting engineer, and since that time I have given nearly all of my time here with headquarters here since 1910. I had aids, and conditions and duties called for visits and surveys in different states, from Texas to Washington, Kansas, Nebraska, Idaho and Montana. I have devoted my entire time to that line of work since 1910. Between 1889 and 1910, practically all of my time was devoted to irrigation matters. Instruction that I was giving was primarily along irrigation lines. The investigations were almost entirely along irrigation lines, as was also the instruction lines, so it would not be very far from the truth to say that all my
1436 time was given to irrigation matters. During the years since 1889, I have kept advised as to irrigation developments on both hemispheres. My interest has been along those lines so that I have kept an eye open to all sources of information that were available. I have not made a trip abroad except the one mentioned in 1892, but I have had an extensive correspondence and exchange with many of these countries, have had visits from officials and engineers from a great many of them and have had many of their official publications as well as the reports that were available in other ways.

I was asked by the Cities of Pueblo, Canon City and Salida, to investigate conditions some years since to see whether there was any remedy which might be adopted which would clear up the river which was much polluted by hydraulic mining, and made a report to them of the conditions. Later on they began suit to enjoin the waste or debris by hydraulic mining into that river, and after a suit of considerable length, it resulted in the issuance of such an injunction, and since then the river has gone back to its original condition as a fine stream suitable for fish and domestic
1437 water. During the years of my private practice, as well as prior to that time, I have been called generally throughout the west as an expert on preliminary examinations for irrigation and municipal supply works for the object of ascertaining and reporting both on the character of the works and the water supply. The investigations made in my private practice have included such as would be customary in asking engineering reports, especially for people who are considering the advisability of making investments and those of questions of water supply, and questions of affording a supplemental supply, of values of land, character of lands, their relation to markets, and, to some extent the questions of administration, but in general all of those things that might have a bearing upon the enterprise or its probable success. The conflict of other rights to water or other users and meeting the troubles that might arise have been considered. There is frequently these investigations have included the consideration
1438 of existing priorities and questions of irrigation law.

I have kept in touch with the irrigation world through various publications and documentary evidence and correspondence.

I read French. I have a large French library both on irrigation and other matters. I read Spanish, Portuguese, German, Italian, so that I have really a great many Italian and Spanish works and French works relating to irrigation. I have a number of Portuguese, but not so many in German.

Starting with the earlier development of irrigation in the arid west and bringing it down to recent times, the irrigation development follows a general plan. From the necessities of the case it follows a general order of procedure. That is true in almost all of the valleys. I have had occasion to investigate the history of a great many and find that they rather classify themselves in such order of procedure. The first irrigation is a sporadic one, a few individuals, consisting of one family or half a dozen families settle and take up land. It is natural for them to take the water the easiest way possible. They naturally select the lands along the river bottoms, in the valleys near the streams, and they obtain water by a short ditch. They then take the smaller streams, not the
1439 large ones because the large ones require expensive construction to divert water, while the small streams are easily managed and require a very short ditch because the fall is great. Then as other people come in, it becomes necessary to build longer ditches. Instead of an individual ditch, they build what may be a cooperative or company ditch. In fact most irrigation companies are cooperative companies, though organized in the forms of corporations. Those may be and are longer and accordingly irrigate land further from the stream so there are, as it were, three or four layers of ditches paralleling each other, but going out further and further from the stream, and in course of time they are apt to call upon all the supply of the stream, at least part of the year. In this country in July and August they are apt to be short. Then they change the character of the agriculture from grain to crops like potatoes, sugar beets and others that require water later in the season and are more profitable; then if they have a shortage of water for a period of the year, that means pressure upon them and the returns are such that they can afford to build ditches and hunt for water. How that need is supplied depends on local conditions. It may result in the building of still longer ditches, getting water at a greater distance; it may result in the building of reservoirs which store the water for a portion of the season from the time when it is plentiful to a time when it is scanty, and naturally it is a step of the same kind to go across to a neighboring stream, if there be a neighboring stream, which will supply water available to supplement their own. There are some changes that arise in administration, like association of ditches and cooperation which are also apt to follow
1440 as in the Poudre Valley. Waste of water decreases both by general economy, general increase in skill and in better preparation of the land so that the land is smooth and the waste water from the roughness is decreased and almost entirely prevented. It may also be by catching tail water which a ditch necessarily loses more or less. That is the general experience. It also comes from the filling in of the sub-soil so that the land does not

require so much water. In such cases very frequently a man does not require one-third as much water as he did in the beginning and even less than that. A great deal of the saving of water comes from the smoothing of the land. The amount of water called for frequently depends not so much on the need of the plant as it does upon the physical condition of the distribution.

The construction of reservoirs is usually not the first step. It generally comes in late and the construction of running water across the divide sometimes comes in somewhat early. It is simply a case of which is the easiest way of getting the water and that depends upon the physical conditions. I know of places where water has come across the divide almost the very first thing
1441 in a community. The same cause which prompts the construction of the cheaper works prompts the construction of the more expensive ones. It is the need for water for the growing of crops. It is rendered possible by the fact that the lands and crops are more valuable so that they can afford to enter upon such construction. It is purely a question in this case of the cost, so that an enterprise which was not feasible thirty years ago would be feasible ten years ago, and an enterprise not feasible ten years ago would be considered feasible today, and enterprises that are not justifiable at the present time will be taken up and built in the course of the next twenty, thirty or forty years.

The development of the Cache la Poudre is typical and one of the best examples in the west, because it has all of these conditions, that is, it has been a pioneer. A pioneer in construction, because the same needs are there. It has developed a little earlier than some of the others. It has therefore been a little ahead of some of the other valleys in the state. It has felt the need of various administrations and of legislation, and a great deal of that in this state originated in the needs of that valley.

The Poudre Valley has been very much as I stated a few moments ago. From 1859 to 1870 there was a period of individual development running into small ditches, confined almost entirely to the bottoms. I do not think that those were confined to the bottoms for the reason that has sometimes been stated, that the people did not believe in the uplands, but because they did not want to go to the
upland.
1442 During that time there were a number of ditches built in a number of individual cases, then from about 1870 came the development of community or company ditches. Then came the location of the Greeley Colony in 1870, and they started out with three ditches planned, two of which were constructed by them and the third built some years later by a corporation. This latter ditch was constructed by the Larimer and Weld Irrigation Company. Governor Eaton was the contractor and was interested. It is called the Eaton ditch. It is near Eaton in the eastern part of the valley.

That second stage of development came with the Greeley Colony. Fort Collins was organized the year following as a kind of an offshoot of the Greeley Colony. Some of the seceders and others who did not get in in time to join the Greeley Colony and some of the

officers of the Greeley Colony who thought they had a chance to build another town, organized another community and there were those two centers. Starting from that period came the development of some of these ditches. Fort Collins built several ditches adjacent to it and almost immediately afterwards came the Larimer County Ditch, built in the early 80's. Those were the company ditches, built largely, or at least inspired by local influences, with the aid of some outside money. In the early 80's came such a pressure for water in July and August as I have already spoken of, especially after the development of the potato industry late in the 80's.
1443 Then came the building of some reservoirs. There had been one or two built by earlier ditches as kind of a side issue; but late in the 80's the Water Supply Ditch found they were short of water. They then planned an extensive system of reservoirs. They built several. The Terry Lake was built by the Larimer & Weld Company and they began an extensive reservoir construction. Parallel with that development and almost simultaneously with it, came the looking for water across the divide.

The reservoirs and the taking of water across the divide were simply two methods of accomplishing the same purpose, that is of supplying water. Almost at the same time this Water Supply & Storage Company started to take water from the Michigan, from the Laramie and Lost Lakes, from the head of the Grand, and also planned to take water from the Laramie, which subsequently developed into the Sky Line Ditch. I visited the head waters of the Poudre in 1888, I think it was, and they were taking water from those sources. I was at Chambers Lake and the man was there then, who was attending to the taking of water from the Laramie Lake and Lost Lake, Michigan Creek, and he was doing some work I believe upon the Grand. I did not visit those places except Lost and Laramie Lakes myself.

The Sky Line Canal was constructed two or three years later and the Grand River Ditch subsequent to that, but they were taking some water across the divide at that time, I was advised.

If permitted to flow in its natural course, the water which they were diverting from the Grand River would have gone into the Gulf of California and into the Pacific Ocean. That diver-
1444 sion brings the water which would have gone into the Pacific over into the Atlantic watershed.

Whether water be taken across the divide or be conserved by the building of a reservoir, these are simply two steps to accomplish the same purpose and which step is taken depends upon the local conditions. In some places they have reservoir sites and prefer reservoirs. In some places they do not have reservoir sites and they do have opportunities to get water from a neighboring stream. In some places they can combine both of these and we find that general situation all over the world. It is generally true that water is diverted from one watershed to another owing to an abundance of supply in the one case and a shortage in the other. It can also be stated that sometimes, as in the case of Indian cases, it is done through several watersheds and by what might be termed a series of exchanges. I am

familiar with the tunnel of the Greeley-Poudre Irrigation District, commonly called the Greeley-Poudre tunnel. That involves the taking of water from one stream to another, in this case through a tunnel instead of over a pass, and in this case it is also from two branches of the same stream system.

1445 The water is taken from two branches of the Platte River which is a tributary of the Missouri. The water is taken from the Laramie river, which is a tributary of the North Platte, and diverted into the Cache la Poudre, which is a tributary of the South Platte. These two branches of the Platte then unite to form the Platte in western Nebraska near the town of North Platte, so that in this case the diversion is between two branches of the same stream system. This diversion differs in no way from the Sky Line diversion from the same stream, except that the Sky Line is brought over a summit and this is brought through a tunnel.

I have had occasion to observe diversions of water from one watershed to places of use upon another watershed the world over. It is practically a universal custom. I think the first case that I came in contact with was the Water Supply & Storage Company, but I find a number of instances in this State, and as my acquaintance with other states increases, and other regions, and my knowledge is broadened by practice elsewhere, I find a great many instances. I have come across some in person and that led to some examination of the question, and shows the universality of the custom.

1446 The diversion has been prompted through the need of water in one watershed with the other watershed providing the most feasible and practicable way of obtaining water. It simply is one step in supplying the need. In some other cases it has been also governed by some or other additional considerations, as, for instance, the place of greatest use.

If inter-watershed diversions had been prohibited in the many instances I have observed, it would have prevented the development of a great many communities and of millions of acres. It would have lessened the food production for quite a large number of the human race, for, I think it is pretty well known, that practically seven-eights of the food of the human race is raised by irrigation. This is not true of our Anglo-Saxon people, but of the people of the world as a whole it is true. So that immense areas would have remained idle and as in India, the loss from death by famine would have been very much increased, in fact, some of these cases in India were forced for the prevention of famine. In some of these cases they have been forced to this character of diversion.

1447 The custom of using streams as natural carriers of water from one part of a system of works to another is as universal as the need. Whenever the stream is so situated and the land to be served is so situated that the stream is convenient for that purpose, it is done without limit. If the land is situated where the stream is not a convenient carrier, they bring it in another way.

I will review a number of cases of foreign countries in which inter-mountain or inter-watershed diversions have been practiced for centuries, or are in practice at the present time, and

will state the purposes for which the diversions were made and what has been accomplished by these diversions. For this purpose, probably, India might be the most notable example, simply because of the scale on which the works were carried out and the fact that it has been a country densely settled for thousands of years and has been in many respects a country of high civilization. Perhaps the first one that might be mentioned is the ancient one connecting the Ganges and the Indus. I might digress a moment to speak of the general topographical characteristics of India. It has on the north the Himalaya Mountains, of very great elevation, with large rainfall, and filled with glaciers and glacial lakes at many places. At the base, on the south, the peninsula is practically cut across by river systems of the Indus and the Ganges. The Ganges flowing eastward to the Bay of Bengal, and the Indus flowing westward to the Indian Sea. These two streams practically catch all the run-off of the Himalaya Mountains. They have many tributaries of large size, some running then into the Ganges and some into the Indus. The Divide between the Ganges and the Indus, in the central part of the continent, is rather a low divide, while there are mountains in the central parts of India and Hindustan that are south of these rivers. There have been diversions from these streams from a very early date. Of course, that was a country of high settlement, of great intellectual development and also of centralized
1448 authority.

The western tributary of the Ganges is the Jumna, that is almost on the border line. It runs down from the Himalayas and flows eastward into the Ganges. There is a tributary of the Indus a few miles to the west, that is, this runs through a number of other streams like the Chitang and then into the Sutlej.

There seems to have been a canal built across this watershed as early as the twelfth century. This was built by a celebrated Indian ruler, Feroz. His name is still identified with some of the cities and other portions of that country. After being used for quite a number of years, it seems to have fallen in disrepair and remained unused until it was reconstructed in 1568 by another ruler of great energy, Akbar. It again was allowed to fall into disrepair in their troubles that arose, and through lack of energy of the rulers, and it was rebuilt about a century later by another ruler, Shah-Jeham.

When the British took charge of the country, they found this, then, largely in bad order. Warren Hastings took an active part in attempting to get this reconstructed, and I think some of the things that he was accused of were because of his attempt of such enterprises of this kind. So it was practically rebuilt in 1820 by the English, and they reconstructed it on a still larger scale in 1870, not in rebuilding the canal as a whole, but in reconstructing to avoid a great many troubles that had shown up. It is now 84 miles long and supplies 555,000 acres, and carries about 2800 cubic feet per second. It carries water, with some of its tributaries, as far as 125 miles west of the Jumna to a place known as Sirea,

so that practically all of its acreage is outside of the watershed of the stream which supplies it.

The canal to which I have referred is called the Western Jumna, the western one from that Jumna river. The map (defendants' Exhibit 22) shows both the Western and Eastern Jumna canals. The eastern canal is the one diverting from the east side of the river and the other, marked "Western," and that is the one of which I have spoken, diverts from the western side of the river. The work from which this map is obtained is Bairds-Smith Volume of maps on Italian Irrigation, 1855. The reason that comes in that unusual place is because he was an Indian engineer. This volume is marked the second edition.

I might state as a matter of interest, that this canal has repaid the English Government all that it outlayed and $5,000,000 besides. This is in addition to the tax returns which the government receives directly.

I will now mention the series of diversions that are now under construction in the Indus Valley. The Indus is the river flowing down the western side of Hindustan and taking a lot of the
1450 streams from the Himalayas. This is an extension of the same plain that this Western Jumna irrigates. There are a lot of old canals that run back to an unknown time, some of them built by private parties, more built by the native rulers; for there are several native states there that are not under British control. That whole plain, at times, suffers somewhat from scarcity of water, or perhaps it ought to be said that the valley does not produce as much as it might produce if it had more water. As a matter of fact the yield is quite large but occasionally they have some shortage in crops and the population is so great that in such cases there is a famine and a loss of hundreds of thousands of lives. So the English have planned to extend the diversion. There are several streams that run into the Indus: The Jhelum, the Chenab, the Ravi, the Sutlej, and all of them are enormous streams as compared with the streams we have to do with here. Each of them has a large system of canals. Now the Indus lies to the west, and the others come down from the Himalayas in succession.

(Defendants' Exhibit 23 offered in evidence.)

These streams and the proposed canals to supplement the existing system, are shown in Exhibit 23 of the defendants. In this case, the English proposed to build a canal starting from the Indus and running over to the Jhelum, a distance of approximately 60 miles. This water will then be available to supply the other ditches down the Jhelum and enable them to take out another ditch about
100 miles higher up the river that will carry water from
1451 the Jhelum over to the Chenab and those can ordinarily supply some of the other ditches on the Chenab, also enable another ditch to be taken out of the Chenab at a higher elevation, about 40 miles up the stream, and run across to the Ravi about 100 miles. That is made possible by the substitution of the water of the canal for the water diverted above, and then carried on be-

yond the Ravi to the lower Bari Doab Canal. So that the taking out of the water from the Indus in the first place, or from the Jhelum where the construction is now under way, really is intended to supplement the Bari Doab Canal a distance of 50 miles or more and to cross over the large streams by a system practically of exchange, but in effect carrying the water from the first stream across to the last. By exchange of water I mean the practice that is familiar to irrigators of supplying early rights by water from some source in a corresponding amount at some other point; very frequently in Colorado, on a great many streams, the Big Thompson and Poudre, largely by use of reservoirs. It is a matter of substitution.

There has been quite a large amount set aside for this construction and reconstruction I believe is under way. I don't know that it is completed.

The next one that I call attention to is of a very similar character, but over on the eastern slope of India; that is in the Ganges watershed.

(Defendants' Exhibit 24 offered in evidence, being a sketch map of a portion of the United Provinces of Agra, Oudh, and Punjab.)

Exhibit 24 was prepared under my direction from a map
1452 of the Indian Irrigation Commission. The canals of the Ganges system here shown, are at the upper portion of the Ganges river. It includes the Ganges, the Jumna and a number of others, the Ramganga and others in this region covered by the Ganges Canal. I will say that the Ganges canal from the point where it takes from the Ganges river to its lower end is something like 500 or 600 miles, and forms, of course, a canal of great size, something like 200 feet wide and twelve to fifteen feet deep at its head. It, in its course, carries water out of the Ganges basin over into the basin of the Hindan and also over into the Jumna basin so that the waters interlace through these various streams.

In order to build that Western Jumna Canal and to extend over some additional country west of the Jumna, they are afraid they will run short of water for the Eastern Jumna Canal, and hence the plan has been considered of supplementing the supply of that Jumna Canal from some other of these streams. The plan under consideration, proposed by the Irrigation Commission of India is, in the first place, to set over some water now used by the Ganges Canal by building a supply canal from the Sardah river about 150 miles long running over to the Ganges, and by so doing, supply the lower Ganges Canal. That then, involves an increased amount to be taken out of the Upper Ganges Canal about
1453 150 miles upstream, and that increased amount taken out of the Upper Ganges can be delivered over to the Eastern Jumna Canal by a branch about 20 miles long, and thus lessen the demand on the Jumna river, and increase the supply for the Western Jumna which runs over on the other side of the Continent. There are several accessary branches proposed, as for instance from the Hindan down to the Jumna to be supplied however by the water from the Upper Ganges Canal. The result of this proposed con-

struction is practically then, to enable the water of the Sardah River to be used about two or three hundred miles to the west, over on the western slope of India, while the Sardah is a tributary on the eastern slope.

(Defendants' Exhibit 25 offered in evidence.)

Exhibit 25 is a sketch map of the Periyar project in southern India. It was prepared under my direction. Exhibit 25 shows what is known as the Periyar project in southern India, that is in the Madras presidency, while the other projects so far referred to in India, are in other provinces under English control. This is in the Madras Presidency and is almost at the southern extremity of the Hindustan Peninsula.

In this case water is carried across the Continental Divide, or from water that is collected on the side of the Arabian Sea, carried by a tunnel through the mountains—the Western Ghats—thence delivered into a stream, the Vaigai river, and carried a distance of about 60 miles to the land to be irrigated. The tunnel is about 6,000 feet long. The reservoir that is constructed, is 8 or 10 miles long, and has a dam nearly 150 feet high. The reservoir is just ad-
1454 jacent to the tunnel and the reservoir is at the upper end of the Periyar river which flows into the Arabian Sea, while the land that is to be irrigated along the Vaigai river is on the side of the Bay of Bengal. This river discharges almost opposite Ceylon. It has been completed for quite a number of years. Since 1896 I think. It is expected to irrigate about 120,000 acres.

The cost of this project is not as much as that of the Greeley-Poudre project. The reservoir is a larger one and is parallel in many ways to the Greeley-Poudre proposition, but with some less cost. The tunnel is less than half as long as the Greeley-Poudre tunnel. It is 5,704 feet long, while the Greeley-Poudre is 11,366 feet. Practically one-half of the length of the Greeley-Poudre tunnel.

I might say here, as to these enterprises, that this enterprise was examined and reported on in 1808, and the steps in this illustrate the conditions I mentioned earlier in my testimony. It was, however, premature; the times were not ready for it. So it was again taken up in 1867, for the time was then riper for it, and it became an enterprise that might be seriously considered and was built in 1888 to 1896.

(Defendants' Exhibit 26 offered in evidence.)

Exhibit 26 is a sketch map of another portion of the Madras Presidency in southeastern India to illustrate its transfer of water from one watershed to another. It was prepared under my super-
1455 vision. It is based on a map of the Irrigation Commission of India of 1901 and 1903, No. 2. It represents two streams running down from the Ghats, that is the central divide of India, into the Indian Ocean. These two streams being the Kistna and the Penner, and it shows one canal already constructed and taking

water from one stream over to another stream, a distance of something like 100 miles, and two others that are under consideration.

On this map the canal that is constructed is shown by a full line and canals that are under consideration are represented by a dotted or broken line.

The canal that is built is referred to as the Kurnool-Cuddapah taken from two towns at the ends, that is Kurnool is near the head of this canal and Cuddapah is at the lower end. This canal was built to carry 3,000 feet per second and to supply the country in between for irrigation and also for navigation.

There are two other projects proposed, one above and one below this Kurnool project, the upper one is spoken of from the name of the stream which it taps which is a branch of the Kistna, called the Tungabhadra.

This would take water about 100 miles above the Kurnool Canal, carry it across several tributaries, and deliver it into a reservoir near the summit of the divide, water a good deal of land on both sides, and finally deliver into the branch of the Penner river, thence across through into another branch, so by two or three successive ditches reach land in the Penner Valley. These two streams, the Kistna and the Penner are both independent streams flowing into the Bay of Bengal. Their water sheds are distinct from
1456 one another. The other canal that is represented by a broken line is proposed as a part of a very much larger enterprise planned by Sir Arthur Cotton, to connect up a large part of the eastern part of India and even to extend to the Ganges. However, it has not been built, as yet, but it is under consideration, and is reported in this report of the Indian Irrigation Commission.

These are the most notable examples of inter-watershed diversions on a large scale in India. There are others on a lesser scale that I have run across and undoubtedly there are any number of smaller ones if looked into — the native states. The native states have no maps available.

These inter-watershed diversions that I have mentioned are diversions from one stream to another that are not tributary to each other.

These diversions are simply made whenever the conditions are favorable, if they have water they can get they plan a diversion from it, but some of these are of a very large class because the Gov-
1457 ernment is interested in them and the Government has constructed them on a larger scale than almost any native country or rulers can. As a matter of fact there are private ditches there, not Government ditches, that run up into hundreds of millions, but they are not indicated in these Government reports.

In each of these cases I have specifically pointed out, had these inter-mountain or inter-watershed diversions been prohibited, it would have meant the loss of millions of lives by famine in India. In fact, many of these canals and diversions have been taken up as a result of a report of the Famine Commission of India about 1898, I think, that suggested some of them, but by no means all. They are entirely a result of the natural growth and development of the region.

Decidedly larger areas are made productive by this method than would be otherwise. A great deal of the water would run to waste otherwise. Necessity has produced the construction of most of these works.

I have looked through the Government Reports, I have a dozen or so, and I have never found any legal objection against these diversions because of their inter-watershed character. This class of diversions seem to be taken as a matter of course to which they
1458 seem to have no objection whatever. There seems to be no more objection presented to it than to taking from a stream within its own shed.

I have investigated inter-watershed diversions in France. I have visited a number there and have learned the condition of quite a number. In these cases I have gone over the ground and have visited most of these canals to which I will refer.

In southern France we have conditions such as I have spoken of where the development of the country called for more water. The rainfall was light and there was water across on the other side of the range of mountains or divide as the case may be. This general statement relates to all that part of the Mediterranean next or near the city of Marseilles, from there eastward, and it also pertains to a greater or less degree to the interior of the country, up along the Rhone for some distance from the coast and practically that portion of the country settled by the Romans in the early days, many of their ruins still existing. Right adjacent to Marseilles there are a number of canals brought from a stream to the north known as the Durance. The Durance is a tributary of the Rhone and drains a portion of the Alps. It is separated from the coast by a mass of mountains, and on the south side of these mountains the rainfall is very light, 6 to 10 inches, and a country of beautiful climatic conditions. It has given rise to a development of a large commercial city like Marseilles, and a number of cities further east like
1459 Nice and Monaco. It is a condition where water is desirable, where the land produces very much with the application of water, and consequently there have been attempts to obtain water from the very earliest time.

The Romans built canals of record length to supply a part of this country along the coast. Near Marseilles and north of it, is a plain know as the Crau, separated from the Durance by a height of considerable elevation and canals had been proposed and built to supply that plain for some centuries. There are two canals, in particular, the Canal of Crapponne, and the Alpine Canal or Canal des Alpine, both taken from the Durance, bringing across a saddle and delivering water on this plain. The Crapponne was built about 1650, by a man named Adam De Crapponne. It covers this plain northwest of Marseilles and east of the old Roman city of Arles. A part of the water finally reaches the Rhone but most of the land it irrigates is not tributary to the Rhone, but is tributary to the Mediterranean Sea. The Alpine Canal was built about a century later, 1772. It passes through the same saddle that the Crapponne Canal does and covers very much the same territory.

There will be shown in a sketch map that is not ready today to be marked as Defendants' Exhibit 27, a portion of the development of Bouches du Rhone.

Exhibit 27 also shows two other diversions across the watershed of somewhat similar character. One of these is the Marseilles Canal, taken likewise from the Durance, running through the same range of mountains but delivering to land in the suburbs of the City of Marseilles and supplying also the City of Marseilles with water for domestic uses.

1460 The latter canal was built between 1840 and 1850. It was principally a matter of health, for the city at times had been very short of water. It is a very extensive canal with many masonry aqueducts. I visited the headworks of all of these canals in 1892.

The same Exhibit, No. 27, also shows the Verdon Canal. In this case the Verdon Canal takes from the Verdone river, which is a branch of the Durance and carries water through the mountain divide and delivers into the basin tributary to the city of Aix. It supplies this small town with water and irrigates that whole basin. This canal was built about 1867, I believe, and irrigates about 40,000 acres as well as supplying the town with Water. To be more definite, it was started in 1863, and it was finished in 1874. It is very interesting from an engineering point of view, but of moderate size as compared with the Indian canals.

The Crapponne Canal comes over a saddle in the divide. These conditions are somewhat similar to the Sky Line Diversion, or any of those coming through the saddle, like the one coming from the Michigan, or the Grand River ditch of The Water Supply & Storage Company, in Colorado. The Canal des Alpine is of exactly the same character as these Colorado diversions.

Exhibit 28 is being prepared under my supervision, from
1461 an official map of the area where the Carpentras Canal is located. It is called a map of the Carpentras Canal. It shows a portion of the Vaucluse. The Canal Carpentras takes water from the Durance canal or headworks of the Marseilles Canal. They are perhaps two or three miles apart. I stayed all night with the headgate man of this canal, and walked between these two places in a very short time. The Carpentras Canal takes from the Durance, runs to the north, while the Marseilles Canal and others mentioned extend to the south. It then covers territory between the Durance and the Aigus river or torrent,rather,a tribuary of the City of Avignon. It also crosses the historical torrent or historical stream of Vaucluse and also supplies territory near the City of Carpentras.

This region has been irrigated from very early times. There is now a charter of a ditch on file at Avignon dating back to 1101.

There were a large number of other ditches that were built from that time up to the present and this present canal of the Carpentras was really an extension of ditches that were built quite a long time ago; so that this name properly only applies to the extension. There are other concessions or charters of ditches there, dating back to the twelfth century, there is one, for instance, dating 1171, and the

records of Avignon have a good deal of this water matter; that is, there are charters of ditches, of the transfer of water rights
1462 to lands, and regulations concerning management of ditches. Those have been preserved because the concessions were sometimes to religious communities. In fact, this document of 1101 refers to a transfer of water from an existing ditch the date of which is not known. This Canal of the Carpentras was projected apparently in 1536, and received the permit of the legal Parliament or legal counsel, but the affair seems to have been suspended because of the religious worries of that time which resulted in the massacre of St. Bartholomew's Eve; then taken up about a century later, and then had trouble because of the financial panic due to John Law in his Louisiana scheme which created so much trouble in France. Some of it was constructed about 1780, nevertheless, but the present canal was taken up seriously in its extension in 1849-1850 and completed in 1858. In this case the water is taken across a number of tributaries of the Rhone and for a distance of something like 40 miles along the foot of the mountains.

Another canal in France, the use of which constitutes an inter-watershed diversion, is the Canal of the Gap, so named because of the town of Gap. It is east of this last canal and diverts water in the opposite direction. It diverts into the Durance water-shed
1462 from the Isere watershed. In this case the enterprise practically surrounds the Carpentras Canal. That is it is further from the Rhone and takes from the Isere which empties into the Rhone about 75 miles north of Avignon, and thence runs into the valley of the Gap which is a part of the water-shed of the Durance. It runs for some distance through an open channel, and then through a tunnel which is nearly two miles—3,640 meters, long, and thence delivers into the valley of the Gap and distributes on both sides of the valley by two canals. The stream that it takes from immediately is called the Drac.

While we had in these other countries examples where the water was taken from the Durance, in this case the water it takeu into the Durance, just reversing the operation, and illustrating again the general principle that wherever the conditions call for water and water is available it was apt to be captured in that way and transferred as a matter of economic development.

(Defendants' Exhibit 29.)

I am having prepared a sketch map showing this canal. It will be marked and introduced as defendants' Exhibit 29.

This concludes all of the French diversions I am going to refer to. The general principles involved in the diversions in France are the same as the diversions in India to which I have referred. There is a difference in magnitude, but where the conditions called for diversion, they have done it. The diversions are the result of the same general conditions. So far as France is concerned, irrigation is not practiced to any extent, except in this portion of the state, the extreme southern part.

If these diversions which I have mentioned had not been made in

France, it would have made probable the loss of a great many lives at Marseilles, which has had in its past years, a great loss of life from lack of water, and it would mean the failure or suspension of population east of Arles on those plains that now is very easily supported by this water, and so it is in the vicinity of Avignon. Before this canal was built land was worth about 300 francs per
1464 hectere, that would be about $25.00 per acre; it immediately jumped to over $100 per acre before water was available, as showing the high value of water in the needs of this land at that time. Along in the '50's and since that time, of course, it has gone up very much higher. In other words, there were conditions justifying such application of water as indicated by the price of lands. That shows something of the conditions.

Had these diversions not been made, that country would have been developed but to a small extent, that is, there might have to be olive orchards and dry crops and very precarious existence. In southern France conditions are such that they try to cultivate all the land and its productive capacity is very much increased by the use of water. Without irrigation it is on the verge of failure, and when there is a little less rainfall than usual it brings a complete failure, but the taking of water across has not changed the total area which they attempt to crop but it has enormously increased the productive capacity.

1466 There are other instances of diversion of water from one stream for application on the watershed of another stream in France. I mentioned yesterday most of what might be termed the important ones that I am acquainted with, but the canal of Neimes might be mentioned because of its historical importance. It is not a very large one in capacity, but still it illustrates the same facts that they are inclined to build a canal under the pressure of need and without any thought where the water comes from as far as that is concerned or where it is applied. The impetus generally comes from the point where it is to be applied.

The City of Neimes was an old Roman city like Arles, Avignon, Marseilles and Aix, and a small amount of rainfall especially in the summer, that needed water both for irrigation and town supply. The City of Neimes had a canal bringing water for about 15 miles as I recall, through tunnels, and by means of celebrated aqueducts to the City of Neimes.

(Defendants' Exhibits 30 and 31 offered in evidence.)

Exhibit 30 is a photograph of the aqueduct of Pont du Gard taken from one end, taken in 1892 by myself on a visit to that locality, and shows the aqueduct from the lower end as it crosses the Gard. At about one-third of its height is seen a series of arches attached to the side of the main aqueduct, built by the French about 1760 as an addition to the side of the aqueduct to carry a road. The aqueduct itself was built about the time of Christ, I think in the reign of Augustus. The channel is above the uppermost series of arches. This aqueduct is one of the most celebrated irrigation works of this character in the world because of its beauty of propor-

tions. In order to make this masonry conduit, there were three series of superimposed arches carrying the tunnel, the upper series being smaller and resting on the top of the second series of arches.

The water was taken to Neimes for general city purposes, to the Roman baths and for irrigation of the gardens in that vicinity.

Exhibit 31 is a view through a tunnel, a little below the end of the aqueduct shown in Exhibit 30. It is a tunnel built by the Romans to carry water through a ridge. It is about 300 or 400 feet long.

1468 The photograph was also taken by me in 1892.

(Defendants' Exhibit 32 offered in evidence.)

Exhibit 32 is a photograph of a masonry aqueduct on the canal of Crapponne, which was mentioned in the testimony yesterday. This aqueduct was one near the City of Arles on one of the branches of that canal and near its extreme end. This was taken by me in 1892. The aqueduct was built about 1654.

(Defendants' Exhibits 33 and 34 offered in evidence.)

Exhibits 33 and 34 are both photographs of an aqueduct on the Carpentras Canal as it crosses the Vaucluse stream. This is the canal referred to in the previous testimony. These photographs were both taken by me in 1892.

The diversions which I have mentioned are typical of the enterprise in France as developed under the conditions and necessities of the case.

In Italy, the conditions are somewhat analogous to India,

1469 but on a very much smaller scale. That is, there are a series of streams coming down from the Alps on the north which join and form the stream known as Po. These streams coming from glaciers of the Alps, are quite large and fairly continuous because many of them are held by glacial lakes or reservoirs like Lake Como, and Lake Maggiore.

This is the greatest region of irrigation in Italy because of the extent of the Valley of the Po, its water supply and ease of irrigation; but does by no means comprise the entire irrigation of Italy. It is the one that is spoken of in speaking of Italian irrigation.

The irrigation in the valley of the Po goes back to a very early date and there were large canals built in the twelfth and thirteenth centuries especially near Milan, a town near Venice. There are two canals known as the Naviglio Grande near Milan, and the Muzza Canal also near Milan, one coming from the west and one from the east. The Canal Biana was another large canal built lower down the Po, and there were quite a good many of considerable importance built at an early date. The Biana was built still earlier than the twelfth century.

There were canals dating back very much further, but those represented the same characteristics that have been spoken of in the development of irrigation in the United States; that is; they were simply canals built to supply small areas or built by individual land holders which in some cases were the old monasteries, one of the

largest was built by a monastery out of Milan. Then there were those of smaller canals built from Springs, etc.

When they found the increased value from irrigation, and the search for water came, and they went farther for water supply, and the next step, likewise, that of tapping streams further away and bringing them across intervening streams. Projects were proposed and considered by the local association, and sometimes by the Government, and out of them all, two might be especially mentioned, that have been built and under consideration for a long time and led to a variety of plans, but all essentially to the same purpose and not materially differing in character. These two canals I refer to here are the Cavour Canal and the Villoresi. The first named after the Italian statesman who accomplished the unification of Italy, and the second for an engineer who had been responsible for one of the plans of the second canal.

These two canals supplement each other something as some of the canals described in India on the Jhelum and Ravi. The Cavour Canal takes its supply of water from the Po, or rather I should say, a part of its supply from the Po and traverses the provinces of Piedmont. It takes a large part of its supply, however, from a wide stream, the Dora Baltea. That canal is used to irrigate a portion of Piedmont north of the Po river directly, and by supplying a system of canals that are already in existence. The latter would be called a system of exchange, supplementing the supply. It supplements the supply as obtained by those canals from other sources. It ends at the Ticino river on the east border of Piedmont.

(Defendants' Exhibit 35 offered in evidence.)

Exhibit 35 is a sketch map of the Cavour Canal, with some of the other canals showing that it starts near the city of Turin, derives its supplemental supply from the Dora Baltea, crossing the Elvo, the Carvo, the Sesia, and other streams, and supplying the lands
1471 in their water-sheds and ending near the city of Novara on the Ticino.

(Exhibit 36 of Defendants offered in evidence.)

Exhibit 36 is a sketch map showing the Villoresi Canal that takes water from the Ticino below Lake Maggiore, and irrigating the region north of Milan and extending to the east. It is what might be called a high line canal. The Villoresi Canal was built more especially to irrigate the province of Milan, while the Cavour Canal was for the Province of Piedmont. The Cavour Canal could be extended into the province of Milan; but its level would have been so low, that it would not have covered much of the country that was capable of irrigation. So that the Villoresi Canal was started from the Ticino at a higher elevation, but is essentially an extension of the idea of the Cavour Canal.

The Cavour Canal was built between 1860 and 1870 and the Villoresi Canal built about 1880. These are all built and are very extensive systems.

The water is used entirely for irrigation in both cases. The lands

are all fertile lands of the Po. They are very largely used for crops, principally hay. The annual rainfall is about 36 inches, so this is used to supplement the rainfall and bring additional water. That valley is one of the thickest populated regions in the world, largely caused by irrigation.

The Canal Emiliano is something of the same character that has been under consideration by the Italian Government directly for twenty years and has been planned for a long time before that. It is designed to irrigate the region near Bologna, Parma, and Ferrara on the south side of the Po and on the Adriatic Sea. This has been reported on by the Government Engineers and has been recommended; but I think the matter of money have prevented its execution up to the present time. It is planned as a large canal at the foot of the hills. It is described in parts 14 and 15 of the Italian Government's reports on the "Carta Idrografio D'Italia."

There are no other instances of special note. There are some along the Apennines and so on that are reported in these cases; but I have not made any particular attempt to trace these out. These are bound to be small; but would be in kind, illustrating the general principle shown by these already given, that they take water freely from any stream that may be available.

I have failed to find any objections ever presented or any such manner of diversion and application of water in Italy. I have looked through the Government reports and other literature of all kinds, some, by the way, running back to the fifteenth and sixteenth centuries, in a series of authors on water in Italy, and in no case has any reference to objection on any such score been made that I have found.

I have failed to find any objection ever presented in France to this manner of diversion and application of water, in any of the descriptions of canals, projects, or in any literature on that subject that I have seen.

1473 I have made search, to some extent, to ascertain the conditions in Spain relative to inter-watershed diversions and applications. The available descriptions in Spain are much fewer, or at least such as I have been able to find, although there are many indications that such a custom prevails.

The irrigation in Spain runs back to an unknown period and that is the reason, perhaps, that descriptions are lacking. That was a very thoroughly irrigated country in the time of the Moors, who systematized irrigation, and the southern part of Spain has been irrigated through portions of it from the earliest date.

The rainfall at Madrid is about the same as Denver, 15 inches, and it has about the same latitude and prevailing weather, but considerably hotter. All of these ancient cities that were occupied by the Romans used aqueducts of great extent and considerable length, so the custom of irrigation was common because of the necessities if the case.

In some of the recent canals, the conditions are such that the canals take water across divides, but I have no maps, and very little descriptions except those like the Henares Canal and Isabella Canal.

Both have been constructed for some years, and irrigate in the neighborhood of 70,000 to 75,000 acres each. The Tamante Canal was taken up some years ago, but I am not certain that it has been built. It was to irrigate nearly 600,000 acres. I am unable to present maps of those, and therefore cannot speak definitely as to the conditions; but along the Mediterranean Sea near Valencia there
1474 are some of the old canals dating to the time of the Moors, analogous to those on the India coast of Madras, where they take from one stream which flows into the Mediterranean and carry it over into another stream flowing also into the Mediterranean. Thus for instance, here is a canal from the Zucar and extending over into the Cataroia, and also canals from the Guadlaviar, extending likewise to the Cataroia, and also in the opposite direction one extending to the small stream of Rio Seco. These date back to a very early date.

This particular map that I refer to is given in Volume 2 of Tassa's description of irrigation in Spain.

The rule of need and convenience has governed these diversions in Spain, that where they needed water they obtained it from any source that might be available and could furnish it.

I know of no objection having been raised to such diversions. I do not think there could have been any, because the practice has gone on so generally.

I know of inter-watershed diversions in other foreign countries. For example, between China and Turkestan the conditions there are favorable for such diversions at the head of the Chinese rivers to those running into Turkestan, and the Russian Government engineer who had charge of Turkestan and the irrigation works of that country described such diversions to me some years since, at a time when he was spending some days with me. His name is E. E. Skorniakoff. I do not have a map of such diversion, but I have a map of the adjacent region of Turkestan showing same in general,
1475 crossing from one stream to another, and irrigating the old city of Tashkent, and its vicinity. There were here a number of canals shown on the topographical map of that portion of Turkestan showing water taken from one stream to another.

I know of no rule governing these inter-watershed diversions except the same rule that has been evidenced elsewhere, that where water was available and land was needing water, it was taken without any regard to divides or considering any more than the physical obstacles that needed to be overcome as to the water of the stream itself. It was a mere physical difficulty.

There is another instance that might be mentioned on the Upper Nile that is proposed by the British, but is not as yet constructed so far as I know. That is at the extreme end of the Blue Nile, and the English have proposed that a tunnel be taken from this lake about two miles in length diverting into another branch which would drop into the Nile about two or three hundred miles below the Blue Nile, but instead of carrying it down this stream, take it out across the Blue Nile over into a country that is not at present irrigated. That project has been proposed by the British as reported in their official

reports and apparently will be taken up when the time comes. And no objection of any kind has been given to it, in fact the question has been considered by the Government.

1476 The various instances that I have enumerated are typical of diversions in the Western Hemisphere. Where conditions are favorable I should look for such diversions, but such places are not very common, for instance, in Australia there are practically no places where we could look for diversions because of the relative shortness of the streams and comparatively few of them. In a great many other countries they undoubtedly exist, but I have no definite information that I could supply at this time. I have a map of a portion of the Alpine region of Germany, but I am not able to present it at this time.

We have quite a number of inter-watershed diversions in the Western Hemisphere outside of the United States. We have first in Canada quite a number, either constructed or under plan of construction.

In British Columbia, the conditions are there such that the streams are generally small and the valleys are narrow, and as a whole the conditions are not such where there would be any call for diversion. At the same time when acting as Commissioner for British Columbia and looking into the stream records, I found a number of instances where water was diverted across divides. There are other reasons also why they would not be expected to be present in any great number in British Columbia, because the country is very new in its irrigation development. There were, however, several instances that I recall where one stream came near enough to another with a feasible divide, so that water was brought from one shed to another.

This was the case, for instance, on the branch of a stream northwest of Ashcroft in British Columbia, where it was carried across

1477 the divide on land toward Spence's Bridge and towards Ashcroft. It was also true in the vicinity of Lake Okanagom, a region which has recently been developing rapidly as a fruit country, where water has been taken from Nelson Creek to irrigate lands to the south over towards Michigan Creek and Kelowna. These are small diversions as compared with the matters which we have had examples of elsewhere. This last enterprise was planned but not constructed, at least at that time. The question was one of funds. Near Pentictom water was taken from Pentictom Creek to the north irrigating the valleys of other branches running into Okanagon Lake.

There was a more noticeable transfer across the divides at the head of the Columbia further east between Columbia and the Kootenay. It happens in this case that conditions are quite favorable. These two streams start close together with a fairly wide mountain valley, so that the water in one runs one way and the water in the other to the north, the Columbia running north at that place. The enterprise was under construction there, taking water from one into the other.

The general physical conditions in British Columbia were not very favorable for such changes; but where ever such conditions were favorable, it was being proposed and considered without objection.

There was still another, that I am not able to locate the name.
1478 There were several smaller changes of that kind that I found, as where water was changed by permission of the Commissioner. They had a system of permits by what in the early days was called the Gold Commissioner and he had charge practically of everything pertaining to the government and all permits were issued by him. In a number of cases I found permits of this character that planned the diversion of water from one stream to another. The physical conditions seem to entirely control in these cases.

As a member of the Irrigation Commission I did not raise any objection whatever. In fact the laws as they were, permitted it, and the laws as passed did not forbid it. It was considered one of the essential conditions to the development in an irrigated country, so it was left entirely permissible.

In Alberta, conditions are similar to the conditions in British Columbia, in fact, there are streams and large plains so that development can be carried on on a large scale, and development there is in the central government, instead of the local government. British Columbia, I may say, in passing, has been in about the same relation to Canada, as Texas has to the United States, that is, Canada owns none of the lands of British Columbia, any more than the United States does in Texas. In Alberta, on the other hand, all public lands belong to the Central Government—to the Dominion of Canada.

There are a number of streams that start from the Rocky Mountains in Alberta, running to the east mostly in the Saskatchewan drainage area. The surveys were made to some extent in the first place by the Canadian Government and an extensive series of surveys has been made by the Canadian Pacific Railway.

I have maps here of the Canadian surveys, which may be referred to by title. In 1884, is one showing a proposed method of diverting water from the Elbow into the North Fork of Fish Creek. In the report of 1897, they present a map showing the location of a canal for diverting water from White Mud river to Swift Current Creek. Also from the South Saskatchewan river to the Regina Districts. There is one in the report of 1894 from Red Deer river into the Rose Bud, and these are the official government surveys of reports showing what they contemplated under Government supervision.

In the British Province of Alberta, in the Dominion of Canada, the more recent construction has been along the Canadian Pacific Railroad from the Bow and Red Deer and connecting them together. I have not a map here of them this morning.

Practically all of the diversions in Alberta, are from one tributary of the principal stream to another tributary of the same stream. They are all in the Saskatchewan drainage area.

In the case at bar, the diversion of water is from one tributary of the stream to another, all in the Platte river drainage area. The conditions here correspond so far as that situation is concerned with those in Alberta.

(Defendants' Exhibit 37 offered in evidence.)

Exhibit 37 is a sketch plan of the Canadian Irrigation surveys to show the proposed location of a canal diverting water from the White Mud river to Swift Currant Creek. It is an official map of the Dominion of Canada, taken from the report of the Canadian Irrigation surveys of the Department of the Interior of the Dominion of Canada.

(Defendants' Exhibit 38 offered in evidence.)

Exhibit 38 is also a map made from the Canadian Irrigation surveys published by the Dominion of Canada and is a sketch showing a proposed diversion of water from Elbow river into the North Fork of Fish Creek.

1481 (Defendants' Exhibit 39 offered in evidence.)

Exhibit 39 is another map from the same official report of the irrigation survey of the Dominion of Canada showing the proposed method of diverting water from the Red Deer river into the Rose Bud River. These three maps all contemplate change of water from one stream to another and proposed by the Government of Canada.

At the time these maps were presented by Canada, the projects were proposed. That was in 1897. Several of them, I think, have been substantially included in the Canadian Pacific diversions.

These three maps, Exhibit- 37, 38, and 39, are taken from the official government publications. Whether constructed by the government or someone else, they are, nevertheless, the work of and bear the sanction of the Government of the Dominion of Canada.

Again referring to the Italian Irrigation, particularly to the canals of which I spoke, I stated that I had a personal inspection of these canals during the year 1892. Most of these visits were made alone, so far as the people from this country are concerned, in company, however, with Italian engineers. There were one or two visits made in connection with E. S. Nettleton, but I think those canals were not referred to in the testimony this morning.

1482 I took photographs while on that inspection trip.

(Defendants' Exhibits 40, 41 and 42 offered in evidence.)

Exhibit 40 is a view of the headgate and regulating works of the Cavour Canal at some two miles below the city of Turin. It is the gate across the canal which regulates the flow of water into the canal a short distance from the Po. This photograph was taken by me in 1892.

Exhibit 41 is a photograph taken about the same time by me, of the intake of the same canal from the Dora Baltea. As before mentioned, the Cavour canal is supplied by both the Po and the Dora Baltea, this latter is the intake from the Dora Baltea, of the same character and near the same size as the headgate from the main river.

Exhibit 42 was a photograph taken in the same summer by me, of the Naviglio Grande Canal in the outskirts of Milan, a canal connecting the Tincino and the City of Milan, serving both for navigation and irrigation and built in the 12th century.

Exhibit 37, being a map of the White Mud-Swift Current inter-watershed diversion in Alberta, should not be passed without calling attention to the fact also that this a proposed diversion from
1483 a stream flowing into the Missouri watershed, into a stream of the Hudson Bay drainage, or into the Saskatchewan drainage. This is in Alberta, proposed by the Canadian Government. I do not think it is constructed, but the matter has not been dropped because of any objection to the proposed transfer of water from one watershed to another. The White Mud comes into the United States finally about 30 miles from this proposed diversion.

The United States Government, through its Reclamation Service has proposed a good many inter-watershed, or trans-mountain, diversions from time to time. They have constructed two, or are in the process of constructing two at least and propose more. One is completed and one has had a good deal of money expended on it. I refer in these to the Strawberry Valley Project in Utah. This is a project of the United States Reclamation Service, practically completed and takes water from the Colorado river which flows into the Gulf of California, and carries it through a tunnel into the Great Basin of Utah, the interior basin. The Interior Basin drainage termi-
1484 nates at Salt Lake. There is no outlet to Salt Lake.

They are to build a reservoir on the Colorado river side, have built a tunnel through the mountains and this tunnel has been completed, or at least the headings will be connected some time this season. The total cost is estimated at nearly two millions of dollars and about 69% of it is reported as being completed. The total length of the tunnel is something like 19,100 feet. It is called the Strawberry Valley Project because of the stream on the Colorado river side where there is a large reservoir being constructed. It is expected to irrigate about 50,000 acres. That is reported and maps are given, and other information appears in the various reports of the U. S. Reclamation Service.

(Defendants' Exhibits 43 offered in evidence.)

Exhibit 43 is a sketch map of this Strawberry Valley project, showing the general relation of the tunnel and diversion with respect to the Colorado River and also in reference to the Interior Basin of Utah. Utah Lake, which is shown in this sketch map, is a tributary of Salt Lake and a part of the general basin. The Jordan river connects the two lakes.

Water diverted from Strawberry river and the Gulf of California drainage into the Jordan river and the Salt Lake Drainage will not go down the Strawberry river and will not return to that stream, but must finally be evaporated in the Interior Basin. Whatever is taken by the project will, of course, not go down the Colorado
1485 river. This case is more extreme in its nature than the diversion of water from one tributary of a river to another tributary of the same stream.

The Milk River project of the United States Reclamation Service, a portion of which is called the St. Mary's Project, also involves an inter-watershed diversion. Money has been appropriated for this project

by the Government. It is located in northern Montana. 18 per cent is reported completed up to this summer. The St. Mary is considered both as a part of and a supplementary part of the Milk River Project.

(Defendants' Exhibit 44 offered in evidence.)

Exhibit 44 is a sketch map showing the general situation of the St. Mary's Project, or the Milk River Project, and shows the fact that the St. Mary diversion from the St. Mary's river is from a stream which is a tributary of the Saskatchewan river, and is consequently a part of the Hudson Bay drainage. This is diverted into Milk river which is a branch of the Missouri, and consequently the diversion undertaken by the Reclamation Service as shown in Exhibit 44 is a diversion from the Hudson Bay drainage in Canada into the Missouri and Mississippi drainage in the United States.

It is under construction in Northern Montana. It is almost
1486 opposite in the character of diversion, from that shown on Exhibit 37 where the Dominion of Canada proposes to take water from the Milk River branch into the Saskatchewan, showing that both countries were willing to transfer water in that way. This sketch map, Exhibit 44, also shows some other facts concerning this proposed diversion. It might also be mentioned in this case, that after the water is transferred from St. Mary River into the Milk river by means of a short canal that it then is carried in Milk River through Canada and finally back into the United States; and that the land that is to be irrigated is in Montana, quite a distance from the point of diversion. A total distance, in fact, of something like 200 or 250 miles carriage in the Milk river before any of it is proposed to be used. This diversion is another illustration of the same principles involved in the Strawberry Project. It is not only across a watershed, but it is from one ocean to another.

There are quite a number of proposed projects of the Reclamaton Service which take water from one tributary of the stream for application upon another tributary. In fact, the Gunnison Project in this state, takes water from the Gunnison and carries it through a tunnel through a ridge and uses it in the Uncompahgre Valley. This project is nearly completed. The tunnel has been completed and the enterprise is about 60% complete. Water has been run
1487 through the tunnel which is six miles long. Water has been run from the Gunnison river through the tunnel at least for one or two years, and when I mentioned that the project as a whole was 60% complete, I did not mean that water had not been diverted through the tunnel from the Gunnison. The Uncompahgre river drains back into the Gunnison river lower down.

Before the United States took up this Gunnison Project, the State of Colorado had made an examination and commenced construction. This was turned over to the United States afterwards and is being completed by the Reclamation Service.

There are many notable examples of inter-watershed diversion in the several States. There are numerous cases in Colorado and Wyoming. There is one between Montana and Idaho, and in fact in

nearly all of these states wherever the conditions require it. Whenever it becomes necessary and feasible to bring water across the divide, wherever they have land on one side and find water on the other side of the divide, then they make the diversion.

1488 In California the most notable example is the Los Angeles Aqueduct. That has been built under public auspices and carries water for a distance of several hundred miles from the Interior Basin, bringing water across two watersheds and finally delivering it on the south side of the Tehachapi mountains.

(Defendants' Exhibit 45 offered in evidence.)

Exhibit 45 is a sketch map of the Los Angeles Aqueduct. It brings water from the Owens river on the east side of the Sierra Nevada mountains and across the Sierra Nevada Mountains and across the head of the San Joaquin Valley, and across a second range of mountains which I spoke of as the Tehachapies, but which are here represented as the Sierra Madra, a total distance of approximately 200 miles and in fact the actual distance is 250 miles.

This diversion of water from the Nevada drainage for use upon the Pacific drainage is authorized in connection with the City of Los Angeles which needed water for all purposes, domestic and irrigation. They had difficulty in getting water nearby and accordingly developed this source of water at this distance. The stream that they intercept would run into Owens Lake. They are to use the water for irrigation and domestic use and also for power and all city uses. They will use it for the irrigation of the garden tracts adjacent to Los Angeles, and for irrigation of farms, gardens

1489 and fruit ranches. The total cost is in the neighborhood of $25,000,000. They intercept not only the Owens River, but a number of intermediate streams. While they started with a capacity of 700 cubic feet per second, the capacity is increased to about 900 cubic feet per second.

In this case the water is transferred across two mountain ranges and from the Interior Basin of the United States to that of the Pacific watershed. By the term Interior Basin I mean the interior portion of the United States east of the Sierra Nevada mountains and west of the Colorado River watershed. It includes a large portion of Utah and Nevada. None of the waters of the interior basin reach the ocean.

San Francisco has felt the same necessity. They have been using water for many years from a watershed that does not include San Francisco and have recently been looking for an additional supply. Under pressure of need, they have sought for any available water, and have looked for water in the Sierra Nevadas, and have recently obtained permission from Congress to utilize what they term the Hetch-Hetchy Project. The permission was passed by Congress within the past week or two. That involves taking water from the Yosemite basin, and they intercept and carry it from there down to San Francisco.

Notable features of the two California inter-watershed diversions are the cost, the length and the fact that these diversions have been

contrary to the accredited custom of that state, showing they have found it desirable to practice this method owing to necessity,
1490 I refer to the riparian doctrine.

I have not made detailed investigations of many of the other states. As I have previously stated, the conditions under which such diversions take place indicate that there has a certain development taken place. It has reached such a point that the local supply of water, if not exhausted, is at least so that the conditions justify their going some distance for water. It is an economic condition. When a state is just developing, they cannot afford to go too far for water, especially when they can get it nearby. Extreme conditions warrant the expenditure of larger sums of money to accomplish the irrigation of larger acreages. This occurs as the country becomes developed.

Colorado is a state in which irrigation has been developed for a considerable time. It has conditions quite advanced, and there are a number of instances of this kind. These diversions are quite common in this state and have been so from the very first. They have been found primarily necessary by the irrigators, owing to the conditions, like the construction of reservoirs, like the exchange of water *on* the streams, as a matter of natural necessity. They have been recognized by law, and while at first without specific statutory authority were recognized through necessity.

I have already mentioned examples of the inter-watershed, or trans-mountain, diversions, in Colorado. There are several at the head of the Poudre river. These are possible at that place, because of the general physical conditions. The head of the Poudre river is near to the head of the Laramie river, a branch of the North Platte, and also near the head of the Grand river.

The North Platte drainage in Colorado is situate in the North Park. The river then runs through Wyoming and into Nebraska. Waters diverted from a branch of the North Platte would, if allowed to follow their natural course, pass into the Pathfinder reservoir in Wyoming.

Waters diverted from the tributaries of the Grand river would naturally flow into the Gulf of California, and the Pacific Ocean. The diversion from the Grand river to the Poudre river is a transcontinental diversion, as well as a transfer across a divide. It illustrates again the general fact that when water is available, the question of the water-shed is simply a physical consideration.

The three ditches which I have mentioned are Grand River Ditch, taking water from the Grand river and delivering it into a tributary of the Poudre; the Michigan ditch, taking water from a branch of the Michigan river and running into a branch of the Poudre; and
the Sky Line Ditch which takes water from the Laramie
1492 river and delivers it into the Poudre. There are two diversions of water from the Michigan, both coming through Cameron Pass, at an elevation of about 10,200 feet. The Michigan river is a tributary of the North Platte. Cameron Pass is the saddle in the range of mountains at the head of the Poudre Valley and separates the Poudre watershed from the North Platte watershed.

The North Platte watershed in Colorado is commonly called the North Park. There is a rim of mountains on both sides or all around it. The Grand river is at a considerably higher elevation, nearly 11,500 feet, and the Laramie diversion is at a lower elevation, of about 9,000 feet. The latter includes the Sky Line ditch and direct diversion from Laramie Lake and Lost Lake. These diversions go back for nearly twenty-five years and were constructed early because the conditions were suitable and feasible. The cost was small.

The three particular ditches of the Water Supply & Storage Company which I have just mentioned, the Grand River Ditch, the Michigan Ditch and the Sky Line Ditch or Laramie River Ditch, all divert water used entirely for irrigation in the Poudre Valley, under the canal commonly known as the Larimer County
1193 Canal. This canal is now owned by The Water Supply & Storage Company, which is a mutual farmers' company. The lands irrigated by water obtained from these three ditches are adjacent to and lap, as it were, the Greeley-Poudre district for nearly the whole length on the south side and lie immediately next to them. The lands of the Greeley-Poudre district would simply be an extension, as it were, of this same area.

In Colorado, whenever there has been a suitable justification, water has been diverted across the divide. I mean by that that whenever there was a saddle or pass which was available at an elevation not so great, and where there were streams flowing enough water to justify the expense, the diversions have been attempted more or less. The stream south of the Poudre, the Big Thompson, has practically none because the rim at the west is so high above timber line, without passes, that there are no streams of any consequence that can be diverted. The St. Vrain has nearly the same situation. In the case of Boulder Creek, there is a diversion at the head of Clear Creek. There are also several others proposed like the Henrylyn Project and the tunnel proposed by the City of Denver, which are at the head of Boulder Creek. The Berthoud Pass Ditch is south of Boulder creek and comes into Clear Creek. It has been used eight or ten years.

The Cimarron ditch takes water from the Cimarron river over into Cow Creek and then delivers into the Uncompahgre river; which stream delivers water in the vicinity of Montrose and in the same neighborhood as the Gunnison Project.

The Pine Ridge Ditch is also an old ditch diverting water from the La Plata to the Las Animas watershed. The La Plata is a tributary of the San Juan and of the Colorado river. This diversion is a case of diversion from one tributary of a stream to another tributary. Both streams finally go into the Colorado.

The ditches at the head of Boulder Creek and Clear Creek divert water from Williams Fork, a tributary of the Grand River and whose waters flow naturally into the Pacific Ocean. These ditches divert Pacific water into Boulder Creek, a tributary of the South Platte, which eventually empties into the Gulf of Mexico. Williams Fork is part of the Grand River watershed, and Boulder Creek a

part of the Platte River system. Clear Creek is a tributary of the South Platte.

The Montezuma Valley enterprise diverts water from
1495 Dolores river by means of a tunnel into Montezuma Valley.
That is a tributary of the San Juan. That ditch and tunnel were built more than 25 years ago and have been in operation during that time.

The Overland Ditch diverts water from Muddy Creek to Laroux; the Highline Ditch diverts water from Surface Creek to Laroux. Now we have a contrary condition prevailing, for a dry creek ditch diverts from the Leroux Creek to a dry creek watershed, that is another instance of the application of that general principle that where the physical conditions were appropriate water was taken across.

The West Cimarron Ditch diverts water from the West Cimarron river to the Uncompahgre, which is a similar condition to that of the Cimarron ditch. And so there are many cases of a minor character where no ditch of any size can be built without carrying water at least across certain restricted watersheds.

There is also a ditch at the head of the Arkansas river. There is a ditch at the head of the Mosca, at first diverting water in that case from Sand Creek, a part of the Rio Grande basin, into a part of the Huerfano system flowing into the Arkansas. That has been
constructed for at least twenty-five years. Wherever those
1496 conditions prevail we find diversions. An inter-watershed
diversion in Colorado became the subject of litigation. The case of Coffin vs. The Left Hand Irrigation Company. That was in the St. Vrain Valley, where the Left Hand carried water across some of the minor divides. This decision has been the leading case in not only Colorado, but I think a great deal of the west. It is reported in 6 Colorado, 443.

The City of Colorado Springs takes water from the south side of Pikes Peak, carries it through a tunnel of 6000 feet or over and through a secondary tunnel of about 700 feet, and delivers it into a creek on the east side of Pikes Peak, which is then a tributary of the Fountain. Beaver Creek flows south into the Arkansas river, near the town of Florence. This water thus diverted from Beaver Creek is used for all city purposes, including irrigation. This is another example of diversion of water from one tributary for application on the watershed of another tributary of the same stream.

The city of Cripple Creek takes water from one branch of Beaver Creek over into Four Mile Creek, which is not a tributary of Beaver Creek at all. Both Beaver Creek and Four Mile Creek are tributaries of the Arkansas river stream system.

The North Platte and the South Platte are tributaries of the
Platte river system.

1497 Inter-watershed diversions within the State of Colorado have
all been brought about through the same causes as diversions of water for use from any stream. Simply need of water. Waters have first been taken from streams nearby and later from any other source of supply without discrimination. The same causes

brought about the construction of these canals as led to the construction of canals of this character in France and India.

The present plan of the city and county of Denver, known as the Mountain Tunnel Plan, proposes the bringing of water through a proposed tunnel from the Pacific to the Atlantic side of the watershed. The plans have not been entirely fixed except in a general way, and are pretty well matured. This project would bring water directly for city use and irrigation.

The Henrylyn Irrigation District has in process of construction a similar tunnel. It proposes diverting water from the Williams Fork, which is a tributary of the Grand River for application on lands near Denver and in the South Platte drainage area.

1498 In nearly all of these cases the water diverted is later turned into a natural channel which is used for some distance for the carriage of water before re-diversion. That is the case in a number of these instances mentioned by me in testimony in this case and as shown in several of the exhibits offered. All over the world streams are recognized as the natural and free carriers of water. Wherever conditions are similar, the solutions that the human mind finds are pretty nearly the same.

From the standpoint of irrigation and development I see no difference, unless it possibly be in degree, between diversions from the watershed of drainage of one ocean into the watershed of drainage of another ocean, or of a stream having no outlet, and between tributaries of the same stream. It is a condition that comes from a state of development and a state of need, and local conditions which either make it possible or impossible. Thus, at the head of the Big Thompson, diversion could only be made at great cost and so high up there would not be enough water obtained to justify the expense. At the head of Boulder Creek diversion could be made at a lower elevation and water caught and the expense justified, and the same in Wyoming where diversions can be made when conditions justify it.

Large tunnel enterprises, like the Greeley-Poudre Tunnel, the Henrylyn Tunnel, and the Moffat Tunnel, all in Colorado, represent a stage in the development of the country which justifies bringing large areas of lands of high value under cultivation to a

1499 sufficient extent to pay for those enterprises and justify the expense. Such enterprises bring an additional source of supply directly to the land already irrigated and also directly irrigate an additional supply of land.

On the Eastern Slope we have an almost unlimited supply of land and a limited supply of water. This development is necessary in order to bring under cultivation a larger area of land, increase the crop production, increase the number of people that can be supported or can get their living from agriculture, and increase the aggregate food production. None of these large tunnel enterprises could have been constructed at the time of the construction of the inter-mountain canals of the Water Supply & Storage Company for the reason that they would not have been justified at that time, that is, they were not economically feasible at that time. The value of the land

or increase in the value at that time, would not have justified so large expenditures. That same general fact is shown in the fact that our earlier ditches were possible only because they used cheap construction, wooden headgates, and the most temporary character of construction. At the present date it is possible to use permanent construction. 25 or 30 years ago, irrigated land was, for instance, sold at from $25.00 to $30.00 per acre, and the cost of irrigation then per acre was perhaps $5.00 to $10.00. In the mean time, these lands have developed to $100.00, $200.00 and $300.00 per acre and a cost of from $30.00 to even $75.00 per acre for water is very common and is justifiable now when it was not 25 or 30 years ago. That means then, that an enterprise could be undertaken now that would involve a great deal larger expenditure than a few
1500 years since, and more than that, in all probability, the next 20 years will show corresponding changes as have been in others. Enterprises that today no company could afford to go into and expect to get the money back, in the course of 25 or 30 years will be found perfectly practical. Thus, changes are progressing constantly, and it makes it possible to consider these tunnels and other large expenses today that were utterly out of the question 25, 15, or 10 years ago. You see those conditions in Italy and India, where in some of those cases it took 25 to 50 years of consideration before they actually constructed the plans that had been formulated.

I do not think that these large tunnel inter-watershed diversion projects represent the final development in their immediate neighborhoods. I think we shall see just as much development in the years to come as we have in the past.

The future development will be of this character, or even more expensive, and of course, lands thus can be subject to increased expense or improved service in a great many ways. These tunnel projects would represent the final construction if by so doing they have exhausted the water supply. Other means will be found to economize and the question of economy is a question of expense, whether they can afford to economize and when the conditions are such that they can afford to spend money for that purpose, the water will be stretched. Thus, I might mention, that in Northern
1501 Italy, in the regions of the valley of the Po, they can afford to and do spend as much as $400.00 per acre in preparing ground for irrigation. That means that it has to be a thickly populated country and lands must be of a high value to justify the consideration of any such construction.

I stated that there is an unlimited supply of irrigable land on the Eastern Slope or great plains region in Colorado. A different condition prevails on the Western Slope. The Rocky Mountains rise abruptly from the plains a little west of Denver running nearly north and south and to the east of that is situated the plains of a very uniform and even surface as a whole; but near the mountains, beginning at the foothills from there for several hundred miles it is a mountainous country, the valleys are narrow, very rarely more than a mile or two miles across, at high elevation and the aggregate

land available for irrigation is small. The land near Montrose has an uncommon expanse, and likewise the San Luis Valley; but in the vicinity of the Gunnison at Grand Junction, the mountain valleys are generally all narrow with very little land subject to irrigation.

The value of irrigated lands in the high mountain regions and in cold climates is very much less than the value of the land on the plains situated at lower elevations. At higher elevations the land is practically confined to hay. It has cold climate, not because of latitude, but because of elevation, which makes really the climate conditions about the same as if the land had been about 1000 miles further north. It is a very fine hay country but can grow only crops than can stand the Arctic climate of that elevation.

1502 The production on these two classes of lands can hardly be compared. That is, the production, for instance, at the elevation of Denver or Greeley, Colorado, about 5000 feet, now runs from $100 to even more per acre per annum. $50.00 and above would indicate a great portion of the production per acre of that area, whether it be wheat, beets or potatoes. This production can be increased by the cultivating of cabbage, onions and like crops to several hundred dollars per acre. There is a record strawberry crop that ran over $2000 per acre; but of course those are not under really typical conditions.

At higher elevations of seven, eight or nine thousand feet, the conditions vary somewhat according to the locality and climatic conditions. Thus, for instance, the San Luis Valley has an elevation of over 7000 feet, but is at the south edge of Colorado and is protected on the north side from winds, and grain grows there very successfully. If it were open to the north winds, the climatic conditions would be very different even at the same altitude. Now, as we go north, they have a region adapted only to the growing of hay, and as we go further north into North Park and also the Laramie basin, the same condition prevails. The Laramie basin has an elevation of about 7000 feet. It is open to cold winds of the north, without protection of a mountain range on the north side, and in addition to that, it is situated so that the storm centers, or at least a great many of them, pass to the south, and that gives it a pretty cold bath of air, and gives it the conditions that make it more Arctic than the elevation itself would.

1503 Inter-mountain and inter-watershed diversions prevail in Wyoming. Wyoming is an arid state where irrigation is practiced under irrigation conditions and is therefore subject to the same general modes of action as other states and other countries. With Wyoming, as with Colorado, Italy, India and France, wherever there has been a locality developing which needed water, they have obtained water either from the adjacent stream or from an available foreign watershed. There are quite a number of instances of this kind in Wyoming.

The most marked instance is in Northern Wyoming which might be mentioned in detail, in the vicinity of Sheridan, and is very marked for a double reason, for its development has been to a greater

degree than anywhere else and the marked conditions there have developed more than anywhere else that I know of in the State. In the first place, the land is at a low elevation, comparatively speaking, and that means that agriculture is more of an agricultural than of a grazing character. The land then justifies higher prices and more extensive development. That is the first condition. For a second reason there also happen to be physical conditions near there encouraging the diversion of water quite rapidly at one particular place. This has led to an extensive series of diversions from one watershed to another. Those diversions have been recognized by the State of Wyoming by permits given by the officers in charge of irrigation. They have also been recognized by the Board of Control in giving the adjudicated rights. Those
1504 adjudicated rights are similar to what we call water rights in this country. They are given by the Board of Control. In Colorado they are fixed by the courts. They are identically the same.

Wyoming has officially recognized all of these transfers and use of water from one shed into another, and this particular place is the pioneer almost, in Wyoming, for the two reasons already given, and also for the reason that that portion of Wyoming has been one of the earliest to develop an agricultural community. The vicinity of Buffalo and Sheridan, was one of the first in that state to become an agricultural community, hence those conditions developed there more than anywhere else in the state.

When I speak of agriculture, I am distinguishing between that and what I call pastoral. I refer to conditions where the cultivation of crops prevails. They may, of course, grow hay, as they do to some extent, as well as cultivated crops.

The elevation at Sheridan is 3,750 feet, while the elevation at Laramie is over 7000 feet. Thus it makes that northern border a portion of the best agricultural section of the state from an economic standpoint.

There is a very extensive series of transfers of water from one watershed to another on the various tributaries of the Powder river, which are south of Sheridan connected by a good many of the tributaries. The ones I refer to as the most marked ones, are those where water is transferred from a branch of the Powder river over to a branch of the Tongue river. These two streams are entirely independent, both in Wyoming and Montana, except as they physically mingle their waters as they enter the Yellowstone river.
1505 The Powder river and the Tongue river in Wyoming are very similar in their general situation to the North Fork and the South Fork of the Platte river. These two streams are entirely separate in what might be called the parent state. After passing out of the parent state into another state, they then both enter into another stream and finally join their waters there. In this case, the Tongue and Powder rivers join their waters in the Yellowstone. In the case of the Laramie and the Poudre rivers, they join their waters by a junction of the North and South Platte

rivers in Nebraska. Both the Laramie river and the Poudre river are Colorado streams and their waters intermingle in another state.

(Defendants' Exhibit 46 offered in evidence.)

Exhibit 46 is a map prepared by me and under my direction. It shows the states of Colorado, Wyoming and Montana and some of the adjacent territory of the adjacent states and shows the Powder and Tongue rivers, their course in Montana and their junction with the Yellowstone and also shows by broken lines the alignments of their watersheds. It also shows the Laramie river and the Poudre and the South Platte streams and their course at their Junction in Nebraska, as well as in Colorado and Wyoming.

The diversions at Sheridan, Wyoming, are exactly parallel to the diversions from the Laramie river to the Poudre river in Colorado. The diversion from the Powder into the Tongue, is made in Wyoming, while the two streams pass through another state.

1506 I had started to speak of the diversions in the Powder watershed before speaking of its diversion into the Tongue river watershed. The Powder river watershed is just south of the Tongue river. In that watershed is the town of Buffalo and the irrigated section adjacent. Lake De Smet is in that watershed. On the west side are the high mountains which supply these streams, and these streams as a whole are more abundant in the Powder river watershed, apparently, than just north of that tributary to Sheridan.

In these streams coming down from the watershed on the Powder river, there have been a large number of diversions from one stream to another. For instance there is a diversion from Clear Creek over into French Creek, and from French Creek into Johnson Creek. These streams I mention are tributaries of the Powder river, and the next, however, are also of the Powder river east. I am taking the transfer of water from one watershed to another of branches in the Powder river stream system. There is also found a diversion that passed from French Creek into Johnson Creek or across Johnson Creek. We likewise have a diversion from Piney Creek on the North to Shell Creek on the south; and also from Rock Creek over to Shell Creek. There is also a place in the mountains some ten or twelve miles west from there, where the South Piney Creek and Rock Creek come close together. That then affords a convenient opportunity to divert water from the South Piney over into Rock Creek.

Such diversions have been made, have been practiced for years, and that whole irrigated tract is itself interlaced with the use of water from one stream to another. The decrees or adjudicated rights have been made from one stream to another according to the original source of supply irrespective of the original location of the land. Now so far mentioned, these diversions are all in the Powder river watershed, the most southerly of these two streams, the Powder and Tongue. Then I refer to the diversion from the Powder over to the Tongue river watershed.

(Defendants' Exhibit 47 offered in evidence.)

Exhibit 47 is a sketch map showing the stream system in northern Wyoming both of the Tongue and of the Powder rivers. It shows these various points where water crosses from one stream to another, and these particular points are marked by a cross. The land which it supplies by water through transfer is marked by crossed lines. I might say that the extent of these cross lines does not indicate very accurately the land itself, but indicates its location in a general way. It also shows the principal ditches simply taking the outside ones, or typical ones that cross the Divide. It does not extend beyond the Montana Border. There is however, in the corner, a map on a small scale that shows its relation to Montana, and the Yellowstone river, showing the general situation on a very much reduced scale.

Exhibit 47 shows the various diversions I have just testified about, that is, those taking water from one portion of the Powder watershed to another. This map was prepared by me or under my direction.

1508 Discussing the diversions between the Powder river and the Tongue river, I will state that there happens to be a very convenient place for diversion between those two watersheds. There is a ridge of rock or rampart between the two sheds; but at one particular place it is broken so that there is a gap very much lower than the summit of the ridge. At the same place a tributary of the Powder river comes very close to the opening, so it required very little work to divert water through that opening. On the north side, that is, the Tongue river side, the water course, a branch of the Prairie Dog, descends very rapidly, so that the country on the north side of that gap is lower than on the south side. This gap has been a noticeable landmark in a sense, and so much so that the early travelers and wagon trains went through the gap and made it a point of crossing through this ridge. That gives the physical conditions for these diversions.

Then, in addition to that, we have the relative fall of the land to the north and the relative early development of that same region make additional water desirable. Hence it was the most natural thing in the world and a consequence of that same general law, that they made a diversion through this gap. In doing this they took water from North Piney Creek which is a branch near the gap; but as the North Piney is not as good a stream as the South Piney which is more or less east and to the south, they then in addition, constructed feeding canals from the South Piney to the North Piney and bring water from the North Piney through this gap into the Prairie Dog Creek on that watershed. Prairie Dog Creek is

1509 used to some extent as a carrier of this water. They use both ditches and the Prairie Dog Creek for this purpose.

Permits and decrees were given for these diversions by the State Engineer, and by the Board of Control. These permits are given to the waters of Piney Creek and the lands are described as lands along the Prairie Dog or other streams to the north. These streams are tributaries of the Tongue river, that is, they are part of the Tongue

river stream system. The Piney is a part of the Powder river stream system.

The rights to this water, as given in the state records of Wyoming, are classed in with the Piney Creek, and except by looking up the specific lands, it would not be revealed that the water was carried across the shed. In this particular case, the list of lands that have thus acquired rights has been platted on the topographical sheet and shown here in color.

(Defendants' Exhibit 48 offered in evidence)

Exhibit 48 is a map prepared on the Sheridan Quadrangle sheet of the United States Geological Survey with additional notations. These notations were made under my direction and show in color the lands on the Tongue river watershed that are supplied by water from Piney Creek of the Powder river watershed. These are the lands to which water has been decreed by the Board of Control of the State of Wyoming. That body consists of the State Engineer and the division superintendents, and is the official body of the State to issue permits to water. In addition, there is noted on this map the divide between the two streams in heavier ink so as to indicate clearly where that watershed is by the broken line. The
1510 ditches are not indicated in my notations. They are shown on the map by a blue line corresponding to the stream. There are three or four colors used which indicate the course given of respective ditches through this gap. The coloring was done by me. There is a legend on the map showing what each color signifies.

There are some diversions in the same general vicinity in addition to the diversions I have noted on this map, that is, from the Tongue river itself, or Tongue river system, from one stream to another, so that there are quite a number of diversions of similar character to those referred to in the Powder river watershed. It simply is a general practice there, and the conditions as mentioned are very favorable to such diversions, and consequently they have done there, as everywhere else on the earth's surface when the occasion justified it. They have carried water from one stream to another, as freely as if no sheds were there, and the only conditions to be considered, physical and economical. These on the map are represented as in the case of the Powder stream system, by crosses at the point where the principal diversions are made across the sheds. It is not an exhaustive list. There are some others in the extreme north and west of this map that are not shown here.

1511 I was compelled to check the lands as fixed by the Board of Control decrees in order to ascertain which of these diversions from Piney Creek and the Powder river tributaries were inter-watershed in their nature. The published list of adjudicated rights, published by the State, simply tells the name of the ditch. For instance, the Prairie Dog or Supply Company, and puts it under Piney Creek, but gives no indication in that as to where the land is located. That requires then a list of lands in detail which are not in the published list.

There are several other instances of inter-watershed diversions in

Wyoming that I know of and undoubtedly there are many that are arising, because wherever the conditions justify, such diversions are the natural consequence.

The diversion by the Wheatland project out of the Laramie river, known as the Wyoming Development Company's tunnel, is an inter-watershed diversion. Water is taken from the Laramie river by a tunnel into Blue Grass Creek, and going over into the Sybille watershed, which also is a tributary finally of the Laramie. It is a diversion from the main stream across into the shed of tributaries in that case.

The difference between the diversion of the Wyoming Development Company and the diversion between the headwaters of the Laramie and Poudre is one of degree only. The two streams come close together and the diversions would undoubtedly have been made just as freely if the Sybille had not entered the Laramie
1512 river at all. It does enter the Laramie river, but I have no doubt from the knowledge of the mind of the people who developed irrigation enterprise, and the people who farm and need water, that those people would have diverted water just as quickly, and just as freely, and believing that it was perfectly right and proper, as the western person does anyway, whether the Blue Grass had gone into the Sybille and then into the Laramie, or whether it had gone in the other direction. In other words, it is just as natural to take water when available there, as it is for a hungry man to search for food.

Had the Wheatland people not made the inter-watershed diversion by means of a tunnel, they could not have developed the Wheatland area, except to a limited extent. That diversion has rendered the whole Wheatland tract possible from an agricultural standpoint.

The only difference between the diversion at issue in the case now on trial and the diversion of the Wyoming Development Company from the Laramie to the Blue Grass is that of degree, and that the streams come together again quicker in one case than in the other. Had the Wyoming Development Company's tunnel not been constructed, the water of the Laramie river would have gone on into the North Platte.

The diversion by the Wyoming Development Company is recognized in Wyoming. That is the same diversion concerning which Mr. Johnson and other witnesses have heretofore testified. The courts and officials have recognized it, permits have been granted, the Board of Control has adjudicated it, but it is in the gen-
1513 eral list which has been subject to appeal, so that I think the final decree has not been rendered. I am not aware of any objection having been raised to this diversion on account of it being inter-watershed in character. I have never heard any suggested.

There is a diversion under construction in Wyoming, where water is proposed to be taken from the North Platte river and brought over into the Little Laramie river, or a branch of the Little Laramie, by the Laramie Water Company, which system includes the Lake Hattie reservoir and the Pioneer Canal, which has been referred to

in evidence in this case. Water is to be taken from Douglas Creek, a part of the North Platte system and brought into the Little Laramie, or one of its tributaries, and thus taken from the North Plate river and supplies the Laramie river or Little Laramie. It runs from the Little Laramie into Lake Hattie, by means of a supply canal tapping the Little Laramie, which is constructed.

If the waters of Douglas Creek were not intercepted and were allowed to flow as naturally, they would go into the North Platte river and into the Pathfinder reservoir. This is the same ditch concerning which Mr. Bishop, as engineer for the Laramie Water Company, testified. It is the same ditch sometimes known as
1514 Douglas Creek Ditch and testified to by other engineers, who were witnesses for Wyoming and employees of the Laramie Water Company.

It is a fact that one of the complaining parties in this suit is doing the very thing of which they complain. The same fact is true with relation to the Wheatland or Wyoming Development Company's project.

Examination by Mr. Delph E. Carpenter:

1515 Speaking further of the State of Wyoming and its recognition and adoption of the custom of inter-watershed diversion and application, I have found several references and plans of such proposed diversion from one stream to another, where maps have been presented and referred to in the State Engineer's reports.

(Defendants' Exhibit 49 offered in evidence.)

Exhibit 49 is reproductions of sketch maps in the reports of the State Engineer of Wyoming, showing proposed diversions from one stream to another. There are three of them, I think there are two or three different reports. These three sketch maps shown in Exhibit 49 are all from one of the State Engineer's reports of the State of Wyoming, that is from the 7th Biennial Report. The one taken from page 40 represents the Encampment Canal in the Platte river drainage basin, and its proposed route crosses several other tributaries of the Platte river system. From page 39 of the same
1516 7th report is a proposed Basin Canal from the Grey Bull river, and crosses the divide between Grey Bull and the Big Horn, passing over the divide and dropping into the Dry Cottonwood, supplying some of the valley in the vicinity of Basin. There are several other minor canals shown, noting proposed developments that are not inter-stream. On page 44 of the same report is also shown a diversion proposed from the Shoshone river across the divide into the watershed of the Grey Bull, and there are some ditches taking from the Shoshone river to the north, running into the minor watersheds.

There are probably a large number of inter-watershed diversions or inter-stream diversions varying only in quantity and degree, through Wyoming. I have not looked up all those places where conditions are favorable; but where conditions are favorable they are apt to be found.

I understand that one of the issues in the case now on trial, is the right of the defendants to divert water from the Laramie river watershed to the Poudre watershed. I have ascertained that the appropriators of Wyoming divert water from the Poudre river over into the Laramie river. There is a case where water is diverted just in the contrary direction to that proposed by the State of Colorado and the Greeley-Poudre system, where water is diverted from a tributary of the Poudre river by systems in Wyoming, into a tributary of the Laramie, or from the Poudre watershed into the Laramie
1517 watershed.

This diversion takes place in Wyoming under the sanction of the laws and regulations of Wyoming. It is done in accordance with the permit of the State, and by the rights which have been passed on and adjudicated by the official Board of Control.

(Defendants' Exhibit 50 offered in evidence.)

Exhibit 50 is a map prepared by the State Engineer's office of Wyoming of township 12 north, range 73 west, or a portion of that township, the southern boundary of this portion being the state line between Colorado and Wyoming. This is one of a series of maps prepared by the State Engineer's Office of Wyoming, showing ditches and streams from which ditches have been taken in that state for the purpose of record in their office. They have a series of such maps covering most of the State where ditches have been built and rights have been recognized. This, then, that I present, is the official map from their office, except that for clearness in this case, I have marked over the streams and ditches in color to make it more distinct. The streams are designed with red and the ditches with yellow. This was done to make them clearer and as this is a blue print the lines are not very clear.

The Johnson ditch crosses the Divide from Fish Creek, which is a branch of Dale Creek in the Poudre River watershed, and over into the willow Creek drainage area, which is a part of the Laramie
1518 Watershed. The Hill ditch, also apparently crosses the Divide and is not so clearly marked. These diversions are of a minor character, compared with the larger ones of which I have spoken. They are small as to the amount of acreage, but they involve the same principle. The Fish Creek is a small stream running into Colorado but having a good many diversions from it in Wyoming.

(Defendants' Exhibit- 22 to 50 inclusive introduced in evidence.)

I have covered a number of examples of inter-watershed diversions on both Hemispheres; situated in several countries and several states of the United States. As I have before stated, they are illustrations of the fact that when water is needed for agriculture, they are going to, or inclined to divert that water for that purpose whether it be from a stream adjacent or from a greater distance, and by a direct diversion or the intermediate use of reservoirs, but in all cases, the diversion is actuated by the need and the opportunities to use
1519 that water. That the fact of passing a watershed seems in no case to be of any more than a question of physical diffi-

culty. That it is done as freely from one stream or a neighboring stream if the physical conditions permit and justify it. It has been recognized by practice and custom as a proper and necessary thing to do. In each instance the object is to obtain water for irrigation of land, and in some cases for domestic use. Practically all the cases I have given have been for irrigation, at least that has been a very important part of the purpose.

There is no essential difference between the use of open ditches or of tunnels for the purpose of making this interwatershed diversion. They are both means adapted to local conditions and accomplish the same general purpose. The selection of either of these means is merely an engineering problem.

I have already spoken of certain variances of land values from crop production. I will speak further on that in subsequent testimony. I merely mentioned it as incidental to interwatershed diversions at this time.

1520 Cross-examination by Mr. John D. Clark:

Most of the irrigation works in India referred to are public works, those in northern India being Government projects. It is not true that the only sovereignty interested is the Government of India, for there are a number of independent projects there, while the reservoir of the Pereyar project is in the Travancore, which is a state not at all under British jurisdiction. The topography
1521 of northern India in which the Jumna diversion occurs is as follows: The united valleys of the Indus and Ganges may be spoken of as a transverse valley across upper India, the distance from the Arabian Sea to the Bay of Bengal being about sixteen hundred to two thousand miles. The valley then spreads from the Himalayas on the north to the central mass of mountains called the Ghatz, and so the transverse valley extends practically clear across the peninsula. The irrigated area from these sources is limited on the south by the Ghatz Mountains.

1522 On the divide between the Indus and the Ganges the precipitation runs something like from fifteen to twenty inches, I believe, and in both cases they are affected by the monsoons. In the western region as you pass down below the Punjab, at the mouth of the Indus, there is very slight rainfall, five or ten inches. That is below the region which I have mentioned in my testimony here, however, as being under the canals that have been described. Toward the divide this annual precipitation increases to an average of about fifteen to twenty inches on the divide. At or near Delhi, it increases very rapidly up into the Himalaya Mountains. As you pass eastward down the Ganges, the rainfall is increasing constantly even as far as the mouth of the stream where the annual precipitation is in the neighborhood of 75 inches; but that is outside of the provinces of Agra and Oudh where irrigation is practiced to such a great extent, and furthermore this is an annual rainfall and not a distributed rainfall, that is, it does not indicate the distribution for the agricultural season. In the Himalayas, as we ascend, the precipitation

rapidly increases as a whole, the high limits running as high as 75 inches, and then drops off as you pass and even before we get through the Himalayas. That is because of the fact that the prevailing winds strike the mountains and drop most of the moisture on the other side before it reaches the summit. The smallest annual precipitation in the Ganges basin is at the Jumna near Delhi, being 25 inches. The precipitation in the provinces of Agra and Oudh ranges from 25 inches at the river to 60 inches in the mountains, 40 inches being the precipitation near Allahbad and Lucknow.

1523 Part of the irrigation in the Ganges basin is in this territory, and the balance is above where the precipitation is 50 inches or more per annum. The greater part of the precipitation occurs during the south-west monsoon between June and October. The precipitation in the portion of the Indus basin irrigated from the Ganges ranges from 15 to 30 inches, the average being about 20 inches. Some portions of the Rajputana, with a precipitation of 10 inches and less is irrigated from the Ganges, but this is not a British project.

1524 The Western Jumna Canal is intended to divert about 3,000 cubic feet per second. There are discharge measurements of the Jumna ranging from 2128 second feet to 145,000 second feet, but average discharge records are not available. Jackson gives a mean discharge record for the Ganges at Benares of 550,000 second feet. Both the Ganges and Indus are very large

1525 streams. Although I had in mind in reading the several authorities on the matter, complaints arising from these inter-stream diversions, I found no mention of any such complaint. The diversion in which the Indus basin was concerned did interfere with desired utilization of water in the Ganges basin itself, and required the construction of canals diverting water from the Sardah and Hindan rivers within the Ganges basin to furnish a supply to canals from the Ganges which were affected by the upper diversion of that stream into the Indus basin. The Western Jumna Canal is in the Punjab, and the Agra Canal is in Agra and Oudh. I do not know whether the entire territory affected was under a single political control when the Western Jumna Canal was originally commenced in the 12th century.

1526 The diversions shown upon Exhibit 23 relate to different tributaries of the Indus River, and those shown upon Exhibit 24 relate to different tributaries of the Ganges River, and all shown in Exhibit 24 excepting the Western Jumna Canal are in the united provinces of Agra and Oudh.

1528 The Western Jumna Canal has one branch irrigating land within the Ganges basin, and extending to Delhi. The mountain range dividing the lower portion of the Indian Peninsula is quite close to the western coast, and the precipitation between the mountains and the coast is extremely high, ranging from 75 inches to more than 100 inches at the summit of the watershed. There is irrigation practiced at some places on this western slope. I do not know whether there is an abundance of water upon the western slope for the required irrigation or whether the diversion to the eastern

slope by the Periyar interferes in any manner with such irrigation, but the British have agreed to pay to Travancore $20,000 per year in connection with their utilization of the water for the eastern slope. The precipitation upon the eastern slope varies from 25 inches to more than 30 inches.

1529 The Kurnoll shown upon Exhibit 26 is entirely within the Madras presidency, and the two rivers affected reach the ocean in the same political subdivision.

The French canals shown on Exhibit 27 were originally private projects. The Verdon and Marseilles canals are municipal projects. The private canals were constructed by public authority. The recent extension of the Carpentras Canal was built in 1850, and the Alpine Canal a little while before that. They take nearly all the water of the Durance River in low stages, and have been the means of developing an extensive territory north of Marseilles which would otherwise be practically a desert.

1531 The diversions from the Durance have not affected the agricultural development of lands in the valley of the Rhone below its confluence with the Durance, and I do not know whether such diversions have affected the irrigation of lands along the lower part of the Durance. The land to the north of the Durance toward Avignon is cultivated and is extremely valuable, a large part of the water used in that region coming from the Vaucluse and other streams above the Durance. I am not certain whether the agricultural development of the lands to the south of the Durance has been very great. All of these streams and territories affected by these diversions are within the same sovereignty, but I do not know whether that was true when they were constructed.

1532 The Carpentras Canal irrigates some lands within the Durance watershed and all lands irrigated from it are within the French area of the Rhone, of which the Durance is a tributary, and the diversion by the Carpentras has not injuriously affected the irrigation of lands within the Durance basin, and the return waters reach the Rhone River just as certainly as though the canal had been entirely within the Durance watershed, and all of the lands, rivers and canals are within the French jurisdiction.

Examination by Mr. Delph E. Carpenter:

In yesterday's testimony I made one or two errors which I desire to correct. The Alpine canal was built in 1875, and not in 1850. I was unable to answer with regard to the quantity of water taken from the Durance, that is the quantity the Carpentras Canals and the Marseilles Canals were taking out. I think the question was as to whether they did not leave quite a large part of the water of the streams. I have with me the figures covering a number of years. The appropriations for those various canals are 98 cubic meters per second, that is, in low water. That is a little more than 3000 cubic feet of water per second. In 1868, the minimum flow of the Durance was 67 cubic meters. In 1869, 47.7; in 1870, 42.95; in 1871, 55.9; in 1872, 56.8; in 1873, 73; in 1874, 55.3; in 1875,

56.5; in 1876, 61.3; in 1877, 60.2; and so on to 1884, all being less than the sums of their appropriations, except in 1881, which is 119. So that the stream runs down to less than the appropriations. That data is taken from the official publication of the French Government published under the Division of Agricultural Hydraulics,
1535 and those particular facts are given in the Fascicle E.

Cross-examination by Mr. John D. Clark:

1535 The combined proportions of the Carpentras and Marseilles Canals is 98 cubic metres per second or about 3,000 second feet, and this quantity exceeds the amount in the Durance River at low water in each year from 1868 to 1884 excepting in the year 1881. The low water periods tend to occur in the winter months. I have no record of the mean flow of the stream, but it runs very high at flood periods. The Rhone River is more stable and is used for commercial purposes.

1536 Exhibit 29 relates to a diversion of the Drac River, a tributary of the Isere, which is a tributary of the Rhone, and the diversion is into the watershed of the Durance which is likewise a tributary of the Rhone, and all of these diversions occur in the same country.

1537 I cannot state whether there is any irrigation in the valley of the Drac. The entire country in this region is in a high state of development from an agricultural standpoint where the land is suitable. I do not know of any desired development which has been effected by this diversion from the Drac. The canal from the Drac is a private enterprise subsidized by the Government.

1538 The Cavour Canal from the Po River was started by a private company, but was completed by the Government. It serves land entirely within the watershed of the Po, and is considered an example of inter-watershed diversion, because it crosses several subsidiary watersheds of tributaries of the Po. The principal
1539 function of the Cavour Canal is to supplement the supply from other sources of many hundreds of large and small ditches between the canal and the river. The only minor watershed from which the Cavour Canal diverts water is of the Dora
1539 Baltea, which is a better stream than the Po, and has an immense flow from the glaciers and Swiss lakes. All that portion of the watershed of the Dora Baltea which is affected
1540 by the Cavour Canal diversion is irrigated from the Cavour Canal and from the Dora Baltea, and the lands within the watershed of the Dora Baltea are not injured by the Cavour diversion.

1541 The Villa Reisi Canal is a private enterprise constructed under a concession from the Italian Government and diverting water from the Ticino, a tributary of the Po, and carrying the water in an easterly direction across two or three other tributaries of the Po, all of the land irrigated being within the basin of the Po. The lower portion of the valley of the Ticino below the
1542 Villa Reisi Canal is very well irrigated and the canals serving it are prior in point of time to the appropriation of the

Villa Reisi Canal, so far as I know, and no potential agricultural development of the lower valley of the Ticino is interfered with by the construction of the Villa Reisi.

1543 The great value of the lands along the Villa Reisi and Cavour canals is due to their use for raising hay for cattle, which are not pastured upon the land, but are fed with the grass cut with scythes and taken in to the animals. The value of such lands exceeds that of the wheat and corn lands. The land so used can produce grass both winter and summer, and a great many cuttings are had in the course of a year.

1544 The proposed diversion from the Blue Nile in Egypt is into the watershed of the main Nile, to which the Blue Nile is a tributary. The Blue Nile traverses the country which is largely non-irrigable on account of the topographical conditions, but I think a portion at least of the watercourse is across a broad flat. I cannot say whether the proposed diversion, if made, would in any manner affect the potential development of the Valley of the Blue

1545 Nile. The whole project involves country within the jurisdiction of Egypt. The diversion I have described in British Columbia is from the Columbia River into the Kootenay River watershed. Both of these streams enter the State of Washington where the Kootenay flows into the Columbia, which is a large river with sufficient water for all irrigation purposes.

1546 The several projects in the province of Alberta other than that shown in Exhibit 37 are contemplated diversions from one tributary of the Saskatchewan into another tributary of the same river, all within the same province, and the two minor watersheds in each case uniting in Alberta. At least up to this time they have not interfered with irrigation development below the points of diversion.

1547 The project shown upon Exhibit 37 has not been constructed. It is proposed to divert water from the White Mud River, a tributary of the Milk River, which belongs to the Missouri River system, into a tributary of the Saskatchewan. I do not know whether it has been a subject of international agreement, nor whether it is connected with the international agreement relative to the St. Mary's-Milk River project.

1548 This international agreement was required by the United States because the Milk River flows back into Canada, and without the agreement there was no certainty that the water carried into that river from the St. Mary's would be permitted to re-enter the United States. On Canada's part it was not considered that any agreement was necessary.

The project shown on Exhibit 38 has not been constructed, but is contemplated by the central government of Canada, which has jurisdiction over such matters in the province of Alberta wherein

1549 all of the lands and rivers affected lie.

Exhibit No. 39 shows a project diverting water from the Red Deer River into the Rosebud River, both being tributaries of the same stream and both watersheds uniting in the same province where the diversions occur. Some of the system has been constructed

by the Canadian Pacific Railway under authority of the central government which has jurisdiction over the lands.

1550 Irrigation along the Red River is comparatively new and has not progressed to any great extent.

1551 Exhibit 43 shows the Strawberry valley project of the Federal Reclamation Service, which is 69% completed. The diversion is from Strawberry Creek, which belongs to the Colorado River system, and to which the Grand River also belongs.

1553 The diversion carries water into the interior basin of Utah. Strawberry Creek and the other small creeks supplying the reservoir for this project constitute but a small portion of the Grand River system, and the Grand River itself is but one of several large tributaries to the Colorado River. The diversion occurs in Utah where the lands irrigated are also situated, and does not directly affect the State of Colorado, excepting that there has been some intimation that Colorado might be called on to furnish water lower down on the Colorado River, in which event the Strawberry Creek diversion might affect the Colorado interests.

1554 Suggestion that Colorado might be indirectly affected by this diversion first brought to mind by correspondence that I saw some years ago from some minor government employee, in which he spoke of fact that there might be some need of water from Colorado to irrigate land in southern California and in which he intimated that certain rights through government forests in Colorado might be held up on that account. That is the first time such a thing was suggested or considered possible. I do not believe most people of Colorado have been aware of possibility of claim from the lower portion of the Colorado River. It would seem preposterous to them.

The Strawberry Creek enters the Green River above its junction with the Grand River to form the Colorado River, this junction occurring within Utah, where this project has been constructed.

1555 The Colorado River enters a canyon shortly below the junction of the Grand and Green Rivers, and emerges from the canyon on the border between California and Arizona, and the principal irrigation project below that point is in the Imperial Valley, and has been completed for several years, during

1556 which period the lands under it have been under irrigation. In addition to that project there is one undertaken by the Reclamation Service in Arizona on the east side of the river. These two projects do not exhaust the irrigable lands at the lower end of the Colorado River. The diversion through the Strawberry project is a very small part of the total flow of the Colorado River.

1557 Some officers of the Reclamation Service have suggested that diversions from the Grand River in Colorado and on the Green River in Wyoming might be injurious to the Reclamation Service project on the lower Colorado River, and it has been a contention of Colorado officials that the stream flow in the Grand River has been more than ample for any possible use upon the

western slope. While I was State Engineer, the question of the possible effect upon irrigation of the western slope of Colorado of trans-mountain diversions from the Grand River was never presented in such form, although such diversions were in consideration and were considered perfectly proper, the question of conflict being only the same as in the case of any other diversion.

1560 So far as I know it has never been necessary to determine the adequacy of the Grand River for present irrigation purposes. The western slope in Colorado contains little land susceptible of irrigation as compared with the acreage in the watershed. Such of the Grand Valley as is available is now pretty well irrigated, and there are a number of ditches near Grand Junction, and a considerable added acreage can be irrigated. In my opinion there is an ample supply of water for the present irrigation systems in that country, with proper storage and economy. I have no additional data upon which to change the computation of C. W. Beach and P. J. Preston that the annual stream flow of the Grand River at Palisade is 3,378,000 acre feet. This point of measurement is thirty miles above the state line and ten miles above Grand Junction, and is above some of the large canals and also above the mouth of the Gunnison River, which has a large annual flow.

The Government project which I have described diverting the water from the Gunnison River, carries it into the Uncompaghre River, which is a tributary of the Gunnison itself. The diversion occurs in the State of Colorado and the Uncompaghre enters the Gunnison River within the State of Colorado. As state engineer I required the Reclamation Service to file in my office the proper maps for this project and to follow the local laws and regulations.

1561 The diversion from the Dolores River into the Montezuma Valley was made by private enterprise in 1887. Prior to that time the users from the Dolores River had complained of shortage of water, and they thought that the diversion intensified this situation, but I do not know whether the latter is true. The diversion was never objected to by the State of Colorado. The Dolores River is a tributary of the Grand River, and the stream into which the diversion is made is a direct tributary of the Colorado, although the latter stream enters the Colorado near the southern boundary line of Utah, a long distance from the point where the Dolores River enters the Grand River, a few miles inside the eastern boundary of Utah. I do not know whether there is any irrigation from the Dolores River in Utah. The pro-

1562 posed Henrylyn Tunnel diverting water from the western slope to the eastern slope of Colorado is a part of a much larger system upon which a great deal of money has been expended. Some work was done on the tunnel till the Forest Service, which had not approved the application for right-of-way, made objection and the work was stopped. I cannot say definitely whether any objection was made to the Henrylyn Tunnel by any Government bureau on the ground of its effect upon irrigation from the Colo-

rado River, but there has been some kind of indefinite objection.

1563 The diversion from the Grand River into the Poudre, which I have mentioned, is by a ditch of considerable size, being from twelve to fifteen feet wide, and carrying from four to six feet of water in depth. The annual flow through the ditch has been some place around 12,000 acre feet. All of the diversions from the Grand River into the South Platte basin are relatively small, being at high elevation and intercepting a small proportion of the watershed at a point several hundred miles above the point where the Grand River leaves the State of Colorado, and intercepting the water from a few of its tributaries.

1564 Exhibit 44 relates to a Reclamation Service project in Montana, where water is diverted from St. Mary's River in the Hudson Bay drainage into the Milk River within the Missouri River drainage, and the project was 18% completed in May, 1913. The international agreement relating to this project was desired, I believe, by the Reclamation Service to insure the water remaining in the Milk River where the same flows through Canada between the point it receives water from the St. Mary's River and the point it re-enters the United States, and its purpose was not to secure the right to divert the water from St. Mary's into a different basin.

1565 This international agreement was that signed January 11, 1909, and proclaimed May 13, 1910, reading in part as follows: "The St. Mary and Milk rivers and their tributaries in the State of Montana and the provinces of Alberta and Saskatchewan are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the division of such waters during the irrigation season, between the 1st of April and the 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of 500 cubic feet per second of the waters of the Milk River, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of St. Mary's River, or so much of such amount as constitutes three-fourths of its natural flow.

The channel of the Milk River in Canada may be used at the convenience of the United States for the conveyance, while passing through Canadian territory, of waters diverted from the St. Mary River.

The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by properly constituted reclamation officers of the United States and the properly constituted officers of his Majesty under the direction of the International Joint Commission."

1566 Of course the United States had to make some concessions to Canada, whose citizens made some complaint when this project was proposed.

Exhibit 45 shows the plan of the Los Angeles aqueduct, diverting water from the Owens River, which is a tributary of Owens Lake, lying within the interior basin. Both Owens River and Owens Lake are situated in the State of California. I do not know whether the state gave express authority to the City of Los Angeles to construct this aqueduct. The aqueduct was undoubtedly constructed for municipal purposes and would probably never have been built for irrigation purposes on account of the large expense, but I do not know whether the proposed irrigation from this project is merely temporary, under special permit, or whether it is permanent. While this diversion could have no effect on any diversion from the Owens River excepting one between the aqueduct and Owens Lake, I do not believe it is correct to say that the only land affected by the diversion is that lying along Owens River between the point of diversion and the Lake for it would be possible, as was here done, to construct canals from the Owens River around the lake. I do not know whether the city, in order to effect this construction, purchased the privately owned lands along the Owens River, nor do I know whether the land other than a small acreage adjacent to the river is public land embraced within the Federal Forest Reserves; nor do I know whether there is any land in private ownership which can be affected by the aqueduct.

1567 Exhibits 46, 47 and 48 relate to inter-stream diversions between the Tongue and Powder Rivers in Wyoming. I have never been over these diversions personally, and have no acquaintance with the topography of the lands in the watersheds of these two rivers in the State of Montana, nor do I know whether there is any irrigation from either of these rivers within that state. Both streams enter Montana and flow into the Yellowstone River in that state. The principal part of the watershed of the Tongue River is in Montana and the larger part of the watershed of the Powder River is in Wyoming. The diversions from the Powder River into the Tongue River occur about twenty-five miles from the Montana line. The diversions shown upon Exhibit 47 in Township 53, Range 83, in reality consist of three separate ditches carrying water from the Powder River drainage into the Tongue River drainage, and are as old as any ditches in that part of Wyoming, being constructed before 1888, I believe. I am unable to state how much water is carried from one watershed to the other, but the acreage irrigated by these diversions would aggregate nearly 10,000 acres, and it is not my information that any part of this acreage is supplied with water other than that taken across the divide. Piney Creek, from which the diversions are made, is but one of several tributaries of the Powder River in Wyoming, but I am unable to state what proportions the water diverted from that creek into the other watershed bears to the entire flow of Powder River.

1570 The second diversion from Powder River shown upon Exhibit 47, being in Township 54 North, Range 81 West, has been proposed by the Reclamation Service, but its construction is not contemplated at the present time, there being no funds available for Wyoming for a number of years.

1571 From the topographical maps of that country it appears that the Powder River watershed near Buffalo, Wyoming, includes considerable lands susceptible of irrigation, as there are many ditches near there, but below the town of Buffalo for the last thirty miles of the course of the stream through Wyoming, the watershed consists of a series of relatively narrow valleys. I do not understand that the Bad Lands of Montana and Wyoming occupy the drainage area of the Powder River, my information being that they lie east of the Powder River. I am not familiar with the character of the country in the Powder River watershed in Montana as to its availability for irrigation.

1572 It is possible that Montana is as much benefited by the return flow from the diversion from the Powder River watershed into the Tongue River watershed as though the water had been permitted to remain in the former watershed, and if the lands within the watershed of the Powder River in Montana are not suitable for irrigation and the lands within the Tongue River watershed are, I do not know whether the inter-stream diversions would benefit Montana or not.

1573 The other diversions shown upon Exhibit 47 are between the various tributaries of either the Tongue River or the Powder River, and the subsidiary watersheds affected are all united within the State of Wyoming.

1574 The description of the lands shown on Exhibit 48 as being irrigated by diversions from Piney Creek are secured from the records of the Wyoming Board of Control. I cannot state whether some of the water for these lands is not likewise furnished from Prarie Dog Creek, in the watershed of which the lands lie. I know that in some cases where lands have been supplied from several sources, the decrees of the Board of Control attribute such lands to each source, but I did not find any such situation with respect to these lands, although such might be the case in some instances. I made no personal examination to ascertain if in fact these lands were not actually irrigated from Prairie Dog Creek and not Piney Creek. One of the Wyoming State Engineers has stated that before the ditches were built across the divide, Prairie Dog Creek was of little importance and irrigation therefrom uncertain.

1575 The first plat upon Exhibit 49 shows a proposed diversion from Cedar Creek, a tributary of the North Platte River, across the divide into the watershed of Pass Creek, another tributary of the North Platte River. The diversions obviously supply all the lands lying on the north side of Cedar Creek, but also run into the Pass Creek watershed. The streams, watersheds and the ditches are entirely within the State of Wyoming, and the diversions do not affect the North Platte River below the Union Pacific Railroad in Wyoming so far as return flow is concerned.

1576 The second plat upon Exhibit 49 shows a diversion from the watershed of the Grey Bull River, a tributary of the Big Horn River in northern Wyoming, into the watershed of the Big Horn River. The Grey Bull enters the Big Horn within the State

of Wyoming, and below the junction the Big Horn watershed is not affected by the upper diversion.

1577 I have no personal acquaintance with the diversion from Fish Creek, a tributary of the Poudre, into Willow Creek, a tributary of the Laramie, shown on Exhibit 50, but I suppose it has been made or the rights would not have been decreed. Fish Creek is one of several tributaries of Dale Creek, which is one of the tributaries of the Poudre River, and it has no large drainage area, but there are a number of decrees from it in Wyoming. It is actually as well as theoretically a tributary of Dale Creek. The ditch shown upon this plat has an appropriation for 44 acres, and the statutory limit upon the appropriation is one second foot for each 70 acres. I think some of the land irrigated from this ditch is on the Fish Creek side of the divide and some on the Willow Creek side. The second ditch shown on this plat has an appropriation for 26 acres and irrigates land on both sides of the divide. The Hill ditch, also shown on this plat, has an appropriation for 459 acres, and I think some of this land is on the north side of the divide.

1578 I do not know whether investigations were made to ascertain whether the proposed Hetch-Hetchy diversion in California would interfere with the subsequent development of lands within the watershed, although I have known that there was a very strong objection made to the project. I would consider any

1579 report upon this project prepared by John R. Freeman to be authentic, and I assume that his statement of facts is correct in his report to the mayor of San Francisco upon this project wherein he says, pages 82, 83: "In order to satisfy any doubts as to the quantity that the irrigation districts might be able to put to beneficial use under a more intensified agricultural development, or by an increase in the carrying capacity of their canals, or by extending their respective areas to the broadest possible limits, a very painstaking investigation already mentioned, has been carried on during the past year. These investigations make it plain that the districts now comprise substantially all of the arable land lying between the shores of the Stanilaus river on the north and the Merced river on the south, the rough hill country on the east and the swamp lands of the San Joaquin river on the west, and that they thus contain broad areas that naturally should have looked to the Stanislaus and Merced rivers for their irrigation supply, and that there is no important area of irrigable land remaining which would naturally look to the Tuo-

1580 lumne river." As to his conclusions, however, I would not be able to accept them without knowing more about the situation.

I do not know whether the diversions from the Ganges river in India into the watershed of the Indus have prevented the irrigation of any lands which might properly be irrigated from the Ganges or its tributaries, but it is evident that the diversion from the Jumna River would shorten the supply for some of the lower canals. I doubt if the available water supply is greater than the requirements of the large areas running into millions of acres which could be irrigated from the Ganges. I question the statement of the Indian Irrigation

Commission of 1901 as reported in the Encyclopedia Britan-
1581 nica that the irrigation works then proposed would exhaust the irrigable land in India. Such investigations have regard to the projects under consideration at the time, and a project which might not be feasible at one time may become feasible at a later date when conditions have changed and values increased. It is true that many land owners objected to the construction of the Sardah canal to irrigate lands in Oudh on account of the considerable rainfall, and the doubt as to whether the irrigation would not waterlog the land, but I think the canal has actually been surveyed by the Indian Government.

1582 I do not believe that the Sardah project has been indefinitely postponed on account of these considerations. I presume that the statement in the Encyclopedia Britannica relative to the Periyar project that "the rainfall on the west very much exceeds that on the east, and the Periyar used to find its way by a short torrent course to the sea, rendering no service to mankind," is so, but there has been a large reservoir built in Travancore on the west slope near the mouth of the Periyar.

1584 I do not believe the statement in the same encyclopedia that the Western Jumna Canal was originally constructed for the purpose of irrigating lands towards Delhi, which is within the same watershed, is correct, as I understand that its primary purpose war for irrigating lands near Hissen, and that the Delhi branch was built afterwards.

I have no definite information about the projects mentioned in Spain, but they all affect watersheds, canals and ditches within that country, and I have no knowledge as to the effect of such diversions upon subsequent irrigation development.

1585 Redirect examination by Mr. Delph E. Carpenter:

When I spoke yesterday of annual precipitations in portions of India, and particularly mentioned the precipitations of large quantities, I did not mean that those precipitations were continuous during all of those months. The precipitation is like it is elsewhere, that there is in India a rainy season and the year as a whole is divided into two seasons, the period of the southwest and the northeast monsoon, the southwest monsoon occurring during the summer months, is the rainy season, the wind then comes from the Indian Ocean and as it strikes the Chats or Himalayas it precipitates rain in very great quantities so that they have these railfalls
1586 of 75 to 100 inches, and I think there is one recorded place that is used as an example of extreme rainfall of as much as 600 inches in the Himalayas, but of course, that is not continuous.

This is what produces the immense run-off of the rivers. For the next six months of the year the wind comes from the northeast, from the interior of Asia, comes over the high Himalayas, and is practically stripped of its water and thus there is the dry season, from October to April, but this dry season is the winter season, as

this country is all below the Tropic of Cancer, it is hot anyway. But the effect is shown in irrigation, that the winter crops are irrigated to a much greater extent than the summer crops. The Kharf crops, the winter crops, I think had about twice as much irrigation for those as the Rabi crops, which are the summer crops, or grown during the period of this southwest monsoon.

Irrigation does not cease in India during the time of a famine, that is when it is increased, if anything, because the shortage of rain or water is the cause of famine. It is generally because of the delay or shortage of rains from the monsoon, the fact that the monsoon does not start in as early as they expect and consequently the precipitation is less. The food production is of course lessened, and as the population is very great, all the time near the verge of the available food supply, it then has very disastrous results.

1587 The large volumes of water flowing in these rivers is eventually indicative of the available water for irrigation. The matter depends upon the expense and upon the available money for construction, and of course whether the returns will justify the expense.

The total heavy precipitation in India does not indicate that they do not need irrigation. The distribution of rainfall may of course have a very decided influence upon the necessities. But right parallel with that great rainfall there is irrigation in every season on an enormous scale. It simply is increased in the case of a dry year or a delayed monsoon. The acreage that takes water from the Government canals is increased perhaps in the neighborhood of one-half. On the other hand, the people to whom a penny may mean a great deal, the expense of irrigation is not to be incurred unless they think it is justified by returns. It requires both irrigation and rainfall to produce a food supply for the country.

The evaporation is bound to be heavy. In the Indus, the rainfall is very much less than on the Ganges side, so that the conditions are intensified, so that the effects of that have been in times past, in the case of the Indus, the population is much less dense with irrigation, than it is on the Ganges without irrigation. For instance, in the State of Rajputana there are quite large areas that have been

1588 almost devoid of people, notwithstanding the pressure. That is due not entirely to the scanty rainfall, but partly to the local conditions of soil, because there are other places without any greater rainfall that really have quite a large population.

I think all of the inter-watershed ditches crossing between those two watersheds, come from the Ganges watershed.

Hay lands of the river Po of Italy are utterly different from the hay lands of the Laramie Valley in Wyoming. They are hard to compare and are more to be contrasted. The Po Valley is very fertile ground, is at a low elevation and of a moderate climate. The Laramie Valley is not a very rich soil, it is at a very high elevation and has a climate that is practically Arctic in character, or semi-Arctic. The crops that are raised in the Po valley are therefore almost any crops that could be raised at a latitude of practically 40°, and in fact it has a very much milder climate than prevails in this

country at that same latitude. The valley of the Po has always been recognized as one of the richest valleys in the world, of high civilization and a very dense population, so that it has been the envy and has aroused the cupidity of many of the northern nations that came across the Alps. It has been a constant battle-ground by invaders from the north and has been a constant attraction. The dense population is largely because of its growth of hay and grass. The pressure of population makes it so that they cannot afford to let the land lie idle. It is subject to their constant study to keep it
1589 busy and one of the crops which they can grow and keep the ground busy for twelve months in the year, is hay. With them human labor is much cheaper than land. They do not need to economize in labor.

By hay I mean the dry part of grass, but in the Po Valley they use it almost entirely in its green form without waiting for it to become hay, and this is because that same pressure makes it desirable that they cut the grass a number of times. They get frequent cuttings during the year. They obtain their winter crop by winter irrigation, so that they get from two to three cuttings of hay during the winter and, during the summer months, from April to September or October, they get at least one cutting a month. They take this grass to their cattle which they keep in their farm yards so they will not trample the grass, or, in other words, they have a practice of soiling. They raise largely dairy cattle so that these conditions are rather in contrast to the conditions we find in the Laramie Valley, rather than of direct comparison. They are almost different in type and that means, then, that the population runs up in the neighborhood of three to four hundred per square mile over the Valley of the Po.

No hay is produced in the Laramie Valley in the winter
1590 time. During the summer months they get one cutting. The production of grass consumed for hay in the Laramie Valley amounts to only one cutting a year. In the Po Valley it amounts to many cuttings.

1591 Examination by Mr. Delph E. Carpenter:

I think some of the projects in India have had the depletion of the flow of one stream to the detriment of possible future development for the benefit of lands on another watershed, as a possible consequence. At least this has been discussed or mentioned in some cases. I have given only an incidental examination to that subject, but in the comments that have been made from time to time, they have apparently simply considered that irrigation when necessary would be carried on, and that if there was any question of conflict of interests, that the early construction was apt to have the priority, and in fact there have been some instances in which the Government has proposed to undertake enterprises that eventually might take water away from tracts that have had it for a long time, where it would do more good in another place. That has been suggested in reference to one of those western Jumna propositions and between the Punjab and United Provinces, where it was considered that there

might be a greater need and a greater benefit to take it across
1592 the line from those streams.

It seems to have been seriously considered as the proper thing to withdraw the water entirely from certain portions of the Ganges Irrigation drainage, through the Rabi season and to utilize that water upon the dryer tracts where irrigation was more constant and urgently required, even though by so dong, they would work great injury to the lands of the Ganges drainage area. I am not acquainted with the extent of the conflict. A. Mr. Wilson made a report on that subject, but I have never had an opportunity to go through it in detail. The theory of the greatest good to the greatest number seems to have prevailed there.

The principle of diversion seems to be understood so thoroughly, that in any ordinary case, except where it interferes, or where it might interfere with irrigation where it had been practiced for some time, they do not give any consideration to it, at least I have found no mention of it.

The preservation of waters in their natural watershed for a period of years ranging from a few years to a thousand years or more for the purpose of future development has never seemed to
1593 enter into the calculation. I have seen no case where they seem to have given that any particular weight except *as* in the consideration as to where the greatest benefit might be.

Speaking further concerning the rainfall in the Ganges drainage area, I have a rainfall map of the upper part of the Ganges Basin that is more in detail than we had yesterday. The general statements made yesterday are correct, but they perhaps should be extended a little further for completeness and explanation beyond what I have given. This rainfall map in detail of the United Provinces, indicates a larger area that is below 20 inches of rainfall than I in my remarks may have employed, and more than that, there are quite a good many places where the rainfall drops down to less than 15 inches, or as low as 15 inches, and some as low as 7 inches or less, as for instance in the vicinity of Agra. This refers to the annual precipitation. This precipitation nearly all occurs in the course of those three or four months of the spring or early summer. The diagram of monthly distribution of rainfall that I have from the Indian report is simply for the one year 1896-7; but is, notwithstanding, a pretty typical year. In that case the greatest part of the rainfall in that year under the Agra Canal came in July. There was ¼ inch in May, 1.6 in June, 9½ inches in July, nearly all of that coming in three days, and 2.68 inches in August, that was during the period of monsoon. For the rest of the year we have as illustrating the character of their rainfall,
1594 September was practically nothing, .08; October .01; November ½ inch; December ½ inch; January .05; February nothing, March .03, and April .02. This illustrates the general character of the distribution of their rainfall through the year. A great portion of the region under the Ganges, or south of the Ganges river, has less than 20 inches annual rainfall. This region is irrigated by the Ganges canals. The major portion of the remaining Ganges

drainage area, shown on this map, which is confined to the United Provinces, has 20 to 25 inches annual precipitation. The lower part of the Ganges Valley I have not discussed, that is just the upper end of it. That includes a considerable portion of the area irrigated by what are called Ganges Canals and the ones especially discussed. There is irrigation further down the valley in larger quantities in the Province of Bengal, evidently that is in a region where the rainfall is heavier. The inference is that the diversion of the Western Jumma Canal naturally interferes with the irrigation in the upper portion of the Ganges area. This inference is drawn from the fact that they have considered means of bringing in additional supply. So far as their reports are concerned, it would appear that the consideration of that came in as a secondary matter, that is, supplementary canals were considered and take up after the diversions had been made. They met the conditions as they found them. Those
1595 supplementary canals are for the purpose of supplying existing conditions. Some of the regions found they could use more water, or the Government thought they could increase the production by bringing in additional supply and support a larger population, or a larger per cent of population than they already had.

Speaking of the Los Angeles aqueduct in California and the recognition of existing rights on the Owens river, I think that the decisions, at least many of them, have maintained the riparian right doctrine. The practice has not always been in accord, because it is a case where the legal doctrines are contrary to the natural development and progress of the country.

The diversion of water from the head of Fish Creek, a tributary of the Cache la Poudre where the Wyoming people are taking water over into the Laramie river drainage area in small quantities, I will state that even that small diversion is an injury to the Poudre Valley. All the water in the Poudre river, especially on Fish Creek, Dale Creek, and the North Poudre is needed, and has been used substantially for years. It is particularly needed during the summer season. Sometimes there has been a scarcity of water on that stream in Colorado, in canals that have been built for many
1596 years. This diversion might, to some extent, interfere with the future development of the Poudre Valley but more with regard to existing things there. It might work an injury to both existing and future development. The difference between this diversion and a larger diversion is entirely a question of degree. This Fish Creek diversion simply illustrates that natural tendency to obtain water where land is situated, so that it can be used and to derive the water from any adjacent or available source.

1596 Recross-examination by Mr. John D. Clark:

The proposals to which I have referred which have been made to divert water from portions of India where it has been utilized into portions which have a greater need for it and which involve a consideration of relative benefits, have been made by the Irrigation Commission of India, which in this connection has considered the

possibility of procuring water principally through other sources for the lands already served, and the reduction of the amount of water to be given to these lands.

1597 This commission was appointed by the Indian Government and was a commission of inquiry without authority to perform any work. Its recommendations were made, I believe, to the Governor-General of India. I do not know whether the Governor-General would have authority to undertake such a project, but I rather doubt if he has, nor do I know whether such a project could be executed by any central authority, or would require a co-operation of two independent authorities. I believe in some cases some such works have been local and have been undertaken by local authorities. The Jumna diversion was into what was originally an independent state, although now under the control of the General Indian Government, but I do not know whether the Emperor Feroz, when he undertook this project, had jurisdiction over the whole territory or not.

The map to which I last referred in my re-direct examination, showing the rainfall in the Northwest Province and Oudh, is for the single year of 1896-7. It covers a large part of the irrigated area of those two provinces, an area about six hundred miles long and two hundred miles wide, lying in the upper portion of the Ganges valley, and running over into the watershed of the Indus River.

1599 The diversion by the Laramie Water Company from Douglas Creek, a tributary of the North Platte River in Wyoming, is into the Little Laramie River, a tributary of the Laramie River, which is also a tributary of the North Platte River in Wyoming. The first irrigation from the North Platte River below the diversion, which is controlled by an independent authority, is that of the Reclamation Service, which diverts water from the North Platte River in Wyoming below the mouth of the Laramie

1600 River, although the dam in which the water for this Reclamation Service project is stored is a long way above the mouth of the Laramie River. Such return flow as may arise from the use of the waters of Douglas Creek when so diverted will be returned to the North Platte River above the diversion works of the Government by a shorter route than if the water had remained in the original watershed, if such waters return at all. I make this qualification because the proposed use of this water is in meadow irrigation upon the Laramie Plains, which involves a very great loss. This loss is largely due, however, to the method of use, and not to the place of use.

Redirect examination by Mr. Delph E. Carpenter:

1601 The place of use may very materially affect or control in the *case* of the Douglas diversion, because of the peculiar topographical conditions of the area to be irrigated. Water turned into the drainage area of Big Basin or the basin of Big Hollow, would not return to the North Platte river, and there are those and

similar basins that take a great deal of the waste water. They are largely blind basins and of course, that is lost by evaporation, unless there be seepage, which is not very clear. No matter where the return may go, a diversion is contemplated and is in process of completion.

As a matter of fact, water diverted from the Laramie river for consumption through the Greeley-Poudre tunnel, will probably reach the forks of the Platte by a shorter and more direct route than it would to go round by the North Platte. That diversion takes place in Colorado and the application of the water is in that state.

By Mr. Fred Farrar:

A map is attached to the answer of the defendants, the Laramie-Poudre Reservoirs and Irrigation Company, and the Greeley-Poudre Irrigation District, which we refer to in the Answer as Exhibit 1. In the evidence heretofore taken in this matter, on one or two occasions I believe this map was referred to as Defendants' Exhibit A. Defendants have, because of this mistake, had another marked Exhibit 1, but not introduced, and I desire to make this explanation to avoid any confusion between the two exhibits.

1602 JOHN R. WORTHAM, Greeley, Colorado.

Direct examination by Mr. Charles F. Tew:

I am thirty-two years old and live at Greeley, Colorado. Have resided there since the fall of 1907. Am a civil engineer, a graduate of Purdue University of Lafayette, Ind., in the year 1905. Received my previous education at Galveston, Texas. I had previous experience in surveying and engineering before entering Purdue University. I was employed by the Gulf, Colorado & Santa Fe Railroad Company about Feb. 1897, until the Spring of 1898, in the
1603 office of the Chief engineer of that Railroad. Subsequently I was out with an engineering party on location and construction work from 1898 to July, 1901. I first started as a back flagman on location surveys and afterwards as chain man and rod man on construction works. After that again, was rodman and levelman on location, and topographic and instrument man on maintenance of way works for the Santa Fe, and I became pretty well familiar with railroad work at that time in the use of engineering instruments. I left the High School and entered this work as a matter of necessity. In July, 1901, I severed my connection with the railroad to prepare myself for entrance examination in the University. During the time I was working for the railroad company, had taken up a course of railroad engineering with the International Correspondence School of Scranton, Pa. I had practical experience in engineering before entering Purdue University. I passed the entrance examination to the University and entered in September, 1901. Attended the school of engineering four years, graduated in 1905. I am an Associate Member of the American Society of Civil Engineers. In 1904, in addition to my work at the University, I worked

for Mr. George Weasche, the professor of Hydraulic Engineering in Purdue University, on the measurements of the Tippecanoe and Wabash rivers. He was obtaining data for the probable establishment of a power plant near Lafayette, Ind. I did this work for compensation to help me in supporting myself at the University. I was engaged in this work from September, 1903, to the spring of
1904, at different times. From this work I gained a knowl-
1605 edge of stream measurements. I became familiar with the use of current meters and flow of streams.

Immediately after graduation from Purdue University, was employed by the Pennsylvania, New York & Long Island Railroad Company, on construction of tunnels, under East River, at New York City. Subsequently was employed by Union Pacific Railroad Company as Assistant Engineer on double track construction in the State of Wyoming and on the completion of that part of the double track work I was given charge of construction of bridges and buildings on the Colorado Division of the Union Pacific Railroad Company under the direct supervision of the resident engineer. I left the employ of the Union Pacific R. R. Co. in the early fall of 1907 and located at Greeley for the purpose of engineering work.
I established an office in engineering at Greeley and still
1606 have that office. I am the engineer for the defendant, the Greeley-Poudre Irrigation District. I practiced at Greeley from the fall of 1907 till June 1909 before becoming engineer for the district. Was engaged in general engineering, measuring ditches, making surveys of various irrigation propositions, preparing maps for filing with the State Engineer, etc., and the general engineering business that would be practiced in an irrigated country.

Became acquainted with the Greeley-Poudre Irrigation District immediately after my arrival in Greeley, but had no connection with the project until June, 1909. I became chief engineer for the district and have held that position since. At the time of employment by the district, made an inspection of the work proposed and also of work done, acting in an advisory capacity at the voting of contract of September 8, 1909. I made trips of inspection in all of 1909 until September, with various parties. I held several conferences with Mr. Charles R. Hedke, the Chief Engineer of the Laramie-Poudre Reservoirs & Irrigation Company as to what was proposed; the plans that he had drawn for the system of works, etc. Made inspection trips with Hedke over the water supply on Laramie River, over lines of ditches and reservoirs and became thoroughly familiar with conditions and with what the District was going to receive.

1608 Made several trips over district with Board of Directors and attorney. Investigated all of the various reservoirs of the Greeley-Poudre District. In August, 1909, made inspection trip on Laramie river with directors of District, Chief Engineer of Laramie-Poudre Company and others, taking several days.

1609 Viewed the tunnel site at that time. The site then inspected is the location of the present tunnel. Also inspected the site of the dam to be constructed for regulating the flow of waters

into the Laramie River tunnel by means of reservoir. Was shown the lines of the east side and west side collection ditches, taking water from Rawah and other creeks back to the tunnel. The present ditches are along these lines.

1610 Inspected Boyd Lake to ascertain whether or not it was feasible to obtain water by exchange from that source. Was present through the negotiations between the District and the Company, leading up to the drafting of the final contract in September, 1909, between the District and the Construction Company.

The system of Works of the district was to be completed for $5,000,000 in bonds. 125,000 acres of land are to be served by

1612 the district works. Contracts for completed system of works ratified October 1909, by vote of the electorate of the District. Prior to this time made surveys for laterals from main canals of District for service of lands. Had party of men in field with me. Preceding October, 1909, had familiarized myself with all parts of system from the Laramie river to the lands.

1613 Out purchase price of $5,000,000, $500,000 was set aside to retire indebtedness incurred by previous owners of the Irrigation District prior to the Laramie-Poudre Reservoirs and Irrigation Company. $3,500,000 of bonds was placed in escrow for delivery for completion of system. Work of completion to be done in stages and paid for monthly upon estimates.

1614 I was engaged in taking of estimates and inspection during all of construction.

1615 Before 1909, a large amount of work had been done from eastern terminus of Poudre Valley Canal, which was then constructed, along line of now constructed portions of canal. Am thoroughly familiar with all of the work of the District from the headwaters of the Rawah and McIntyre Creeks and other tributaries of the Laramie river and throughout the distribution works of the system. Have been on the summit of the Medicine Bow range at the headwaters of the streams supplying the district.

1616 The Sky Line canal of The Water Supply and Storage Co., takes its water from the West Fork of the Laramie river, and discharges water into Chambers Lake at a point at the extreme southern edge of what is called the Green Mountains. The headgate is in the Laramie watershed and the discharge at Chambers Lake is in the Cache la Poudre watershed. I have been over the Sky Line Ditch. I have been across the Green Mountains from the west portal to the east portal of the Greeley-Poudre tunnel a number of times. This is a chain of mountains beginning at Chambers Lake and running northerly and northeasterly and finally called Boulder Ridge, Sherman Mountain, and Black Hills.

1617 Am familiar with this ridge of mountains. The Wilson Supply Ditch takes water from Deadman Creek and carries it over the divide into Sheep Creek, which is a tributary of the Cache la Poudre watershed. These canals constitute an inter-watershed diversion and belong to the Divide Canal and Reservoir Company. It is a constructed and operating ditch. I have observed the Sky Line Ditch while in operation. Headgate of Wilson Supply Ditch is in

drainage area of Laramie river. It takes its water from Deadman's Creek, carries the water into Sand Creek, then along that creek to th ditch known as the Divide Canal, where it is carried over the divide between the Laramie and the Poudre rivers and discharged into Sheep Creek, a tributary of the North Fork of the Cache la Poudre, which discharges into the main stream in the cañon
1618 above the headgate of the Poudre Valley Ditch.

I have made surveys of the lakes at the headwaters of Rawah, McIntyre and other tributaries of the Laramie river, commonly known as Link Lakes, and spent some weeks on that portion of the work. I camped in the immediate vicinity of these lakes. It is a country very difficult of access. Went in there with teams, going over a road previously constructed by Messrs. Link and Akin. The going was very difficult. Surveying and construction operations in that region are limited to a short period during the summer season. The season is very short near the Link Lakes and it is impossible to haul supplies in there during any but the summer months, the latter part of June, July, August and possibly the first half of September. After that the snows come in very heavy and it is impossible to get supplies in there in order to carry on construction work. These lakes lie just on the eastern slope of the Medicine Bow Range. The upper lakes are about half a mile from the crest of the range. They lie in the region of perpetual snow. The Link and Akin road is necessary in order to get supplies into that region unless they are packed in there on the backs of animals.

1620 Supplies have to be hauled from the railroad points on wagons, principally from Fort Collins or Laramie, Wyoming. These lakes are about 80 miles from either of these towns by wagon road. The road from the Laramie river up to the Link Lakes is very mountainous.

I have been over the Greeley-Poudre works in Laramie valley during the years 1910, 1911, 1912 and 1913, very many times, although have not been up to the headwaters of the McIntyre and Rawah Creeks as much as I have been over the works in the valley proper, many times in company with the engineer Hedke or his assistant engineer, Coy. Visits occupied period of from two to three days to a week or ten days and sometimes longer. Visits sometimes oftener than once a month. Since active work ceased, have been in the Laramie Valley an average of five or six times a year.

I made a survey of the entire Laramie Valley from the Greeley-Poudre tunnel northward to the state line. The snowfall on the Medicine Bow range is approximately the same through the line of the watershed, heavier in places than in others, the timber having something to do with the holding of the snow and keeping it from blowing away.

1622 The southern extreme of the watershed has elevation of about 13000 feet. There is a peak called Clark's Peak, which has an elevation of some two or three hundred feet in excess of 13000 feet, but the average elevation in Colorado at that point is about 11000 to 12000 feet. Going northward the range and watershed drop somewhat. At places it is 9000 to 10000 feet. At headwaters of

the Little Laramie river you get an elevation of something like 11000 feet. Have been at the point where the Greeley-Poudre tunnel pierces the Green Mountain Range, many times. Have been on the crest of that range several times. Have been at place about eight miles north from tunnel where the Wilson Supply
1623 Ditch crosses this range. From tunnel location northward the Green Mountains widen and spread out. There is no location north of Greeley-Poudre tunnel where a similar tunnel could be constructed. From Chambers Lake down to the Greeley-Poudre tunnel the Green Mountains are comparatively narrow and the Cache la Poudre river flows nearly parallel to the Laramie river. From the tunnel site the Cache la Poudre turns and runs nearly due east, while the Laramie river flows north and a little west to
1624 the Colorado state line. From the point opposite the tunnel on Green Mountain, the Laramie river leaves the top of the divide going northward and the Cache la Poudre very materially increases the distance from that river to the top of the range. The range broadens out at the base.

There is no point northward of the present Greeley Poudre tunnel at which a tunnel can be feasibly constructed to divert water from the Laramie river to the Poudre watershed.

I was on Laramie river in 1910, 1911, 1912 and 1913. The Greeley-Poudre district and the Laramie-Poudre Reservoirs & Irrigation Company have maintained an engineering camp during all of those years on that river. This camp is a good, comfortable five-room house, several tents and equipment.

1625 I have made personal examination of the Cache la Poudre river from Chambers Lake to the point of discharge into the South Platte river below Greeley, Colorado. I personally made one survey of the Elkhorn Reservoir site. In October, 1909, assisted in making certain surveys on the Cache la Poudre side of the Tunnel.

1626 I have made personal inspection of the several sites upon which reservoirs were to be constructed on the Cache la Poudre river for the district. I examined the location and surveys of two of the dams and reservoir basins and personally made a survey of the third. I completed the surveys of the Elk Horn reservoir site in June and July, 1913. This reservoir had previously been surveyed by Mr. McFadden, of Denver, who had also surveyed the other reservoirs in the river. I made examination of the foundation of the dam and the bedrock across the stream at the dam site. I
1627 calculated the storage capacity of the Elk Horn reservoir to be 1,500,000,000 cubic feet, or 34,500 acre feet.

1628 I have surveys of the Poudre Valley ditch from the headgate of the Cache la Poudre river to its terminus, also of all extensions of that canal.

I designed the plans and superintended the actual construction of the concrete lining installed in the Greeley-Poudre tunnel. I designed the plans about December 1, 1911, and the work was completed May 1, 1912. I resided at the east portal of the tunnel during construction.

1629 I am familiar with the character of the channel and the course of the Cache la Poudre river from the east portal of the Greeley-Poudre tunnel to the head of the Poudre Valley Canal. This canal constitutes the principal diversion canal of the Greeley-Poudre Irrigation District. The District has sources of supply of water from the Cache la Poudre river.

The Mitchell Lakes constitute a group of reservoirs situated on tributaries of the North Fork of the Cache la Poudre river used for reservoirs by the district. I have been in charge of and operated these lakes and the ditches from them. We have used the water of the lakes for irrigation of land in the Cache la Poudre Valley and they were used prior to the time that they were obtained by the district. They obtain all of their water from the tributaries of the Cache la Poudre.

1630 I personally designed a number of improvements for the Poudre Valley Ditch; headgate enlargement, lining of canal with concrete for over a mile and other improvements. Have made surveys of Cobb Lake and the outlet canal for the same. Made detailed surveys of Lake McGrew. Also of the March reservoir, the Dover Reservoir, the Briggsdale Lateral, the Camfield Reservoir, the Nunn Lateral, the Pierce Lateral, Middle Lateral. These surveys of mine were all subsequent to many previous surveys that had been made by other engineers before I became associated with the system.

I have made careful and detailed surveys of the irrigable land in the Greeley-Poudre Irrigation District, re-checking a previous survey made by Charles R. Hedke. There are 160,000 acres of land, good and bad, within the boundaries of the District. There are about 125,000 acres of this land which are irrigable from the works of the District. This acreage includes that held in fee simple title by government entrymen and others holdings.

The Greeley-Poudre canal, sometimes called the Laramie-Poudre canal, marks the upper boundary of the district. The lands lie south and east of that line of canal and their general slope is in that direction. The district lands extend southward to the present northerly boundaries of the irrigated area of the Cache la Poudre Valley.

1634 The Greeley-Poudre Irrigation District is practically an addition to the already developed areas of the Cache la Poudre Valley. The general fall of the lands in the Greeley Poudre Irrigation District averages from twenty to twenty-five feet to the mile. It is about the same as the fall of the irrigated country in the valley. The lands of the District are now in a dry arid state. Large areas of this land have been broken and planted to crops and have wholly failed for lack of water. The land and soil of the District compares very favorably with that of the irrigated areas of the south. There is no line of demarcation between the area of the district and the older irrigated area to the south. Generally speaking, the soil is

1635 comparatively uniform throughout the district.

I prepared the map attached to and forming a part of the answer of defendants, the Laramie-Poudre Reservoirs and Irrigation Company and the Greeley-Poudre Irrigation District in this case. The work covered eighteen months. I commenced in June, 1911,

and completed the map in January, 1913. I refer to defendants' Exhibit 1. It has sometimes been alluded to as defendants' Exhibit A. The main object of the map was to show with the greatest degree of accuracy, the Laramie river and its watershed from the headwaters to the point of discharge into the North Fork of the
1636 Platte river near Fort Laramie, Wyoming, and the Cache la Poudre river from its headwaters to its point of discharge into the South Fork of the Platte River below Greeley, Colorado. The crest of the Divide between the Cache la Poudre and Laramie drainages is indicated by a line which also defines the boundaries and watersheds of these two forks of the main Platte river. In the preparation of the map I have endeavored to show this line of demarcation. I have indicated the location of the works of the defendant district. Also the portion of the Laramie river watershed intercepted by the works of the District. I also indicated other ditches which are taking water from the Laramie river in the State of Colorado. The Sky Line Ditch taps the west fork of the Laramie river and carries the water in a southerly direction into Chambers Lake over the divide between the Cach la Poudre and the Laramie rivers. From Chambers Lake this water flows down the Cache la Poudre and then to the irrigated section of the valley. The Wilson Supply Ditch and the Divide Canal taking water from tributaries of the Laramie river over into the North Fork of the Poudre are also shown.

The tunnel which diverts water from the Laramie river and conveys it into Blue Grass Creek in Wyoming, by means of which the Wheatland tract is irrigated is shown on the map.

The work of preparing this map did not take my time continuously for eighteen months, but probably six months of that time was actually consumed. I obtained data from every available credible source. I used the Quadrangle Sheet of the United States Geological Survey wherever possible, and information contained on them was accepted as correct. These sheets included the Greeley, Eaton, Loveland, Livermore, Quadrangles in Colorado, and the Laramie, Sherman, Medicine Bow, Goshen Hole, Hartville and Patrick quadrangles in Wyoming; also the sheets issued by the United States Reclamation Service of the North Platte Project in the states of Wyoming and Nebraska. Where quadrangle sheets were not available I gathered all the maps and data that I could find that would in any way pertain to the territory in question. I obtained data from the Surveyor General's office in Cheyenne, Wyoming, and in Denver, Colo., from the offices of the State Engineers of Colorado and Wyoming, from the records of the county clerks and recorders of Weld and Larimer counties in Colorado. I also consulted maps of the
1639 Wheatland Industrial Company of Wyoming, the Goldsborough Engineering Company who had to do with the Laramie Plains system; the Talmadge-Buntin people of Chicago, and maps published by different publishers from surveys and data otherwise obtained. Data was gathered in Wyoming under my direction by Mr. B. C. Bellamy, of Laramie, Wyoming, an engineer. I was also assisted by Mr. C. C. Washington from actual surveys of the Wheatland area, from surveys by Mr. Charles R. Hedke, Engineer,

Mr. Zac T. Duvall, Engineer, and Mr. C. E. Black of Laramie, also Mr. Burgess Coy and numerous and divers other engineers. The location of the Union Pacific Railroad was obtained from data received from the office of the engineer at Omaha. The map, Exhibit 1, is made on a large scale owing to the scope of the territory embraced. It is a print obtained from a tracing, which in turn was made after all data had been traced and noted in lead pencil on drawing paper. Each location and set of figures was thoroughly checked.

1640 I also made personal inspection of most of the places to verify the correctness of the map. In preparing the tracing I had the prints made and thereafter colored the maps by hand. I spent two or three weeks in the office of the State Engineer at Cheyenne, Wyoming, and made copies of township plats that are on file at that office showing the ditches and the sources from which these ditches receive water supply. These copies cover the entire Laramie river drainage in the State of Wyoming. They are official maps. They are taken from the actual filing maps made by the different engineers who had surveyed and located the different ditches.

1641 I understand that the maps were made from plane table surveys. I checked their work against the topographic sheets and found them to be accurate in the main.

The Wheatland, Wyoming, territory was checked in person by Mr. C. C. Washington. I received a plat from Mr. Bellamy of Laramie, whom I employed to do some work. I also made personal inspection trips over a great deal of territory.

1642 The greater portion of the territory on the map is covered by the government quadrangle sheets. That not covered by the sheets embraces that portion from about range 72 west to the west border line of the map, extending north and south from a line on the south of township 6 north to the boundary line of the State of Wyoming and Colorado. Also in Wyoming from the south line of township 19 north and extending northward to the north boundary of the map and from a point about the east line of range 67 westward to a line about on the west line of range 77. That is the country in Wyoming taking in the Wheatland reservoir location and the Laramie river from a point opposite Cooper Lake to and beyond the town of Uva, Wyoming. There are no quadrangle maps obtainable for that part of the Laramie River watershed lying within the confines of Colorado; no topographical surveys of that country have been made so far as I know.

The crest of the watershed between the Laramie and Poudre Rivers is noted on Exhibit A by a brown or burnt sienna line. The location as given is subsiantially correct. The western boundary of the watershed in Colorado was obtained by consulting several

1643 maps and particularly those prepared by engineers Zac T. Duvall and C. W. Beach from surveys made by them at Link Lakes; also from other maps available. After drafting the map, the survey of Link Lakes took me into the neighborhood of the Medicine Bow range, and while making that survey I ran triangulation lines to the top of the range, and located a point at the crest opposite the head-

waters of the McIntyre. I also did the same at the headwaters of the Rawah. These demonstrated that the location of the crest of the watershed is correct as shown on the map.

The territory indicated in green on the map is the territory embraced within the boundaries of the Greeley-Poudre Irrigation District. It includes all land within the boundaries whether servable or not. The watershed of the Laramie River intercepted by the Sky Line Ditch is indicated in yellow. That part intercepted by the works of the Greeley-Poudre system is indicated in purple.

1645 The irrigation works indicated in red belong to the district. The irrigation system for the carriage of water from the Laramie river to the District is described about as follows: From diversion on McIntyre Creek, water will flow through the McIntyre ditch to Rawah Creek, then down the creek to the West Side Mountain Ditch, down this canal to a regulating reservoir near the mouth of the tunnel, through this reservoir into the tunnel, and thence to the Cache la Poudre river, thence down the Cache la Poudre river in an easterly direction into the Poudre valley canal, through this canal and the extension of this canal known as the Laramie Poudre Canal to McGrew reservoir, through McGrew Reservoir and its outlet to the Briggsdale Lateral, to the terminus of that lateral, a total distance of about 190 miles.

1646 There is also a ditch collecting the streams on the east side of the Laramie Valley and running to the tunnel known as the East Side Collection Ditch. It is 41,100 feet in length.

It is about thirteen miles from the diversion on the McIntyre to the tunnel. The total drainage area of McIntyre creek is about 40 square miles. About two squares miles of this drainage area is intercepted by McIntyre ditch. McIntyre creek compares quite favorably with the Laramie River at the point of confluence. I have seen it flow about as much water as the main river.

1647 Water flows about 2,500 feet from McIntyre creek through the McIntyre ditch into Rawah creek, thence down Rawah creek about five miles to the West Side Collection Ditch, thence 26,800 feet to the tunnel. The dam of the tunnel reservoir is about 1,400 feet north from the west portal of the tunnel.

The Greeley-Poudre tunnel is 11,366 feet long between portals. Is 7½ feet high and 9½ feet wide, and has a grade of one and seven tenths feet per hundred feet. The east portal or the portal on the Poudre river side is near a small creek which discharges into the Poudre river, called Tunnel Creek. This portal is about 1,500 feet from the Cache la Poudre river. The east portal is about

1648 300 feet *feet* higher in elevation than the Cache la Poudre river. The elevation of west portal of tunnel 8,550 feet.

1649 In October, 1909, I assisted in locating the pipe line on the Poudre river side for the generation of power for the driving of the tunnel. The power plant was installed under direction of Charles R. Hedke, and consisted of rock-filled crib diversion dam in the river above site of power house and immediately above Poudre river falls. Woodstave pipes, 22 inches in diameter and 8,700 feet long connected the dam with the power house, and conveyed water

to run 50 inch Pelton Water Wheel which was directly connected to a blower with a capacity of 13 cubic feet of air per revolution and a speed of 245 revolutions per minute. There was another Pelton wheel with double nozzles, belt connected to a 150 kilowatt electric generator for transmission of power from east portal to west portal, and another Pelton wheel connected to an air compressor for furnishing of compressed air to operate the rock drills.

There was a transmission line about three miles in length from the east portal to the west portal, and at the west portal there was installed an air compressor of the same size as the one on the east side, a blower, and also a hoist. These were driven by motors. There was also other machinery. Machinery was necessary to operate the plant. The air compressor furnished power for the drills. The blower furnished ventilation, the hoist on the west side was necessary for getting the excavated material out of the tunnel and the generator furnished current to operate motor installed at the west end of the tunnel. Mr. McIlwee, the contractor had installed a small steam plant and a compressor at the east portal of the tunnel, before the installation of the electric plant. He drilled
1651 probably three or four hundred feet of the east end of the tunnel prior to the installation of the electric plant. He abandoned the steam plant as soon as the electric plant was ready.

At both the east and west portals of the tunnel large camps were established, each capable of taking care of 60 or 70 men. The camps were all electric lighted and each looked like a miniature city, surrounded by tents, stables and other like out-buildings.

The plant and the machinery were all transported by team from Fort Collins, a distance of about 65 miles to the east portal. All over mountain roads. The transmission line over the mountains was done with a pack outfit.

1652 Work was prosecuted continuously day and night from the time it started until the completion of the tunnel; on the east portal with a force of 65 to 70 men, and with about the same force on the west side for about ten months. Work was carried on in three shifts of eight hours each. The contractor claimed to establish a United States record for tunnel drilling. The two bores met in the tunnel July, 1911. There was no deviation in the line at meeting and the grade of the tunnel is uniform throughout. The total cost of the tunnel and power plant and the concrete lining was about $600,000.

1653 It is still necessary to line about 40 feet of the west end of the tunnel with concrete and to remove the tracks from the tunnel. I designed the plans for the lining of the tunnel. These were later approved by the State Engineer and also by Mr. Hedke. 1104 linear feet of the tunnel were lined. The longest section lined was 450 feet, and the shortest 12 feet. With the exception of one place near the center of the tunnel where the 450 feet of concrete lining is installed, the material encountered in the construction is hard granite. At the places where the tunnel was lined seams were found and the rock was slippery and in shooting in construction it had been loosened up so as to make it insecure.

1654 The lining is circular, the top being a semi-circle and the bottom a three centered arch. It is one foot in thickness and was reinforced with steel rails originally used in the tunnel pipe and other steel. It is hooped every 12 inches longitudinally with steel rails and had pipes and rails running at right angles to the hoops on both bottom sides and top. I had supervision of the work. It was very difficult because of the conditions under which the work had to be prosecuted. Cement was purchased in Denver, shipped to Tie Siding, Wyoming, and from there transported by wagons and teams to the west portal of the tunnel, a distance of 50 miles over mountain roads. It required four-horse teams and consumed four days for the round-trip for each team. 5,000 sacks of cement were used and 1,104 feet of lining cost $20,507.19, the cost per foot being $18.57½. The work was done entirely by the district and not by contract.

1656 A portion of the approach cut between the river and the west portal is not yet complete. (Shown as completed at the conclusion of the testimony). It will cost $8,500 to complete the tunnel so that it will be ready to carry water. Contract has been let to complete this work, but prosecution has been delayed on account of heavy snows which blocked all manner of trans-

1657 portation into the Laramie river. About ninety days' work will complete the tunnel.

1658 A large amount of work has been done on the East Side Collection Ditch from Deadman Creek southward towards the tunnel. The same is true of the West Side Collection Ditch. Water flows in these ditches southward, while the water in the Laramie river flows northward. The elevation of the head-

1659 gate at the East side Collection Ditch at Deadman Creek is approximately 200 feet above the channel of the Laramie river opposite the headgate, and is about one-mile east of the channel of the Laramie river. The ditch is constructed on a steep side hill and the same slope prevails below the ditch as does above. The slope breaks about 100 feet in elevation below the ditch. It is more gradual from there down to the river. The ditch runs south to Nunn Creek, the grade varying from Deadman to Nunn Creek. In the solid material the ditch has a larger grade than it does in the loose material and the size of the ditch varies. In the loose material the grade being changed, the section of the ditch is enlarged, and the solid material, grade being increased, size of the ditch

1660 is decreased. The carrying capacity of the ditch from Deadman Creek to Nunn Creek, a distance of 15,000 feet, is 125 cubic feet per second. This ditch extends a greater portion of the way along mountain sides which are precipitous. This section of the ditch is about 98% completed. The materials encountered are mostly loose rock and solid rock. In the Deadman Creek division there were 288,300 yards to be removed. 62,157 cubic yards of solid rock and 220,377 cubic yards of loose rock and earth are at present removed. There is 22% of solid rock in this division.

1661 This division was peculiar in that it did not require much blasting. The remainder of this East Side Ditch and all of

the West Side Ditch require more blasting. On the division of the East Side Ditch between Deadman Creek and Porter Creek there was some team work and some pick and shovel work. Would say about one-half of each. On Nunn Creek Division of this work there was some team work. There was none on Porter Creek Division. There was no team work on the West Side Ditch.

The displaced materials are all placed on the lower side of the ditch in order to form an embankment and to get rid of the material and furnish a slope for retention of water. The cut is much higher on the upper side than on the lower side of the ditch
1662 in many places. The slopes in places along these mountain ditches is as much as 40 feet cut on the upper side, while on the lower side it would not exceed more than two feet. This is occasioned by the character of material and the slopes of the mountain.

Material was removed in the construction of the larger portion of these ditches by the use of picks, shovels and powder. It was drilled and loaded with dynamite and loosened by the explosion, and that material was afterwards shoveled over the bank. Larger rock was placed on stone boats and hauled up to the top of the lower bank and rolled over and some material was placed with wheelbarrows used on plank runways.

1663 The excavation work on the West Side Ditch was begun in the winter of 1909 and operations on both ditches ceased October, 1910.

Labor ceased on these ditches after this suit had been instituted. At least a month later, I think.

Mr. Hedke, in the original plans, designed diversion dams in Deadman, Rawah and other creeks, and also designed waste gates at numerous points along the line of both ditches. These plans have not been changed. The district has ordered me to prepare plans for what are termed overflow sections for these ditches, in addition to the waste gates designed by Mr. Hedke, as I reported to them that I did not think these waste gates were quite large enough.
1664 Both spillways and waste gates will be installed for the operation of the ditch. They are necessary for the safety and proper operation. The water in Deadman Creek in times of freshet, will more than fill the ditch and the excess will go over to waste ways. My suggestions for the construction of overflow sections, as well as spillways, are the result of observations of the waterflow in the streams. These observations cover four years.

I was in the Laramie valley during high water period in 1910, 1911, 1912 and 1913. These streams have a very heavy flow
1665 of water during that time. The high flows from the watershed on the East are discharged earlier than those from the west side. The East Side flow starts between April 15 and May 15, and the West Side flow starts from the early part of May and continues to the early part of June. This is varied in different years, but as a rule occurs about at these times. The heavy flow in the Laramie river in this vicinity from the tributaries comes first from those on the east side and second from those discharging from the west side.

The east side starts first because the drainage receives the warm sun of the afternoon and, being at a lower elevation, receives a little less snowfall than does the west drainage. The snow on the east side does not pack as hard as it does on the west side. The sun striking the snow in the afternoon melts the snow quicker and starts the melting of the snow sooner. This is also aided by the spring rains. In the Laramie Valley it frequently is raining on the east side while it is snowing on the west side of the watershed. It may be said to be an almost invariable rule that the water from the east side starts first and reaches the peak of discharge at about the time that the
1666 west side creeks, such as Rawah and Rapid, are beginning to come out. I am speaking from my own personal observation. The highest point of discharge has been reached on the east side before the highest point of discharge has been reached on the west side by from ten to twenty days.

The streams on the east side of the Laramie river in Colorado do not rise uniformly. The run-off will rise gradually for a time, and then owing to climatic conditions, will rise very suddenly. This will gradually subside again to the normal flow of the discharge. After a time another peak of great discharge will suddenly come and that is true of the out-flow of the entire east side drainage throughout the season from point of low discharge to the peak or maximum
1667 discharge. These statements are made from observations made by me while I was in the Laramie valley. I have been on the upper drainage sheds of the Rawah when it was snowing up there and raining in the Laramie Valley and on the east side. The crest of the ridge at the easterly extreme of the watershed is much lower than the crest of the ridge on the west side of the drainage area, commonly called the Medicine Bow Range. The east ridge, commonly called the Green Mountains, has an elevation between 9,000 and 9,500 feet at the tunnel, while the Medicine Bow Range near there has an elevation of some 11,500 to high peaks of 13,000 feet and over. The timber on the drainage shed above the west side ditch is very much heavier than the timber on the drainage shed above the east side ditch, taking the whole area of each watershed into
1668 consideration. The east side drainage receives the afternoon sunshine during the time that the precipitous slopes on the west side, which is on the east side of the Medicine Bow Range, will be in the shadow more or less, and therefore will not receive the benefit of the sun as much as does the east side of the drainage area.

The east side collection ditch will not be able to divert all of the water flowing in Deadman Creek. Moreover, the waste gates at Deadman Creek will be left entirely open during the winter, from the first of November to the first of April. This is necessary
1669 because the snow fills the ditches and prohibits keeping the ditch open during the winter months. This water is lost to the system and is in addition to any losses that will occur through leakage through the diversion dam and waste gates. The East Side Ditch at points is constructed through loose rock and boulders, resting on a steep mountain side. About 40 per cent to 50 per cent of the total length of the first division of this ditch is through this kind

of material. This material permits the loss of water by seep-
1670 age. I have observed many places along this ditch where the ground above the ditch was dry while below it was wet. This material is very similar to that encountered in the approach cut to the Laramie river tunnel where I found water 1,100 feet distant south of and about two feet above the level of the water in the stream.

I have observed the Sky Line Ditch. Some of the material through which that ditch is constructed is very similar to the material through which the East Side Collection Ditch of the Greeley-Poudre
1671 system is constructed, although it is more like material encountered on the West Side Collection Ditch of the Greeley-Poudre system. The East Side Collection Ditch from Deadman to Nunn Creek will carry water better, in my judgment, than will the Sky Line Canal, as a whole. The slopes below the Deadman—Nunn Creek Section are not quite as steep as those below the Sky Line Ditch and the slope is not so long because the Sky Line Ditch is higher up on the side hill than is the Deadman Ditch. Some of the water flowing in the streams intercepted by the East Side Ditch will pass by it and will not be intercepted by it. Much of the water precipitated on the watershed above the ditch does not find its way into the creeks and is from side hill drainage, some of which
1672 will find its way into the ditch. I am basing my conclusions on what I have seen at the Sky Line Ditch.

The East Side Ditch is built on what might be termed a steep grade. It has a grade of two and one-half feet per thousand feet in the loose section and four and one-half feet per thousand feet in the solid section throughout the portion from Deadman Creek to Nunn Creek. Such a ditch will not deposit silt on the bottom and sides of the canal. It will be carried in suspension. It is more likely to erode than to deposit. The losses in this ditch will be materially larger from seepage than they would be in a ditch of a similar
1673 size and similar construction on the plains. In the Poudre Valley Canal, taking water from the Cache la Poudre river, there is a section about 7,000 feet long, which is built on steep side hill through loose and solid rock and the losses from seepage in this section are very great. This is the section through which these large losses occur and it is intended to line this with concrete for the purpose of conserving the water that flows from the ditch, thereby saving heavy losses from seepage.

Water which escapes from the collection ditches of the Greeley-Poudre system through seepage and otherwise will flow down into the Laramie river and from thence into the State of Wyoming. No part of this water can ever again be recaptured for use in Colorado through the Greeley-Poudre system, or through the Sky Line or Wilson Supply Ditches. This seepage water will flow by sub-
1674 surface channels into the Laramie river or directly over the surface back into the stream.

In Contract of September 8, 1909, between the District and the Company, there is a waste way called for under the plans made by Engineer Hedke and located between Deadman and Nunn Creeks on the East side ditch. It will be put about half-way between the

two creeks. The purpose will be to take care of excess of water that will come into the ditch from the side hill drainage between the two creeks. By side hill drainage I refer to the fact that there is quite a long stretch of country between these creeks that catches quite a large amount of snow and drainage and the water from this will be discharged into the ditch along the side hill slopes through small ravines. These ravines run water from 15 to 30 days during times of high water. The quantities of the run-off are variable. The flow of these small streams on the side hill is very rapid. They
1675 discharge their water very quickly and the run does not last as long as it does in the creeks.

The East Side Ditch crosses Nunn Creek with an embankment across the bed of the channel of the stream, which might be termed a diversion dam. It was not planned to put a dam in Nunn Creek of the same kind that was designed for Deadman Creek. At this point there will be waste gate put in the bank of the ditch. These gates are so constructed that they may be raised or lowered to permit the withdrawing of all of the water from the canal. The top of the waste gates is at the same elevation as the high water line in the canal. These waste-ways serve as an automatic discharge of excess water from the ditch. When the ditch is carrying its full capacity, the high water line will be exactly on the same elevation as the top of the waste ways and any excess water will find its way
1676 over the gates and into the Laramie river below the ditch line.

An overflow section will be constructed near Nunn creek on this ditch. It was not included in the contract, but has been added by me. The spillway and waste gate was in the contract between the District and the Company. This waste gate was not sufficient to take care of the excess water that would flow down Nunn Creek and for that reason I recommended a design of an overflow section to be sure to have enough overflows so that the canal would not be endangered by excess water at that point. The same is true at Deadman Creek, between Deadman and Nunn Creeks there is a waste gate designed in the original contract, but no overflow
1677 section at that point.

There will be times that all of the water taken into the canal at its headgate at Deadman Creek will be discharged over the spillway before it reaches Nunn Creek owing to the accumulation of water in the canal from Nunn Creek and the ravines between Deadman and Nunn Creeks. This water will pass down to the Laramie river. Nunn Creek is a smaller stream than Dead-
1678 man Creek, and given to more erratic flows. At times it will carry more water than Deadman Creek, although the total discharge will be more in Deadman than in Nunn Creek. Generally speaking, the streams are quite similar.

The East Side Collection Ditch is 1,100 feet in length between Nunn Creek and Porter Creek. The ditch increases in capacity from Nunn to Porter creek and between these two creeks has a capacity of 250 cubic feet per second. The material encountered on this division is a loose rock and boulder material. It is a little more difficult of construction than what is termed the Deadman Creek

division, from Deadman to Nunn creek, it being almost im-
1679 possible to use teams in this portion of the work. The material was all classified in this division as solid rock and loose rock. There were 20,000 cubic yards of material removed from this division, twenty per cent of the same being solid rock. The quantities being 4,000 cubic yards of solid rock and 16,000 cubic yards of loose rock. This work was practically all done with picks and shovels and wheelbarrows. It required quite a large amount of blasting and will require quite a large amount to complete it. The ditch is located along a less precipitous hill in this division than on the Deadman Division. The ditch through this portion of the division is through solid rock and boulder.

Am familiar with the water flows in Nunn Creek from
1680 observation of them from time to time. There will be times when there will be more water diverted by this ditch from Deadman, Nunn and Porter creeks than the ditch can carry. This excess water will go into the Laramie river and down into the State of Wyoming. At Porter Creek a flume will be installed when work is resumed on this canal. Water will be taken from Porter creek through a small, supplemental canal, which will have a capacity of
25 cubic feet per second and will discharge into the East Side
1681 Collection Ditch below the point of crossing. Am familiar with the flows of water in Porter Creek. There are times when the flow is in excess of 25 cubic feet per second. This excess water will pass over the diversion dam in Porter Creek and also over the wastewavs that are designed at Porter Creek, shown in the original contract, and part will find its way down the natural channel of Porter Creek to the Laramie river and part will go over the waste ways at Porter Creek and down into the same river, the water finding its way from there to the State of Wyoming. Porter Creek is a smaller stream than either Deadman or Nunn Creek, and in my opinion it does not flow during the season as much water as either of these other streams, although the flows in the creek act in a similar manner to that of the other streams. The next stream encountered is Brinker Creek, which is a short distance along the canal.

The canal from Porter Creek to the tunnel has a carrying
1682 capacity of 275 feet per second of time. It is proposed to install spillways at Brinker Creek. Brinker Creek and Porter Creek are quite similar both from the standpoint of watershed and run-off. When the ditch is already filled to its full capacity of 275 cubic feet before it reaches Porter or Brinker Creek, any excess water coming down either of these two creeks will naturally flow over the spillways as it will be in excess of the capacity of the ditch. There will be times when these conditions will prevail during the high stages of water in the other streams. I am unable to give the exact duration of these different flows or the quantity that will
1683 thus pass over. From Porter to Brinker Creek the material is loose and solid rock. Portions of the canal rest on solid rock.

The canal is 25,300 feet in length from Porter Creek to the tunnel. There has been removed by construction of the canal, in this

division, 22,000 cubic yards of material, 20 per cent of which was solid rock. The amounts are 4,400 cubic yards of solid rock and 17,600 cubic yards of loose rock. The slopes of the mountain in this division are more steep than on the Nunn Creek division and are about the same as on the Deadman Creek Division. About
1684 75 per cent of the canal of this division rests on solid rock and boulders. The canal is considerably higher than the Laramie river at Porter Creek, although at the tunnel the elevation of the ditch is only 50 feet above the bed of the river. Small
1685 creeks and ravines are encountered throughout this division. These carry water through some portions of the year. Waste gates are designed for installation at East Springer Creek in this division, also overflow sections have been designed. There will be times when the water from all sources of supply will be greater than this ditch can carry, in which event the excess will go over the waste gates and will be discharged directly into the Laramie river
1686 and by means of that stream will find its way into the State of Wyoming. There will be times when the side-hill drainage, that is run-off from melting snows and storms, will find its way through the canal in such large quantities as to overflow.

The excavation on this East Side Collection Ditch occurred largely between November, 1909, and October, 1910. As I recall the
1687 *occasion* of labor occurred after the commencement of this suit.

Am familiar with the McIntyre and the Rawah ditch, also the West Side Collection Ditch. The McIntyre ditch carries water from McIntyre Creek to Rawah Creek. It will be 2,500 feet long. A small ditch on a flat slope having its headgate near the headwaters of McIntyre Creek within two miles of the extreme headwaters of that stream. It will carry water from McIntyre creek over into Rawah Creek and the water will find its way from there down Rawah creek to the point of diversion of the West Side Collection Ditch.

Am familiar with Rawah Creek and point of diversion on that stream of the West Side Collection ditch. At the diversion there will be installed a dam, wasteway and an overflow section similar to the one to be installed at Deadman Creek on the East
1688 Side Collection Ditch. The first division of the West Side Collection Ditch extends from Rawah Creek to Rapid, a distance of 17,500 feet, and will have a carrying capacity of 200 cubic feet per second of time. The next division is from Rapid Creek to Fall Creek and has a length of 2,000 feet and a capacity of 250 feet per second. The third division of this West Side Collection Ditch extends from Fall Creek to Mill Creek, and has a length of 3,700 feet and a capacity of 270 cubic feet per second of time. The next division is from Mill Creek to the tunnel reservoir, a distance of 4,000 feet, and has a carrying capacity of 275 cubic feet of water per second. This division has been fully completed.

Included in the contract of September 8, 1909, between
1689 the District and the Company, the West Side Mountain Ditch is constructed along a very steep side hill mountain.

More solid rock is moved in constructing this canal than the one on the east side of the valley. All work thus far completed has been done with picks and shovels and wheelbarrows, what might be termed "hand work." It required a large amount of blasting with dynamite. The canals divide into four divisions. On Rawah Creek division there were 32,000 cubic yards of material moved, of which 16,000 was solid rock and 16,000 loose rock. On Fall Creek division there were 15,000 cubic yards of material moved, of which 4,500 was solid rock and 10,500 yards was loose rock. No work was done on Rapid Creek division, which extends from Rapid to Fall Creek. On Mill Creek division 18,000 cubic yards of material are moved, of which 6,300 cubic yards were solid rock and 11,700 cubic yards were loose rock. The terminus of the Mill Creek division is at the reservoir dam. All this work was pick and shovel work. In addition to the open ditch work there have been two tunnels driven on the Mill Creek division, the aggregate length of which is about 270 feet. These tunnels were necessary owing to the fact that the ditch at this point intercepted a cliff of
1690 solid rock. This perpendicular wall of rock is so situate as to make flume construction or open cut ditch out of the question. The expense would be too great.

A tunnel 750 feet long will be necessary on Rawah Creek division near Rawah Creek. Tunnels aggregating 690 to 700 feet will be constructed on the Fall Creek division. Total length of additional tunnels is something in excess of 1,500 feet. These tunnels are six feet high by eight feet wide. Work was done by hand drills.

Waste ways have been designed for installation along this West Side Ditch as designated in the original contract; one at Rawah Creek, one at Rapid Creek, one at Mill Creek and another at Fall Creek will be installed. At times there will be discharges
1691 of excess water over these waste ways.

Upper Rawah Ditch is surveyed throughout its entire length and is partly constructed. It intercepts some of the streams that are also intercepted by the West Side Mountain Ditch. All work performed on this ditch was done prior to the time I entered the employ of the District. This was the ditch first projected in the early history of the system by Mr. Akin and Wallace A. Link. I have been all over this line of ditch, both the constructed and the unconstructed portions. The capacity of this ditch is something like 200 cubic feet per second. This ditch was not to be completed for the District under contract of September 8, 1909, although in that contract the District acquired the ownership of that portion which had been constructed. The district proposes to complete the ditch. Water accumulated in its discharges into West Fork of the Laramie river. It flows down the West Fork into the tunnel reservoir and then through the tunnel.

Water of all these streams are carried from a northerly direction to a southerly point, back up the watershed in a sense.

Am acquainted with characteristics of water flow in Mill Creek.

There are times when it will carry considerably more than
1693 five cubic feet per second. Upper Rawah ditch does not interfere with the flow of Mill Creek. If this ditch was charged to its full capacity before reaching Mill Creek, all of the waters would go over the waste way. Water will discharge over spillways on lower Rawah Ditch or West Side Mountain Ditch at various times with flows of short duration. Overflow sections have been designed for installation along this canal. These waste-gates contemplated will be installed so that the high-water line of the ditch is at the same elevation as top of gates and also gates are designed so that they may be raised and discharge the water through these gates. The object of putting the top of the gate at the same elevation as the high-water line of the ditch being that any excess water will find its way over the top of these gates and not go over the bank of the ditch.

West Side Mountain Ditch compares very favorably with the line of the Sky Line Canal. Both ditches being on same general slope of the Medicine Bow Range, on the west side of the Laramie river. Sky Line ditch is at slightly higher elevation than West Side Ditch.

West Side ditch has grade of from one and one-half feet per thousand feet to as high as three feet per thousand feet and the velocity of this canal is fairly great. Water will flow rapidly through it. This grade would be too steep in valley, but is good mountain grade. Waters flowing in these mountain streams are
clear. From observations I have made on the Sky Line
1695 Ditch of the Water Supply & Storage Company, which canal is similar to the West Side Collection Ditch, I should say that there would be considerable seepage from the latter ditch along practically its entire length. It is impossible to determine amount until ditch is put in operation. This canal discharges its water at reservoir dam site just above the dam in the reservoir basin at the west portal of the tunnel. Its point of discharge is directly opposite the point where the East Side Collection Ditch discharges into the same basin. Tunnel reservoir embankment extends across the channel of Laramie river and across valley from East Side Collection Ditch to West Side Collection Ditch.

This dam is 1,893 feet long. 28,305 cubic yards of ma-
1696 terial have been placed in the embankment. Also 3,250 yards of concrete which go to make up the outlet tube in the bed and channel of the Laramie river through embankment for discharge of waters down river channel. This outlet is single tube with a double gate. It has, I believe, a five-foot arch with two and one-half feet rise and distance from spring line of two and one-half feet. Mr. Hedke designed it and it was put in under his supervision.

Three streams enter the Tunnel reservoir, Half Mile Creek, a small stream discharging very little water, the East Fork of the Laramie river and West Fork of Laramie river. East Fork
1697 of Laramie river is, in my judgment, a smaller stream than Deadman Creek. It discharges less water. West Fork of Laramie river is a larger stream than Deadman Creek. Less water

is available from West Fork than from Deadman after the
1698 diversion of Sky Line Ditch is made. Have been along toe of slope of mountain below Sky Line Ditch and in many places have observed water coming down the small streams that are intercepted by it. Water also appeared along slope of mountain side itself where no streams occur. A considerable amount of water was coming from seepage and going back into Laramie river. Excess or overflow also occurs at the head of the Sky Line ditch. Have seen water passing over Diversion Dam of Sky Line Ditch and flowing down West Fork of Laramie. This same condition would undoubtedly prevail at both Rawah and Deadman Creeks on the Greeley-Poudre system. Water overflowing spillways would likewise go down Laramie river. Water overflowing spillway at Sky Line Ditch would go down to tunnel of Greeley-Poudre system.

1699 Material going to make up dam of Tunnel reservoir consists of rock, some earth and gravel in large quantities. In my opinion this reservoir will lose considerable water by seepage which will be lost to the District system of works. Seepage from this reservoir will be much greater than with ordinary reservoirs constructed on the plains. All these seepages, escapements and overflows, which I have mentioned, will find their way into the channel of the Laramie river below the diversion works of the Greeley-Poudre Irrigation District and will be lost to that system. There are no works in the watershed of the Laramie river in the State of Colorado which can divert water from that stream for use on lands in the Poudre-Valley and which can or do take out water at a lower elevation than those of the defendant district. It is impossible to construct works to take waters from that stream lower down the stream than are the works of the district.

Am thoroughly familiar with works of the District in Poudre Valley, also with work done since making of contract of September 8, 1909. Large amount of construction work has been performed. The Laramie-Poudre Canal has been completed from its head, at the eastern terminus of the Poudre Valley Canal throughout various portions along its entire course. This canal is divided into two divisions, so-called. First division extends from terminus of Poudre Valley Canal to point called Black Hollow Siphon, length 113,000 feet, being 1130 stations of 100 feet each. Second division of canal extends from east end of Black Hollow Siphon to point at Eastman Creek and has a length of 173,300 feet, being 1733 stations of 100 feet each. Material on both divisions of this canal were classed in contract of September 8, 1909, as enlargement. Enlargement being that portion of canal which had previously been constructed. In work of enlargement there were 216,970 cubic yards of earth moved, and 59,000 yards of solid rock moved after District entered into contract with Company. Am unable to state amount of material that had been moved prior to contract with District. Mr. Hedke can give these quantities.

1701 New work on canal consisted of excavation where no previous work had been done. 740,000 cubic yards of material

were to be removed, out of which 555,000 cubic yards of earth and 6,2000 cubic yards of solid rock have been removed to date. The siphon across Black Hollow consists of two parallel 7 foot steel pipes, resting and bolted to concrete foundation. Foundation is installed.

Now from Eastman Creek to McGrew Lake reservoir is known as Eastman Creek Inlet Canal. It is 30,600 feet long and was constructed prior to contract of September 8, 1909. 60,800 cubic yards of material were removed from this inlet ditch after signing of contract. At terminus of this canal McGrew Lake reservoir has its beginning. Length of enbankment is 163 stations of 100 feet each. Embankment has maximum height of 25 feet and contains 405,000 cubic yards of material. 395,000 cubic yards of material have already been placed. Outlet tube is installed which contains 350 cubic yards of concrete. Reservoir holds water 38.4 feet in depth above bottom of outlet tube, and impounds about 858,000,000 cubic feet of water, or approximately 19,734 acre feet. Top
1702 of embankment is 6 feet above high water line and the entire inside space will be paved with reinforced concrete paving with a coping wall one foot above top of embankment, making top of coping wall seven feet above high water line of reservoir.

McGrew Outlet canal extends easterly from McGrew Reservoir. It begins at outlet tube of reservoir and ends near Crow Creek, from which point Briggsdale lateral extends some twenty miles further on. Of this McGrew outlet canal, there has been completed 1060 stations of 100 feet each and there has been removed 212,000 cubic yards of earth.

Rock work excavated on Laramie-Poudre Canal was taken
1703 from large cut at west of Black Hollow. There remains 13,500 yards of rock to move in this cut. The cut has a length of 3,300 feet and maximum depth of 35 feet. Ditch has width on bottom of 27 feet with side slopes of one-half to one. There is another large cut known as Wellington Cut, situate north and west of Wellington, Colorado. It is through earth. It has maximum depth of 31 feet, is 20 feet wide on bottom and has slopes at point two feet above high-water line of two to one. Some rock has been taken from bottom of Laramie-Poudre Canal between these two cuts. From Wellington Cut to Poudre Valley Canal is all enlargement.

District has rights in canal constructed and in operation known as Pierce lateral, which is extension of canal of the Water Supply & Storage Company. Begins directly opposite Black Hollow Reservoir. From this point the Company's canal discharges into Black Hollow reservoir and takes water out of the reservoir from the bottom and runs thence easterly. Pierce Lateral extends around the reservoir on upper contour and runs eastward. This lateral
1704 is to be enlarged under contract of September 8, 1909.

Waters of District to be carried through this lateral will be discharged into Black Hollow, a natural depression, from Laramie-Poudre canal. Waters will then be carried down Black Hollow to Pierce Lateral and through same to terminus where will be dis-

charged into a creek called Owl Creek. Point of discharge will be within boundaries of District. From this point waters will flow down Owl Creek and from thence will be diverted by the Middle or Central Lateral of the Greeley-Poudre District. This ditch will also be supplied in part from the Laramie-Poudre-Canal at point where said canal crosses Owl Creek. Waters carried by this lateral will be taken to point near the eastern side of District, and into
1705 Camfield Reservoir. This canal will be used to irrigate lands lying below its line between Owl Creek and the Camfield Reservoir and will also be used as filler for that reservoir. It will also be used to fill March reservoir. Waters discharged from this ditch for purpose of filling this reservoir will come in through Coal Creek. From point of discharge waters will be carried down Coal Creek a short distance to point where canal known as March Reservoir Inlet Canal will have its diversion. This canal extends from Coal Creek in a southerly direction to reservoir.

There is one canal extending from outlet tube of Camfield reservoir and serving lands below. From March reservoir there is outlet canal extending a short distance from point where canal divides, one branch of outlet runs thence eastward and one branch runs southwestward. This canal known as March Outlet Canal.

60,000 cubic yards of material have been placed in the March Reservoir embankment. No work has been done on
1706 outlet or inlet canals. Inlet canal to March Reservoir is also to be constructed for diversion of seepage and flood waters flowing into stream.

Long prior to my employment with district there was ditch built from Crow Creek leading to Camfield Reservoir. This ditch still is in operation. The outlet gates or reservoir are constructed. It is natural basin having capacity of 175,000,000 cubic feet, without need of artificial embankment. Inlet from Crow Creek to Camfield Reservoir is about five or six miles long. It is a large canal.

These reservoirs, McGrew, March, Camfield, also Douglas and Cobb Lake, and the main canal of the system, and the long laterals which I have described, are to be employed for the diversion, storage, carriage and distribution of all waters obtainable for the irrigation of the lands of the District. Waters of Cobb Lake and Douglas Reservoir can be used by exchange. All Douglas reservoir water will have to be exchanged while the major portion Cobb Lake water can be used through canals of the system directly. Small portion will have to be exchanged.

By exchange I mean that water is supplied from this reservoir to owners of prior rights from the flow of the Cache le Poudre and an equivalent amount taken out at head works of Greeley-Poudre District at the river. This is the practice on the Poudre river and is in extensive use. For illustration, waters of Fossil Creek Reservoir are owned by ditches which lie above the reservoir and the water is exchanged by delivery into other canals and the water which these canals are entitled to is taken by the owners of the reservoir.
1708 The entire system of works which I have described was designed for the diversion, carriage, storage and distribution

for irrigation of all the lands of the District. The system includes the reservoir to be constructed across the bed and channel of the Cache la Poudre river. All water which can be obtained from all sources is necessary for sufficient annual irrigation of lands included in Greeley-Poudre District. The Channel Reservoir in the Poudre river will intercept all of the water that will be used by District. All water obtainable through or by means of whole system contemplated in contract of September 8, 1909, is necessary for District irrigation.

Dover Reservoir was not considered in contract of September 8, 1909. It was surveyed and built by District. It is situate across bed and channel of Lone Tree Creek, about five miles north of town of Nunn, and is a small reservoir. It is complete. Embankment contains about 40,000 cubic yards of earth. It is a flood-
1709 water reservoir. Lone Tree Creek, upon which Dover reservoir is situate, heads in Wyoming and flows through and into the State of Colorado. Waters of this stream are intercepted and impounded in reservoirs in Wyoming and used for irrigation of lands in that State. I have been informed that there are also ditches taking water directly from the stream in that State. If these waters were not diverted and used by the Wyoming appropriators they would naturally flow down the creek, into Colorado, and into this Dover Reservoir. They would also flow into the canal of the District and be used for the irrigation of District lands.

The same is true of Crow Creek, which heads in Wyoming and flows into Colorado. Along eastern border of district Crow Creek is a dry arroya for a greater part of the year. It sometimes
1710 carries flood waters. Inlet to Camfield Reservoir was designed and constructed for interception of these waters. This stream furnishes the water supply for irrigation and domestic use for city of Cheyenne in Wyoming.

The lands of the Greeley-Poudre Irrigation District will require all of the water contemplated to be obtained by the completed system of works for their irrigation. The system has been designed for diversion, storage and distribution of all water obtainable to
1711 accomplish the economic irrigation of this land.

On map attached to corporate defendant's answer figures showing elevations appear with plus mark at various points. These elevations were obtained by me from United States Geological Survey.

Elevation of Nunn, Colorado, is approximately 5190 feet. At beginning of second division of Laramie-Poudre Canal at Black Hollow elevation is 5197.29 feet. Elevation of McGrew Lake outlet is 5090 feet. From this point canal has gradual fall and elevation lessens accordingly.

Lands of Greeley-Poudre District are approximately five hundred feet higher than lands at Greeley. Slope is gentle. Trend of whole country in irrigated territory in District is similar, sloping to south.

I have indicated elevations on map of portions showing
1712 Laramie Plains. Elevation at Woods Landing is 7461 feet according to United States Geological Survey. Wyoming Experiment Station located near Laramie has elevation of 7187 feet.

Have been over Laramie River Valley from tunnel of the Greeley-Poudre District to Wheatland, Wyoming. Laramie river flows through what is commonly called Laramie Plains. These are broad level stretches of country having elevation of about 7000 feet and more, and dotted over with alkali basins and depressions. Whole plains are unprotected country and are in my judgment unfit for raising crops to any great extent. Soil on Laramie Plains is comparatively shallow and is soon worn out.

It is a fact that frosts occur very late in the spring. Professor of the University of Wyoming stated to me last spring that he had been at the Experiment Station for thirty years and that was the first month of August in which he had not seen killing frosts
1713 during the thirty years he had been at Laramie. On the other hand, the Cache la Poudre Valley is at an elevation of some 2000 feet lower than the Laramie Plains. It is in a well-known high state of cultivation and has been for a long period. Laramie Plains had facilities for transportation before Cache la Poudre Valley did. There is no comparison between two valleys.

I have been over portions of the irrigated territory situated under the work of the Wheatland Industrial Company and The Wyoming Development Company in the vicinity of Wheatland in the Laramie Valley in Wyoming. This was during inspection trip of the Valley that I made during fall of 1911. Was along Sybille Creek where stream is used by that enterprise for carriage of water in conjunction with its ditches. Visited intake of Ditch No. 1 leading from Sybille Creek to irrigated area in vicinity of Wheatland. Water was flowing in Sybille Creek at point of intake. Gates at head of canal
1714 were closed. Diversion dam at head of ditch for diversion of water from the creek was of no efficiency for that purpose. The water was going through the dam, it had been washed out. Water was flowing through the dam. The portion which I saw was composed of sticks and manure. I saw all that was there. A large portion of the water was going through where the dam had been washed out, some small quantity was going through and under. This was during fall of 1911. This is first point where waters from Sybille Creek are diverted into works of the Wheatland project. Water I saw was partly from Blue Grass and partly from Sybille. Do not know quantity; about 20 to 30 cubic feet per second.
1715 On this trip saw reservoir that lies within body of irrigated land near Wheatland, known as Reservoir No. 1. It had water in it. Passed over inlet ditch to Reservoir. No water was flowing in it. I did not make an inspection of entire line of canals. I did not see any water flowing in the ditches at that time.

Each month during time work was being carried on in completion of the system of the Greeley-Poudre Irrigation District and prior to institution of this litigation, there were issued monthly estimates by the Board of Directors of the District. Upon these estimates
1716 bonds were paid over to contracting company for work done. These estimates were issued continuously each month. Under them bonds of District amounting to two and one-half million dollars (2,500,000) were paid over. $1,800,000 of bonds were paid by trus-

tee to Company. $500,000 of bonds were deposited for taking care of and retirement of bonds of Company. The District still has on hand $2,500,000 of bonds out of the original $5,100,000 of bonds.

Am acquainted with the general character of the water flow of the streams that are tributary to Laramie river in Colorado. Tributaries entering river from west side which are not intercepted by works of Greeley-Poudre are a portion of McIntyre below present or contemplated diversion, La Garde Creek, Forrester Creek, Grace Creek, Stuck Creek and Johnson and Beaver Creeks. (These latter two streams head in Colorado but discharge their waters into the river in Wyoming.) All these tributaries which I have mentioned head in the Medicine Bow Range in the regions of perpetual snow and on high mountains. They are streams of constant flow. Stuck Creek is a much larger stream and with heavier flows than Deadman Creek. McIntyre Creek is one of the larger tributaries of the Laramie river. It is larger than Stuck Creek. La Garde Creek is a smaller stream than Stuck Creek and is about the size of Deadman Creek. Grace Creek is a fairly large stream at the time of
1719 freshets and discharges considerable water.

Streams on the east side of the Laramie river which cannot be intercepted by the Greeley-Poudre system are: Jimmy
1720 Creek and Sand Creek, also Brown, Pete, Arroya and Lone Tree.

Sand Creek discharges quite a considerable supply of water from Colorado into Wyoming. I have seen the stream in heavy flow. At the times I observed it it was a larger stream than Deadman Creek. Jimmy Creek is a smaller stream than Deadman, although during freshets it discharges a considerable quantity of water. Some of the waters of Sand Creek are carried across the divide into Sheep Creek, in the Cache la Poudre Drainage, although the watershed thus diverted is comparatively small when considered with the entire watershed of the creek.

1721 I am acquainted with the vicinity of Woods Landing, in Wyoming. It is at the southern extremity of the basin known
1722 as the Laramie Plains. There are streams flowing into the Laramie river in that vicinity which flow constantly. They are Bear Creek, Woods Creek and Fox Creek. These drain area to the north of the Colorado boundary. I am not attempting to give the tributaries of the Laramie river in Wyoming. I have better acquaintance with the stream, its watershed and waterflow, and of the tributaries, at the upper reaches of the stream and particularly to the basin of the Laramie in Colorado. My experience has extended in this region during my service as engineer for the Greeley Poudre Irrigation District during the years 1910, 1911, 1912 and 1913.

CHARLES R. HEDKE, Civil Engineer:

Direct examination by Mr. Fred Farrar:

1723 Am a civil engineer. Reside at present at San Acacio, Colorado. I am especially engaged in irrigation engineering. Am at present affiliated with the project of The Costilla Estates De-

velopment Company. The Costilla Estates consist of land situated within an old Spanish land grant. It lies in the southern part of Colorado and some in northern New Mexico.

I am a graduate of University of Wisconsin, class of 1900, and following year went to Michigan and was engaged in work connected with the sugar factory at Holland, Michigan. Worked in civil engineering department with specialty of sanitary engineering, involving problems of water supply, sewage and sewage disposal.

1724 At Holland, Michigan, was in charge of chemical work of factory during night work. While there became acquainted with Kilby Manufacturing Company of Cleveland, Ohio, who were builders and contractors of sugar factories. In Spring of 1901 I came to Colorado with that company for the erection of a sugar factory at Loveland, Colorado, and was put in charge of construction with position of resident engineer and had to do with local problems of water supply, drainage, foundation, masonry construction, stone, concrete and brick in erection of buildings and installation of machinery and transportation and storage problems connected with beets.

That year the sugar company at Loveland started to build a feeder line for their factory; a railroad for transportation of beets from farmer to factory. That railroad is now called The Denver and Great Western Railroad. That is the railroad which now runs from Loveland in an easterly direction, one branch thence running south to Milliken and Johnstown and meeting another branch going across the watershed between the Thompson and Poudre Rivers, crossing the Colorado & Southern Railroad at Windsor, then easterly down the Poudre Valley past Severance and connecting with the

1725 Union Pacific Railroad at Eaton, Colorado. Work in connection with this railroad was performed by sugar company and I became closely connected with terminal of it at Loveland and became familiar with line projected through territory and business of construction. That work brought me in touch with agricultural conditions. The problem of water supply connected with the sugar factory covered investigation of ditch and reservoir sites in immediate vicinity of factory.

With completion of sugar factory at Loveland, I took up my duties in connection with same work at factory then in process of construction at Eaton in 1903. Eaton is in the northeasterly section of the Poudre Valley and about eight or nine miles north of Greeley. These special problems coming up in connection with that factory were those of water supply, which required a consideration of returned waters to a natural draw that was tributary to the immediate vicinity of factory, and history of that draw and its returned waters were of the most important consideration. While engaged at that factory I was also interested in the growing of 100 acres of beets, which brought me in contact with the farmers of the community and also the officers of the ditch companies and reservoir companies. Also considered transportation problems connected with handling of the beet crop. It was necessary in connection with this factory,

to work out the storage or handling of beet pulp for feeding
1726 purposes; principally to cattle at that time. On completion of that work I was transferred to Fort Collins as headquarters and had under supervision construction of three factories in 1903: one at Fort Collins, one at Longmont, and one at Windsor. Had responsible charge of all three factories. This work brought me into consideration of many water supply problems of the valley, both at Windsor and Collins, and also on the St. Vrain.

These several factories I have mentioned are all for the purpose of manufacturing sugar from sugar beets. Their cost was considerable. The Loveland, Fort Collins and Longmont factories each cost a little more than $1,000,000, while the factories at Windsor and Eaton, being a little smaller in capacity, cost about $750,000 each. The factory at Greeley, Colorado, was built by another company but cost about the same as Eaton, $700,000 to $800,000. The company owning all these factories at the present time is The Great Western Sugar Company. They also own three other factories in the South Platte Valley, at Brush, Fort Morgan and Sterling, Colorado. Other than the last three mentioned, these sugar factories are within a radius of thirty miles, of which perhaps Windsor
1727 and Loveland are the center.

Every acre of sugar beets raised for these factories is on irrigated land. It would not be possible to raise sugar beets in Colorado successfully without irrigation.

Upon completion of these three factories in 1903 severed my connection with the construction company and entered private professional practice locating at Fort Collins. Engaged almost exclusively in irrigation construction and engineering. Constructed canals and reservoirs, outlets to reservoirs, detailed structures on canals and larger works of diversion dams and mountain ditches. My work required careful consideration of water supply of the valley, its expense and present and future development, value of water, which in turn covered problem of soil and character and amount of crops produced on the soil with the water. Also gave careful study to cost of production, net returns, markets and other factors entering into the general problem of irrigation and its economic conditions. My work in the years subsequent to 1904
1728 has led to necessity of investigation of many irrigation problems and in course of such investigations it became apparent from time to time that there were certain fixed matters in relation to these problems which would admit of a fixed system of analysis. This system is not yet complete but many features of it are just a natural analysis of conditions surrounding the development of irrigation I made a definite study of such a system of analysis, for the purpose of being able to advise definitely upon any question or problem that might arise concerning irrigation.

My special work at present time is that pertaining to general problems of irrigation which follow actual construction, problems of operation and relation between detailed use of water by farmers and operation of constructed works. It covers the essential
1729 problems of economic use and distribution of water.

The Costilla land grant contains about 500,000 acres.

Present plans contemplate irrigation of 75,000 acres and actual reclamation of about 20,000 acres for year 1913. The system of works at present constructed cost in the neighborhood of $2,000,000.

During time of my private practice of irrigation engineering at Fort Collins was associated in one way or another with almost every ditch and reservoir system in northern Colorado. Among the prominent ones for which I performed services are The Water Supply & Storage Company, which owns the Larimer County canal; The Larimer and Weld Irrigation Company, which owned the Eaton ditch, irrigating land around Eaton and Ault, Colorado; The Poudre Valley Reservoir Company, which had already constructed the Poudre Valley canal; the Divide Canal and Reservoir Company, which had under construction at that time the diversion of the system for the diversion of waters from the headwaters of Deadman and Sand Creek- tributary to the Laramie River: The North Poudre Irrigation Company, owning the North Poudre Canal diverting water from the North Fork of the Cache la Poudre; The Mountain Supply Ditch Company which irrigates land in the same vicinity as the North Poudre canal. The Mountain Supply Company is now absorbed by the North Poudre Irrigation Company. It originally owned canals constructed and in operation diverting water from the Michigan River, tributary of the North Platte, in North Park, Colorado. The water is brought across the divide from North Platte through Cameron Pass, a low point on the watershed between the North Platte and the Cache la Poudre Rivers. This water is then taken down the Cache la Poudre river and used on lands in
1731 that valley, largely under the North Poudre system by means of exchanges of water with the older canals in which the Company having the Michigan river diversion systems turn their water to the Divide Canal and Reservoir Company, and then they in turn give the former the water diverted from the Sand Creek diversion, which is a tributary to the lands the Mountain Supply Company were covering.

I also worked in connection with systems on the Big Thompson, Little Thompson, St. Vrain, and other streams and did some work in Wyoming in the neighborhood of Douglas and also some investigation in Texas, also on the Laramie Poudre system.

Constructed diversion works of considerable magnitude in Cache la Poudre river. One consisted of concrete dam across bed of river at head of the Larimer County Canal, including controlling works, all of which are built of concrete and steel. A very similar structure was installed at head of Larimer County No. 2 Irrigating Com-
1732 pany canal, and also the head of the New Mercer Canal. These latter ditches head on the river four or five miles west of Fort Collins. They irrigate lands south of Fort Collins. Also constructed minor works, such as outlet works of the No. 8 reservoir system of the Divide Canal and Reservoir Company, several dams and outlet works in connection with the system of The Mountain Supply Ditch Company, and enlargement of Clark Lakes and construction of concrete rip-rap on that lake. No concrete rip-rapping of reservoirs had been constructed in Colorado at the time of in-

stallation of that on Clark Lake. It was the first constructed in this State so far as I know. The usual method of rip-rapping reservoirs for the protection of the dams was by means of loose rock placed upon the slope of the embankment on the water side. In this particular instance the rock was not easily available, was expensive and of poor quality. We decided to use gravel and make a concrete rip-rap covering the entire face of the reservoir dam to a thickness of six inches, reinforced with steel wire. This consists of paving the interior slope of the reservoir with reinforced concrete.
1733 That system of rip-rapping reservoir embankments is almost universally used at present time in northern and eastern Colorado. This work which I I placed on this reservoir might be considered the pioneer in that line of construction in Colorado.

At time I first became acquainted with Poudre Valley in 1901, the general development had passed through the period of application of water directly from the stream and even through the period of reservoir development, which supplemented the direct supply from the stream, and was just entering into the period of maximum development with relation to flood waters. The agricultural development was of a very high type, and the development with relation to irrigation construction and use of water was also of high type. Irrigation had been practiced in that valley for perhaps 40 years. It was and had been of the nature that brought large returns and made a wealthy community. There were several cities in the valley having considerable population for agricultural communities.
1734 They had good schools, excellent transportation facilities and a reputation for products that was known all over the country. I refer particularly to the reputation for potatoes grown in the valley and the by-products of agriculture, the feeding of sheep and cattle in northern Colorado. This development had progressed until it was considered of the very highest in the state, if not in the west.

The section of the valley near Greeley, Eaton and Ault, is noted for its potatoes. The product is generally known in the commercial world as "Greeley Potatoes." Valley also had a very extensive reputation for the feeding and finishing of lambs for market. Alfalfa was particularly used in this industry. Commencing about 1900 the cultivation and production of sugar beets progressed. The Valley at that time had advanced to a very high state of development, in so far as it had been possible to reclaim the land by the then existing irrigation systems. It was considered a model for
1735 many parts of the country. There yet remained a considerable area of land in the northern and eastern parts of the valley that was still arable, but not irrigated. The area was perhaps two or three times that actually irrigated at that time. There were several hundred thousand acres of such land. The arid lands situate immediately adjacent to the then irrigated lands were of a very similar character. If anything, the arid lands were of a little better quality because the larger portion of the area was to the east and northeast of the then irrigated area and the soil of this arid land was of a little finer texture and its physical features were, perhaps

even better than those then irrigated and which were more immediately adjacent to the stream. The arid lands being bench lands were more of a uniform character than those previously irrigated.

The values of irrigated lands in the Cache la Poudre valley were quite uniform. This land is all in a high state of cultivation, with good improvements and water rights of almost equal value, so that lands anywhere in the Poudre Valley have values from $100 an acre to $250 per acre, depending slightly upon proximity to railroad stations, cities and a few conditions of that kind. There was a decided advance in the general values of the lands in the community at the time of the introduction of the sugar factories.

The primary need of the valley in 1900 and immediately thereafter, and for all time in the future will be the problem of securing water, and its application to lands of the valley which are still unreclaimed. The maximum use of the water will always be attempted. The most striking illustration of the practical expression of this need of the community is that of the construction of the Poudre Valley Canal of The Poudre Valley Reservoir Company's works. That project had its inception the latter part of the 90's, in about 1898 or 1899. In 1900 or 1901, there was constructed a large canal which had for its purpose utilization of the flood waters of the Cache la Poudre river. This canal was constructed through a very difficult and dangerous country for ditch construction. There were several available reservoir sites to the east of the point of diversion and this enterprise was commenced and the money was obtained from the farmers of the Cache la Poudre Valley for the enterprise. Many of the owners of lands under existing canals were interested in this development, and they believed at that time that there
1737 was sufficient water to justify the expense.

The canal is located at the upper reaches of the valley and at the point where the river leaves the mountainous country. It is the highest canal that has its headgate on the principal stream. The headgate is located about twelve miles above the city of Fort Collins. The construction of this canal entailed an expenditure of two or three times as much money as was first thought necessary. $600,000 was expended in the construction of the first sixteen miles of the canal and all of this money was obtained from the farmers of the Poudre Valley. The system was never entirely completed. The development covered such a large territory, in order to justify the initial expense of construction, that it was difficult to reconcile the water supply with the quantity of land to be irrigated. The available water supply was never really ascertained and it was impossible to interest the necessary capital to complete this work without a further supply of water from that which was apparent at that time.

I mean a greater supply of water than the Poudre River was
1738 able to furnish. Great difficulty was that there was not sufficient water in the Poudre River for the irrigation of the lands contemplated in the plans of the projectors. The original purpose of that canal was to obtain the flood waters in the river, or rather, the peak of the flood. Canal was very large and required such construction in order to handle that class of water supply. The

lands proposed for reclamation were immediately adjacent to and above the irrigated section of the valley reclaimed by the Larimer County Canal. The Poudre Valley Canal is now a part of the system of works of the Greeley-Poudre Irrigation District. To sum up my statements, the need for irrigation of lands in the Poudre Valley at that time not under irrigation caused the construction of the Poudre Valley canal in 1901. The available water supply was found insufficient to irrigate the lands the reclamation of which had been contemplated. Those lands are the same as those now in-
1739 cluded in the Greeley-Poudre Irrigation District.

Direct examination by Mr. Delph E. Carpenter:

Became acquainted with those who were projecting the Poudre Valley Canal while I was living at Eaton, Colo. By living in their community and meeting them, we frequently discussed the construction of this canal. I also learned the needs of the community, the hopes and aspirations of the projectors with relation to this proposition. This was in 1902. In 1904, when I took up the general practice of engineering at Fort Collins, I became identified with the property directly. That year was one of great floods in the Cache la Poudre river. The works constructed by The Poudre Valley Reservoir Company were not as yet seasoned. The canal was badly crippled by the excessive floods. I was employed in reconstruction of canal. That portion of canal immediately below head-
gate had been damaged and also the portion on the steep
1740 hillside close to the valley. The great floods had more than filled the canal and had overtopped its banks and washed out large sections. These sections were situated on steep hillsides and the material was of a treacherous character and difficult of reconstruction. It involved some special and new problems along the line of construction. Core-walls were installed to strengthen the high fills. The previous alignment of the canal made reconstruction where the sections were washed out very difficult, requiring loose rock construction and concrete toe walls, and even concrete lining was considered for some of the sections. I had the designing and supervision of most of these repairs. This included reconstruction of the headworks and a large fill across the Hook and Moore draw, and the facing of that fill with concrete rip-rap. Also construction of overflow sections and regulating gates for floods a short distance below that draw. Also repair of sections of canal between that point and Shipp's Hill and the draw immediately adjacent thereto. Also several sections in the vicinity of Dry Creek north of the Douglas Reservoir. During that time I became even more familiar with the entire system and its details.

1741 After building first 16 miles of this canal, the farmers were unable to go further for reasons I have already given. The farmers' company was known as The Poudre Valley Reservoir Company. The Greeley-Poudre Irrigation District is the successor of that Company. This District has continued the efforts of those farmers. The Poudre Valley Reservoir Company had completed

the first 16 miles of the Poudre Valley Canal and the Douglas Reservoir. They contemplated the construction of Cobb Lake Reservoir and commenced a small portion of work in that construction. Douglas Reservoir is situate beneath the canal and just a little above the then terminus. Waters stored in this reservoir have to be utilized by means of exchange system practiced in the Poudre Valley. This exchange permits the Company owning water in this reservoir to deliver the same into canals below the reservoir and take out an equivalent amount of water from the stream at the head of the canal, which water in turn is run through the canal and used for the irri-
1742 gation of lands irrigable from it.

The distribution and diversion of water generally in the Cache la Poudre is one great system of exchanges and inter-exchanges. The administration has developed a means of changing and exchanging and inter-changing water so as to bring about the most economical and maximum use of the waters of the river.

I was associated with The Laramie Poudre Reservoirs & Irrigation Company in a professional way. I was also connected with its predecessor, The Laramie Reservoirs & Irrigation Company. I was also connected with The Laramie Tunnels, Ditches and Feeders Company, a partnership, as I understood it, which was the predecessor of The Laramie Reservoirs & Irrigation Company. This Laramie Tunnels, Ditches and Feeders Company was commonly known as the Link and Akin Company.

My first acquaintance with the Laramie River Valley was in 1904. At that time investigation was made and work performed upon a system of diversions for the Divide Canal and Reservoirs Company in the summer of 1904 at headwaters of Deadman Creek. This work was construction of the old Wilson Supply Ditch. This work
1743 made me familiar with the Laramie Valley.

My first acquaintance with the Greeley-Poudre Project in the Laramie Valley was in 1904, when there was under consideration a diversion of water from the Laramie River to the Cache la Poudre river by means of a tunnel. The matter was brought to my attention and discussed. Persons working on the project consulted me at that time. I began active operations in connection with that system in 1905. Made some personal and extensive investigations in connection with the project.

My work in 1905 consisted of a general analysis and special detailed surveys as a means of applying the water from the Laramie river to lands in the Cache la Poudre Valley, and also work in connection with the settlements between the contractors and the owners of the Laramie River system, upon work done on the Laramie river system in the year 1904, upon the unit of the Greeley-Poudre system now called the Rawah Ditch. It is sometimes called the Upper Supply Ditch, and is situated on the west side of the Laramie river valley at an altitude of about 10,500 feet, and work had been done the year previous and the contractors were forced to go out of the country on account of the snow, and final and complete estimates were not made that year but were completed and made by me in 1905. This

required me to go over that work already done in great detail for purpose of estimate.

1744 The work performed to that date was of a very good character. Very good class of mountain ditch construction. Between 4,500 and 5,000 feet of mountain ditch construction had been completed at that time. There was considerable solid rock and loose rock material, not perhaps very heavy construction. There had been actual construction done before I became associated with the project. A considerable amount of such work had been done; roads were built to the works, clearing had been done to a great extent, necessary preliminary work had been performed. The 1904 work had progressed under the direct supervision of Mr. Zac T. Duvall, an engineer of Denver, Colorado. In 1904 some work had been done by Mr. R. Q. Tenney, of Fort Collins, prior to the time that Mr. Duvall was employed.

In 1905 I found a road constructed from the Valley of the Laramie proper, up the West Fork to the work outlined, and to Rawah Creek, which is in a very rough section of the country, and involves a difference in elevation of about 2,000 feet in two or three

1745 miles. This was a very heavy piece of road work. There was also a road constructed from the State Road to the north of this property. This road was constructed from the State Road in a southerly direction to the upper end of the Rawah system in the neighborhood of McIntyre Creek and the Rawah diversion. It was about seven miles long. The principal obstacle that had been encountered in the construction of that highway was the heavy timber, both green and fallen. Several sections of that road were constructed through a burnt timber district, in which the trees had fallen and it was required to clear that and remove the boulders from the surface, thereby usually permitting a pretty good road to be constructed. These two roads penetrated a country which in fact had never had even trails previously. It was a country ranging in elevation from 8,500 to 11,000 feet, and even higher elevations. It was in the region of perpetual snow and was very wet during the summer time and required many structures of corduroy to make the roads passable over swampy places. The construction of these roads was an absolute necessity before beginning active ditch construction, as there was no other means of getting into the country. It would be impractical to pack materials, tools, machinery and supplies that would be necessary for the work contemplated in that region.

1746 The region thus penetrated by these roads is one of short working seasons, lasting from July 1st to October 1st out of the year. Sometimes the season is even shorter than that, depending on the snowfall and the character of the spring, which causes heavy thaws and a greater run-off. From October 1st snow storms are frequent and snow gets very deep and it is impracticable and impossible to do any such work. This canal is very close to timber line. The region above the line of this canal has peaks above an elevation of 13,000 feet and is the region of perpetual snow.

I found the first work upon this system and in this inaccessible

region performed. There had also been considerable surveying and clearing and other work done on the system preceding that time.

In 1905 I found then surveyed and in process of construction the system of irrigation works afterwards constructed. It was substantially the system as it exists today, that is, the main features
1747 are the same. The details have been worked out in somewhat different lines and some changes of a slight character have been made, but in the main the system is the same. I found the tunnel line located and surveyed.

The final line of the tunnel was placed on exactly the same line that I found surveyed in 1905, after all possible other considerations had later been taken into account. That was the line of the Duvall and the Tenney surveys. The collection ditches of the present system were substantially outlined at that time. Minor changes, due mostly to the size and character of the enterprise and the existing conditions, and also brought about by a better class of construction than originally contemplated, have been made. The system as a whole is the same for all practical purposes. As an example of the slight departures made, I will state that the system of collection ditches on the west side was designed to catch water on that slope from the drainage area, and on account of physical obstacles it was then proposed to take the water across the valley in a pipe line. These difficulties were great cliffs of rock, very heavy construction and some
1748 very dangerous. I discarded the idea of the siphon line across the valley and substituted a tunnel on the ditch. A tunnel was projected in place of the siphon and a continuous ditch was constructed along the west side for the purpose of diverting and carrying that water. There were several tunnels on that line. These tunnels vary from 100 feet to 800 or 900 feet in length.
1748 Tunnels are substituted for siphons. Are more permanent. These changes made no difference on diversion of water, object was just the same.

Other than time I have mentioned, the major portion of my time was spent on this enterprise on the plains, in 1905. The relation of the plains work to the Laramie river work was that of working out the details connected with the work of distribution and application of that water to lands in the Poudre Valley. It was work on the same general project, in fact, it was the lower end of the same project, the distribution end. Diversion without distribution would be of
1749 absolutely no value. This plains work was only a portion of the same thing, one is as essential as the other. If no distribution were provided, the water would flow down the stream and be wasted or taken out by other appropriators who would furnish distribution.

During 1905 the Company was preparing itself for expensive financing necessary to development of this project and such work was performed as could be done with the means at hand. It was impossible to work in the mountains during winter months, due to heavy snow in that locality. Impossible to get in and impracticable to do work. Work was always going on somewhere in connection with the project, it never ceased. It was continuous. The Company

was also considering at that time its relation to other companies on the river and negotiations were going on between various companies and this Company for the purpose of obtaining the works of construction and rights and water of various companies involved and considered in this development, with object of merging. It was found necessary to merge several of these properties into one to make a practical proposition.

1750 Wellington Hibbard was the main man at that time in promotion of this proposition. His entire time was given to it. He had active and personal charge of the enterprise in all its phases, financially and otherwise. He made several trips to Chicago, St. Louis and Omaha during that season. He was constantly spending money towards completion of project. He was killed in connection with this enterprise while making a trip to the tunnel in the year 1910. His services had been continuous, and his entire time had been given to the project from the time he first associated with it until the time of his death. He had no other business.

Other individuals were associated with Mr. Hibbard in his work and gave it their constant efforts. I had responsible charge of the engineering and was Chief Engineer from 1907. Prior to 1907 my work with project was more in nature of occasional consultation in necessary work connected with it, and with detailed work. Was out on the works and often in charge, but at that time under another engineer.

1751 In 1905 and 1906, we considered almost every piece of property on Cache la Poudre river in connection with this system, and surveys were made in these computations. Lines of distribution, water supplies, lands to be irrigated, and how the system could be used in connection with other systems for distribution were considered; necessary surveys from reservoirs and lands, several of which went as far as the Crow Creek country east of the Union Pacific Railroad. Other work was done in connection with system at upper end taking into consideration group of reservoirs then belonging to The North Poudre Irrigation Company and its relation to this system.

1752 This involved surveys for the different reservoirs and computations were made as to capacity and cost of incorporating them into general system. Also investigated possible supply from Big Thompson and Boyd Lakes, to ascertain possibility of utilizing this water by exchange methods with Cache la Poudre Valley and its system. Conducted further investigations of Eastman Canal and Reservoir Company. This was later absorbed into system. It constitutes that portion of the Greeley-Poudre system known as the McGrew Reservoir and its inlet canal, now a portion of the Greeley-Poudre canal. It was the portion of work located directly east of Nunn, a distance of seven or eight miles. This Company had also completed outlet tube to lake which is now called McGrew Reservoir. The inlet that was then completed consisted of that portion of the Greeley-Poudre Canal that extends from Eastman Creek into Reservoir, a distance of seven or eight miles.

There are examples of work which was generally going on during

that time. The works were numerous and entailed a very careful consideration of large number of systems of Cache la Poudre valley. Expenditure of money on the system was constant during years 1905 and 1906, principally along lines I have mentioned. During those two years there were employees on Laramie river in charge of project.

As another example of work that took place during years 1905 and 1906, the matter of diverting water from Laramie River watershed into Cache la Poudre watershed was considered and investigation was made as to other means of diverting this water outside of the tunnel then surveyed and contemplated. Investigation was made to divert the same water by means of canal and other works of similar character, around the watershed to the north, extending into Wyoming and across the divide between the Poudre and the Laramie at a point known as Fish Creek Divide, near Tie Siding, in Wyoming.

In connection with development of an enterprise as large as the Greeley-Poudre, involving large expenditure of money, it is always necessary and customary to investigate every possible means of accomplishing the same general end by the cheapest and best means. Any idea that suggested itself was thoroughly investigated and reported upon.

1754 In 1907 upper unit of Laramie River portion of works, known as Rawah unit was extended and surveys were made in connection with the canals and works of that entire unit. The work covering the largest expense was in connection with the Upper Rawah Ditch, upon which considerable work was done that season. The entire season was used with all the men that it was possible to get up there and as high as 100 were employed, the nature of the work being such that it was impractical to employ more men than that.

In beginning of season 1907 labor conditions were favorable, men were hard to get in a region of that kind, work was plentiful and after considerable negotiation along those lines finally some foreign labor was used in construction.

The usual method of going at that class of work is by first getting into the region in any possible manner, oftentimes by foot or on pack horses, making a preliminary survey, seeing whether it is possible to divert certain waters over or through certain places for delivery at a certain point, and upon finding that that is possible, re-

1755 running such lines and making them more definite and permanent. After this follows the work of clearing. Consideration of snow obstruction makes it necessary to clear a wide strip for construction of such ditches and this work is usually through very heavy timber. After clearing is done lines are rerun and cross-sections made for the actual beginning of excavation. Details of such construction usually involve the task of obtaining best possible results from material at hand. It involves preparation of face of bank, leaving the finer and more impervious material on the inner side. Where hillsides are very steep it is often required to have means of holding loose material and larger material, which has tendency to roll to bottom of slopes and which is often required for

support of embankment. It is necessary to put in rock cribs and loose rock retaining wall construction to make a good class of work.

Roads are necessary before heavy work of excavation is commenced. Construction of roads required use of large amount of tools, machinery, powder and supplies and expense of material in these localities is oftentimes very great.

Cost of transportation of materials from supply station at base of mountain on the Laramie river to the Upper Rawah Ditch was as great as cost of transportation of material from Ft. Collins or Laramie to this supply station. The distance in the first instance is seven miles, while in the latter instance it is 65 or 70 miles. The
1756 principal reason for the difference of this condition is the grades to overcome, the difference in elevation being about 2,000 feet in three or four miles, and requiring six horses for hauling of ton of material.

We had a fixed wagon freight rate from Fort Collins and Laramie to the supply station on Laramie River, located in immediate vicinity of junction of the East Fork with the West Fork of the Laramie. The rate was $1.10 per 100 lbs. to that point, with $1.00 per hundred from there on to the construction camp at the Upper Rawah. Fort Collins, Colorado, and Laramie, Wyoming, were nearest railroad stations. Laborers were taken up at same rate as freight; they were weighed and hauled by weight.

1757 In 1907 there was completed on Upper Rawah Ditch the section of canal from its discharge into the West Fork, intersecting Fall Creek and Rapid Creek, around the divide between Rapid Creek and Rawah Creek to a point in the neighborhood of Camp Lake. Clearing and surface work was done as far as Camp Lake. Several hundred feet of excavation was opened up at the upper part of this clearing, but snow stopped work and parties were obliged to cease just as snow found them so that certain portions of upper line were not entirely completed. Work was done on upper Rawah Ditch in 1908. Measuring weir was put in, ditch was opened up and water run and there were several men working up there all through summer. In 1909 and 1910 a small force of men was em-
ployed on that ditch, but not as large as in 1907. Between
1758 1904 and 1910 inclusive, there was expended about $47,000 in construction on Upper Rawah Ditch.

Conditions surrounding labor in the locality were such that it was very hard to keep them there when labor was scarce. They stay a short time and usually want to get out quickly. We employed a system of making it financially attractive to those who would stay an entire season by increasing pay at end of time and all laborers were taken up there with understanding that if they would remain for a certain time their transportation would be paid out.

In 1905 and 1906 diversion of this water from Laramie River and its effect upon the stream and interests along river were investigated by me. Data was collected and brought into shape, hydrographs were made of the flow and computations made of supply available at the various points of diversion for the best design of works and other information of general value obtained. This work in-

volved expenditure of money, largely in office force. It con-
1759 tinued entire time we were employed on river. We consid-
ered matters of hydro-electric development and like subjects. No especial hydrographic work was done by company at their own expense but records of state of Wyoming, State of Colorado and the U. S. Geological Survey were all considered and consulted and used in connection with system. Also considered appropriations of ditches then constructed from Laramie River in Laramie Plains region,—their size and other factors.

In 1905 and 1906 surveys were made in connection with general project to verify wisdom of building tunnel. Investigations of every possible means of diverting water were carried on. Laramie River Reservoir was surveyed in connection with survey for purpose of ascertaining feasibility of diversion of water from Laramie River drainage through the reservoir and an outlet canal from it in place of tunnel and collecting ditches. Had this plan been feasible we could have eliminated all construction of mountain ditches and tunnels. It would have resulted in construction of reservoir in channel of river, collecting all water above it and supplying it into a canal below. This canal would carry water around divide into North Fork of Cache La Poudre River. Preliminary survey for this was first made in 1905 merely to ascertain conditions surrounding two watersheds. Definite location survey was made in 1906 for this and completed October 1. A heavy snow storm at that time covered country to depth of perhaps 36 inches making a continuation of work impossible.

1761 The result of this survey in 1906 was that it was impracticable to build this canal and the company decided upon the construction of the tunnel as the only means of diverting that water.

In 1908 another investigation of this means of obtaining water and avoiding building tunnel was carried on. In that year a complete survey was made and George C. Anderson of Denver, a consulting engineer, was taken over the entire line and a report made. This detailed survey and investigation confirmed the former views and report and confirmed conclusions the Company had reached in 1905 and 1906. It required a ditch of about 100 miles in
1762 length with obstacles of every possible nature, steep hillsides, unsuitable material, broken and disintegrated rock, and conditions were such that under ordinary ditch construction, water turned in at head of canal would undoubtedly be lost before it reached lower end unless canal were lined. Many tunnels were necessary; also siphons and flumes, and character of country required special construction for almost the entire length of canal. That means of diverting water was entirely abandoned after that time. It would have cost about $30,000 per mile and 100 miles of that canal would make the cost beyond consideration.

1763 Several different tunnel sites were considered and their relations to the collecting ditch system. Different elevations of the collecting system, different lengths of tunnel, different means of regulating water into tunnel and such investigations and com-

putations as were necessary to weigh and balance the various propositions and find the one most economical and best suited for conditions of development, were considered and surveys made to ascertain the facts.

As a result of all these investigations I am of opinion that the system of works of the Greeley Poudre district now in process of construction on Laramie river represent the final development for diverting water from the Laramie River watershed in the State of Colorado. There is no possible way of diverting any more water from the Laramie River at a point lower down and conveying it over into the Cache la Poudre Valley. The topography of the country lying between the Laramie River Valley and Cache la Poudre Valley prevents this. One of the main reasons is existence of a spur of mountains making a secondary divide, the one upon which Sand Creek Pass is located, and any point below the present tunnel site gets into a country where the divide widens out so great that tunnelling is impracticable, and the only way to get around is by an open ditch or means similar to it. Thus a ditch could not divert water at any point below the Laramie River Reservoir because of difference of elevation between that point and the divide between the Poudre and and the Laramie, which is about 225 feet, and which would be consumed in grade of canals conveying water. The drainage area contributing to such a ditch is but a few square miles more than that now drained by the Greeley-Poudre system; a little strip of land a mile wide and eight or nine miles in length. It is in the bottom of the Laramie River Valley. The area I refer to is that portion represented by white on the map Exhibit 1, appearing between the two colored portions of the drainage ares of the Laramie river available to the present diversion system. The Laramie River Reservoir, of which I speak, was about three-fourths of a mile south of the point on the map marked Glendevey, and just about the point where township line crosses Laramie river as represented on map, north line of township 2 north, range 76 west. The ditch of which I spoke would discharge into the Cache la Poudre drainage area on divide indicated on map south and west of Tie Siding, Wyoming, about north line of Section 11, Tp. 12 N., R. 73 W.; between reservoir and this point this ditch would run entirely on north and west side of line indicating divide, beginning at reservoir, running parallel to Laramie River, getting into Wyoming in Tp. 12 N., Range 76 W., then coming into drainage area of Sand Creek and its tributaries and going back into Colorado, crossing Sand Creek Valley almost parallel to brown line indicated on Exhibit 1 as ridge between Laramie drainage area and Poudre drainage area, at distance of about six miles from crest. Ditch line would be very crooked. It would be of character indicative of general topography of mountain country through which it runs. With Greeley-Poudre system operating, the amount of water obtainable through such a canal would be very small.

1766 . I do not think it would be possible to take out a ditch or a tunnel line to divert water at a lower point on Laramie river. The tunnel sites are certainly prohibitive, not less than six miles in

length and the many miles of open ditch work would lose the entire flow of the drainage area.

My conclusion was and is that the Greeley-Poudre tunnel is the only means of diversion between Laramie river and the Poudre. It represents the final economical development for purposes of diverting water from Laramie drainage to Poudre drainage.

Surveys of Laramie reservoir were completed, but it was separate and apart from the system commonly called the Greeley-Poudre system. It was surveyed and mapped as a subsequent and junior enterprise. It was surveyed sometime in November, 1906. Rights of way were later purchased and owned by Company doing
1767 the Greeley-Poudre development. Later, those in charge of construction of a system in Wyoming—The Interstate Reservoir Company—interfered with the development and construction of this reservoir. This was after our survey. The Company consisted of F. C. Grable, F. S. Wendelken and some parties at Laramie, I think Mr. Bell was connected with it. They made application to National Government for rights of way which interfered with our work. We considered it was a proposition that would not be necessary in contemplation with our system and abandoned it for the time and no further steps were taken to perfect that portion of the work. There was some controversy over the dam site and the location of the section corner there. A careful survey showed that two sets of section corners existed along that township line, partly overlapping the sections of one township over another, and controversy arose as to the exact location, and upon whose property the dam site was located. It finally worked out that some rights of way were obtained by the Wyoming people from the government. This resulted from the overlapping of these section lines.

The work performed on upper Rawah ditch during 1907 was a part of the general work going on over entire system. There was other work going on at that time on plains division. That work opened up about April 1, 1907. Prior to April, 1907, plains work was generally outlined and a definite location with cross-sections marked. Purchase of rights of way was commenced in 1907 and actual excavation was commenced immediately after.

In 1905-06 there was a plan of financing the development by which money was to be raised from contracts to deliver water to land owners in the territory now known as the Greeley-Poudre Irrigation District, by issuance and sale of bonds of Company, and a considerable amount of money was obtained and spent through that plan of financing. Part of money thus obtained went into Upper Rawah Ditch. In the spring of 1907 active operations on excavation began on plains, rights of way were purchased and arrangements were made with various enterprises which were to be linked up with this system. Construction work was done on not less than 30 to 35 miles at various points. It was impossible to get rights of way at some places and condemnation proceedings were commenced and construction work had to proceed at intervals along line, thus making continuous ditch impossible. Work was carried on through entire year of 1907. A large amount was done,

principally in the vicinity of Wellington, Colorado, and a little to east. All to east and along the line of the extension of the Poudre Valley Canal. That is same line of canal commonly known as Greeley-Poudre Canal. It is indicated on Exhibit 1 by red line along north border of colored area and to west of such area indicated by red line. It is the upper canal of the Greeley-Poudre system.

1770 General construction went on over the entire system of which I have spoken. Work on plains was that of ordinary earth work construction of the vicinity and the outfits usually consisted of men and teams with fresnos and slips, and at that time we had an elevating grader and steam engines for pulling. Had two of these outfits on this line of canal. There were six or seven team outfits averaging 15 to 20 teams per outfit. Three and four horses were used on fresnos, and two horses on slips. There was some rock excavation requiring use of powder and materials were taken out with carts and stone-boats.

This work continued entire year of 1907 and into year 1908. It continued after we had ceased labor on Upper Rawah Ditch in fall of 1907. The force employed on the Upper Rawah Ditch on Laramie River division, when compelled to come out on account of weather conditions, continued the work on the plains division.

1771 In fall of 1907 financial panic interfered to some degree with finances of Company. To overcome the situation there was issued by Company obligations called script, which obligated Company to pay same out of first moneys derived from sale of bonds of Company in future. About $50,000 of such indebtedness was incurred. It was all used in keeping up work on system after October, 1907. Its full value was received in work upon system after panic. In 1907 some work was done on Mitchell Lakes, which are part of system located on Poudre river drainage. This was small compared with expenditures on other portions of system.

In 1907 and 1908 $129,572.00 was expended on actual construction on the system, in addition to overhead expenses. That was all expended in construction of the Greeley-Poudre system. The experience of 1907 required re-[illegible]ation but there was a little work done in 190[illegible].

1772 In 1908 work was done on [illegible] pper Rawah Ditch and some work done on plains. About $25,000 was expended in 1908 on the work. In that year a financial reorganization took place as the result of the panic of 1907. This reorganization terminated in the organization of the Greeley-Poudre Irrigation District. An irrigation district was organized under the laws of the State of Colorado which issued bonds upon lands embraced within the district and a contract was made with the parties then owning the system of works contemplated for the reclamation of that land, for completion of system from Laramie and Poudre rivers and for payment of work and properties in bounds of district. The total bond issue was $5,100,000. Contract was for payment of $5,000,000 in bonds to Company. Payment was to be made to our Company, The Laramie-Poudre Reservoirs and Irrigation Com-

pany. The work was designed in detail. A contract was made and work immediately commenced on the final completion of the enterprise and the development of these properties.

System of works on the Laramie river division or portion provided for completion in this contract was substantially the same as contemplated when I first became acquainted with the system in 1904. Variances were absolutely those of detail. No features of any importance, having any essential differences in amount of water or character of construction or extent of construction were involved. It was the same system upon which my employers had been spending money during the years following 1904.

I have heard Mr. Wortham's testimony concerning details of the Greeley-Poudre Tunnel, power plant installed to make that construction possible, the dimensions, capacities, &c. of the collection ditches and general description of works. It is substantially correct.

The tunnel unit includes control works, approach cuts and outlet construction. There was about $600,000 expended on this unit.

More active work on the collection ditches on Laramie river side was closed down during my time as engineer. The tunnel work continued after that until it was completed. I severed my employment with the Laramie-Poudre Reservoirs and Irrigation Company in February, 1911. I have since been upon the works a number of times. Have done a little work in connection with the property since that time. Am familiar with the work up to date.

1774 About 42% of entire West Side collection ditch is completed on Laramie river. About 30% of East Side Collection Ditch is entirely completed. There are other portions of these ditches that are partly completed. The percentage of this latter work is based upon amount of money that it would cost to finish it and amount it cost to do work that has been done. It is not percentage in feet, but percentage in actual money necessary to complete.

The difficult portions of West Side Collection Ditch are complete. The easier portions are to be done, with exception of one or two tunnels. West Side collection ditch has been very heavy work.

Of East Side Collection Ditch the greater portion yet to be completed is what is known as Porter Creek division. The Deadman and Nunn Creek divisions are practically done. The crews

1775 at work on these two collection ditches were stopped about October 1, 1910. Some tunnel work was continued during winter of 1910 and 1911 under special arrangement. It was not settled at time I left employment of Company. I am not exactly posted as to how much was done.

Primary cause of shutting down work on ditches was lack of money to pay contractors. Money had to be obtained by sale of bonds of irrigation district. The suit or threatened suit of Wyoming against the State of Colorado interfered with the sale of bonds. Death of principal member of bond house interfered. Failure of several other irrigation properties and general decline of irrigation securities also interfered.

I am not personally familiar with extent to which Wyoming offi-

cials had been interfering with the sale of these bonds through various channels. I had heard of it and was advised of it and certainly saw the results of it at the time. I was familiar with the activities of one Francis C. Grable in that regard.

1776 Work and expenditure of money upon the system now known as the Greeley-Poudre system was continuous and uninterrupted from 1904 until February, 1911, at the time I severed my connection with the Company. It was done under some difficulties and conditions that showed remarkable progress for those conditions and difficulties.

The difference in time required to construct a system like the Laramie River diversion system, compared with one constructed on plains region near transportation might be explained thus: Laramie River system is in a region inaccessible; supplies, etc., must be hauled by wagon. Material encountered is of character much harder to work than that upon plains and cost is many times more and from the nature of things surrounding that class of construction, it is impossible to do that work in anywhere near the same time that similar work is done down on the plains. Shortness of working season in mountains creates an obstacle in the way of speedy construction. The character and class of workmen required usually employed on such work must be found and there is much loss of time in beginning of each season's work on such construction. Working season closes early in fall. That necessitates entire abandonment of forces when work is shut down and reorganization in spring.

1777 I might illustrate the difference between time required to build a mile of mountain ditches as compared with a mile of similar canal in plains districts by difference of cost. A ditch of same capacity on plains as our mountain ditches would cost in the neighborhood of $1,000 per mile. Up in mountains it would cost $30,000 per mile, and a mile of plains ditches can be built in a matter of several weeks, while a mile in the mountains may take a year, taking nearly all the men you can get on that mile to do it in one season's work. Work can be carried on throughout the entire year on the plans. Mountain construction entails a certain knowledge of handling that class of material, requiring powder and drilling, and consequently a class of men that are more experienced and expert in that work. Ordinary labor obtained for driving teams on plains ditch construction is impractical on mountain ditch construction.

Am familiar with Sky Line Canal of The Water Supply & Storage Company, its history and construction. The Sky Line Ditch was contemplated and under construction for several years and has been under reconstruction almost continually since, covering a period from 1890 to present time.

1778 Ditches on Greeley-Poudre system have been designed on somewhat different lines than Sky Line Ditch, and although it is not to be expected that troubles will not arise, they have been guarded against as much as possible in that construction, and with reasonable care in operating they should give very little trouble, and

yet they have been under construction for a fewer number of years. Much more work has been done on system of Greeley-Poudre than on the whole Sky Line Canal.

When we found finances would be limited for completion, the consideration of whole work involved determined the necessity of continuing work on tunnel and discontinuing it on other portions of enterprise, so that tunnel was continued and finished while the remainder of the work was discontinued. Tunnel may be considered most important unit of the system. It is the means of diverting water through the divide between the watersheds and is very important. Tunnel completed August of 1911.

1779 Average rate of progress on tunnel compares favorably with any tunnels built in this or foreign countires. Rate has even been considered as almost world's record. Conditions were very favorable to quick construction with plenty of power and fairly good materials.

$1,825,000 had been expended on Greeley-Poudre system at time I severed connection with enterprise. This was cash. In bonds it would represent a considerably larger figure. Bonds had to be negotiated at less than par.

In 1905 and 1906 and other years I made series of investigations concerning available water supply for Greeley-Poudre system on Laramie river. Net results and conclusions were that we could not divert by that system more than twenty-five per cent of flow of that river at inter-state line. This did not include the run-off of such tributaries as Johnson, Beaver and Sand Creek-, which enter the stream proper north of the state line.

1780 During the years I was connected with enterprise I formed general conclusions as to relative agricultural values and development of two areas, Laramie Valley and Poudre Valley. The matter of relative values of agriculture was carefully considered from the very beginning. Cache la Poudre Valley was a section well known and its values readily obtainable. Results obtained from application of water in that valley were increasing from year to year and net crop returns from irrigation were such as to warrant expenditure of money that would justify getting water from remote places at high cost.

General agricultural conditions on Laramie Plains were studied, crop results and returns were investigated and general conclusions reached from all investigations, that water was north many times more in Cache la Poudre Valley than in Laramie Valley. Results show that principal use of water on Laramie watershed was for irrigation of meadows and production of hay with some agricultural development at lower end of valley. In upper reaches hay and pasturage was principal use of water.

1781 By careful analysis it seemed that about one-half ton of hay per acre was obtained on Laramie Plains from irrigated meadows. That has value of from $6.00 to $8.00 per ton, making gross return $4.00 on Laramie Plains. This was figured from the basis of hay production. Growing of other agricultural products had

been attempted there, but had not amounted to anything. Were very expensive and at no time showed any very promising results.

Climatic conditions of Laramie Plains area was such as to almost exclude all of grains and other grasses than native grasses. Wheatland area was not taken into consideration so very thoroughly on account of conclusion we reached that there was plenty of water for that area from the stream after the total diversion had been made.

In the Cache la Poudre Valley crop returns have been growing from year to year. The sugar beet industry made a great difference in values and growing of onions, cabbages and such products has increased values considerably.

Perhaps an average comparison of the two areas might be taken on the hay production, gross return of $4.00 per acre, while the returns from the various crops in the Poudre Valley would give a gross crop return in the neighborhood of from $30 to $35, many products even much more than that, beets always yielding more than that, cabbage as high as $400 to $500 per acre, and the same is true of onions.

In the Cache la Poudre Valley grains produce regularly and uniformly; alfalfa production is from three to four tons of weighed dry hay per acre. Market conditions of the Poudre Valley give prices considerably higher than those on the Laramie Plains, even for similar products.

1782 In arriving at agricultural values of the two areas, both gross and net returns were considered. I believe the net crop return values should be considered. There is always an element of cost of production that varies from section to section, which should receive consideration. Assuming that the same character of cultivation would be required for any highly cultivated agricultural crops raised in either valley, the cultivation in Wyoming would undoubtedly be more expensive. The soil conditions are somewhat different, labor conditions are different, the care and character of its distribution works are different, and the amount of water applied would make some difference; it would be a little more in Wyoming than in Colorado.

It takes considerably more water to irrigate an acre of native hay under Wyoming methods than it does to irrigate an acre of cabbage in the Poudre Valley. The Wyoming methods are of a continuous nature, turning on the water when the conditions seem about right, and allowing it to run upon the meadows for a long period, taking off the water, permitting the ground to dry up and then harvesting the crop. In the Cache la Poudre Valley the system permits of the use of water when absolutely necessary. An economical use of the water is thus obtained. In quantity the average is very low.

I think the duty of the water is more than double in the Cache la Poudre Valley than it is in the Laramie Valley, so that the amount of water it takes to produce a $4.00 hay return from an irrigated acre of meadow in the Laramie Valley would produce as high as $1,000 gross returns from cabbage lands in the Poudre Valley.

I would not class the Laramie Plains as an agricultural section.

We arrived at the conclusion that our diversion would work no in-

terference or damage to the Wheatland enterprise, nor to the Laramie Plains. Later constructions in the Laramie Valley verified my deductions in that respect.

1783 Cross-examination by Mr. N. E. Corthell:

I first came to Colorado in the spring of 1901, and was engaged in engineering work in connection with sugar factories until 1904, when I entered the general practice as civil engineer at Fort Collins, and continued in the same until the middle of April, 1913, when I engaged in southern Colorado and northern New Mexico. Since April, 1913, I have had nothing to do with engineering work in the Poudre country.

1784 From 1904 to 1907 I was not engaged exclusively with the Laramie-Poudre projects, but after that time practically all of my time was given to those matters. I entered upon this employment about April 1st, 1907, being engaged by the Laramie-Poudre Reservoirs and Irrigation Company, the reorganization occurring about that time, and this employment continued until February, 1911.

1785 After February, 1911, I did no field work on the Greeley-Poudre project, but from time to time I performed services as consulting engineer in computing costs and making reports. During the greater part of 1904 I was employed by the Poudre Valley Reservoir Company, which owns the Poudre Valley Ditch, the Douglas Reservoir, and a part of the Cobb Lake Reservoir site, my work being the repairing and the reconstruction of the Poudre Valley Ditch.

1786 The Poudre Valley Ditch did not serve any lands within the present Greeley-Poudre irrigation district. It was designed to serve the land that could be irrigated from a canal extending as an outlet ditch from Cobb Lake reservoir and lying east of that reservoir. The Poudre Valley Ditch was never constructed as far as Cobb Lake by the Poudre Valley Reservoir Company. It ended at Rocky Ridge, about 12 miles north of Fort Collins and 3 miles west of Wellington, where it discharged into a system of reservoirs owned by the North Poudre Irrigation Company, which owned a large part of the stock of the Poudre Valley Reservoir Company.

1787 This point was about 13 miles from Cobb Lake, the high water line of which is about 25 or 30 feet below the grade line of the canal.

No body of land was segregated to be irrigated from the contemplated extension of the Poudre Valley Ditch, and the plans with reference to such extension were not at that time very definitely worked out. I remember going over this matter with the men connected with the Poudre Valley Reservoir Company and they always considered that they would extend the upper line, and they kept that line up to the highest possible grade. The first development of the exchange system would be to extend that line, or if it were not

extended, a line from the bottom of Cobb Lake could be constructed to cover the extensive area.

1788 The stockholders of the Poudre Valley Reservoir Company were principally farmers in the neighborhood of Ault, Eaton, Windsor, and Fort Collins, and the North Poudre Irrigation Company itself. The stockholders of the North Poudre Company were land owners under that Company's system lying in the Wellington district. The North Poudre Irrigation Company owns several properties under the Fossil Creek Reservoir, and the North Poudre Reservoirs Nos. 5, 6, 7 and 9, which were remote from the lands to be irrigated, and which were used as a basis of exchange whereby the canal of the North Poudre Irrigation Company could take water from the river at its headgate, furnishing water from these
1789 reservoirs to those with whom the exchange was made. The interest which the Greeley-Poudre Irrigation District has acquired in the project of the Poudre Valley Irrigation Company, was acquired in this way: In 1908 the Laramie-Poudre Reservoirs and Irrigation Company acquired from the North Poudre Irrigation Company a large part of the stock of the Poudre Valley Reservoir Company, and purchased enough outside stock to acquire the controlling interest, and this controlling interest was transferred to the Greeley-Poudre Irrigation district by the general contract of 1909 with the Laramie-Poudre Reservoirs and Irrigation Company. The irrigation district has acquired further interest in the Poudre Valley Reservoir Company by making certain concessions to the minority stockholders, but how far that deal has progressed I do not know.

1790 The irrigation district is related to the Laramie Tunnels, Ditches, and Feeders Company, through this same general contract of 1909.

Aside from my work for the Poudre Valley Reservoir Company in 1904 I did work upon matters which finally entered into the project of the Greeley-Poudre Irrigation District in the way of consultation in March, 1904, with Mr. Tenney, the engineer who made the first surveys on the tunnel, and during the summer
1791 of 1905 I did considerable work in the way of going over various properties and ascertaining their relations to each other and to the new project, and making some detailed surveys, one being of reservoirs 5, 6, 7, and 9, and determining the area of lands the outlet from those reservoirs and from Cobb Lake Reservoir would cover. Some of this work was performed for the Link Lakes Company, and some for that Company when reorganized, and known as the Laramie Reservoirs and Irrigation Company. The men interested in these companies were Wallis A. Link and A. I. Akin, who were interested in the Link Lake reservoirs in the Laramie Valley.

1792 The work I did in 1905 for the Laramie Reservoirs and Irrigation Company was the investigation of the distribution end of the system, and of the plans and the examination of the work performed in 1904 in the mountains, which I went over in order to make a settlement of the contract for that work. The work

on the distributing end was in connection with the reservoirs near Wellington.

1793 In 1905 I went over the work which had been done in the Laramie Valley the preceding year, all of which was on the upper Rawah Ditch under the direction of Mr. Duvall. There was no construction work done in the Poudre Valley in 1905, and the investigation of reservoirs near Wellington was the only work performed in that year, outside of the Laramie Valley, excepting the work of financing the project. If there was any construction work in the Laramie Valley in 1905, it consisted in road building and camp building, but I do not know whether there was any such work.

1794 I do not know of any work that was done in the Laramie Valley in 1906, and I do not remember any work on the plains that would be considered actual construction work in 1906. In 1907 there was considerable work done upon the upper Rawah Ditch in the Laramie Valley. In 1904 this ditch had been commenced, the work being done at its lower end, and in 1907 the ditch was constructed towards its upper end, three miles.

1795 All of the work was upon this line of ditch and none upon the lower Rawah Ditch, sometimes called the West Side Collection Ditch. About forty or fifty thousand dollars was expended in 1907 on this work, this amount perhaps including engineering work in the Laramie Valley, but the amount expended for such engineering could not amount to more than two or three thousand dollars. The books showing these expenditures are not ac-

1796 cessible to me, so that I must testify from memory. The work upon the upper Rawah Ditch was continuous, but I do not know how many stations it covered. There was no other construction work in the Laramie Valley in 1907. In that year there was considerable work in the Poudre Valley, in the extension of the Poudre Valley Ditch. The Laramie-Poudre Reservoirs and Irrigation Company having acquired the carrying interest in the Poudre Valley Ditch, although not a stock interest in the Company, built several sections of a proposed extension of that ditch to the town of Nunn.

1797 The total expenditure in 1907 was $129,000. I would say that the amount expended on this extension work was about $70,000, this covering only construction work. Several separate sections of the proposed extension were completed, and some sections were not worked upon on account of the lack of right-of-way. It was for this work that scrip to the extent of $50,000 was issued at the end of the season.

1798 The construction work in the Laramie Valley in 1908 consisted of the completion of some small portions of the upper Rawah Ditch. We had a small number of men up there all summer, but I cannot say how many were employed nor for how long. I do not suppose the amount expended for that work exceeded several thousand dollars. Some incompleted sections of the ditch were finished, loose boulders and slides were taken out of the ditch and overflow sections made and a measuring device was put in and some

clearing was done. No other work was done in the Laramie Valley in 1908, and I do not believe that any work has been done upon the upper Rawah Ditch since that time.

1799 In the Poudre Valley the work of 1907 continued through the winter and into the spring of 1908, and in that year some work was done on the Black Hollow Cut on the Greeley-Poudre Canal. I do not remember how much money was spent for construction work outside of the Laramie Valley that year. It was largely paid in scrip. All of the work that was done was on the extension of the Poudre Valley Canal.

1800 No construction work was commenced in 1909 prior to the making of the contract between the Greeley-Poudre irrigation district and the Laramie-Poudre Reservoirs and Irrigation Company. Appropriations were then made for the construction of the tunnel. Camps were built and a power plant was built, and a few days after Thanksgiving Day or about December first, 1909, actual construction work commenced on the tunnel. I am not able to recall definitely, but I believe that some work was done upon the ditches in the Laramie Valley in 1909.

1801 Construction work was commenced on the East Side Collection Ditch in the Laramie Valley in 1910, commencing about May first, I believe, as early as the men could get in. Work on the West Side Collection Ditch had commenced before that time, and I believe they worked upon tunnels along that ditch some time during the winter of 1909 and 1910. The roads were kept open so that supplies could be carried in for that work, and there were perhaps 30 or 40 men engaged in it, and I believe that force was maintained throughout the winter, supplies being hauled in from the railroad in Wyoming, about 65 miles, I believe.

1802 The work on the East and West Side Collection Ditches continued until October 1st, 1910, and I believe a little was done after that date on the West Side ditch. It is not true that a large part of the construction work was shut down about June
1803 15, 1910. Work on the west portal of the tunnel was closed down about that time, but not upon the ditches.

Direct examination by Mr. Delph E. Carpenter:

1804 I wish to correct and make clear the date of incorporation of the Laramie Reservoirs & Irrigation Company, which was incorporated on September 18, 1906. Statements heretofore made by me relative to work done upon this property about that time, referred to work done for individuals or an association of individuals that were not under any corporate name, the work covered all of that done prior to this date, and was done for individuals. These individuals were Wallis A. Link, A. I. Aikin, Wellington Hibbard, Myron Akin and Jesse Harris. Mr. Hibbard was the managing member of these individuals, putting in all his time and managing the affairs of the association. He was later manager of The Laramie Reservoirs and Irrigation Company. I worked under the same direction.

The Laramie-Poudre Reservoirs & Irrigation Company was incor-

porated March 19, 1907. Mr. Hibbard was the manager and directed the work in that company. Mr. A. I. Akin continued to render active service under all three of the associations or companies. Mr. Wallis A. Link was also active with Mr. Hibbard in the association of individuals prior to September 18, 1906. He directed the mountain work.

Cross-examination by Mr. N. E. Corthell:

1805 The work was pushed in 1910 on the mountain system with all the men that could be obtained, and was closed down on October 1st, 1910, after which time work was performed
1806 only on the east end of the tunnel, excepting for the construction of several hundred feet of tunnel work upon the West Side Collection Ditch, which was performed by a few contractors in the winter of 1910-11. In February, 1911, I severed my connections with the Company and no more work was done under my supervision and observation.

In 1910 the Company was proceeding with the construction in the Poudre Valley, upon the extension of the Poudre Valley Canal. The working force was being increased from time to time so as to reach a rate of construction work amounting to about $200,000 per month, and in May, 1910, we reached an expenditure of $160,000 a month, and were ready to increase it to the desired amount in June, when we received orders not to put on any additional force. No decrease was made in the working force in June, but we then received orders to lay off parts of the force as separate sections of the work were completed.

1807 There were about sixteen or eighteen sets of contractors at work in May, and these were gradually cut down until about one-fifth remained on the first of October.

1808 In 1910, $45,000 was expended on the work upon the West Side Collection Ditch and the Laramie Valley, and $38,000 on the East Side Collection Ditch. Prior to October, 1909, all the work that was done in the Laramie Valley was done upon the upper Rawah Ditch, and all that was done in 1909 or later was upon the lower West Side Ditch and the East Side Ditch. The reason for this was that in the early course of this project it was thought necessary to secure some current revenue immediately, and in 1906 a carriage right through the Skyline Ditch, and the construction work on the upper Rawah Ditch was undertaken so as to secure a property from which this current revenue could be derived, through the ten year period in which the major system would be constructed, but in 1909 the general contract was let which provided for the immediate construction of the whole system which would result in an immediate revenue so that it was no longer necessary to carry on the upper Rawah project. The idea leading to its early construction was abandoned, but the line itself was not abandoned, it being still intended under the general contract of 1909 to complete that work.

1809 The upper Rawah ditch may be considered an extension of the Skyline Ditch, and was originally planned to collect

the water from above the ditch and deliver it into the Skyline Ditch, for the purpose of assisting in the development of the larger proposition on the Laramie. It was only a means to an end. It would carry it over the watershed into Chambers Lake. The surveys were made with this end in view, and also with the end in view to use the upper Rawah Ditch to carry water into the west fork of the Laramie River above the tunnel whenever the tunnel should be constructed.

1810 It would have been unnecessary to construct the upper Rawah ditch if the Boulder Ridge project had been constructed, for the water from the watershed above the upper Rawah Ditch would have naturally reached the Laramie River reservoir from which the Boulder Ridge Ditch was to run, extending down the Laramie valley into Wyoming, and around Boulder Ridge into the Poudre Watershed. The water collected by this Laramie River reservoir if it had been constructed, would be from substantially the same watershed as is taken care of by the East Side and West Side Collection ditches, now being constructed, the difference being comparatively unimportant.

1811 The upper Rawah Ditch, if completed, would drain a watershed containing from ten to twelve square miles, which is about one-sixth of the area drained by the system now under construction.

The Greeley-Poudre Irrigation District was planned in the latter part of 1908, and organized on April 3, 1909. It was not during the course of this organization that the plan to take the water from the Laramie valley and distribute it upon the lands in the irrigation district was definitely adopted, the district being merely the outcome of the previous efforts, and embracing the same territory and the same works which had always been under consideration.

My examinations in the preceding years were not to deter-
1812 mine where the water could best be applied, for this was the only available tract of land of any size in the Poudre Valley upon which it could be applied, and the problem was to work out the best and cheapest means to irrigate and develop that piece of land, and my investigations were directed to that end.

My investigation of Boyd Lake was for the same purpose. Boyd Lake is almost on the top of the divide between the Big Thompson and Poudre rivers, being south of the Poudre, and has a supply ditch from the Big Thompson. My examination was made to ascertain the feasibility of constructing another supply ditch from the Poudre River which could be used to carry flood waters
1813 from the Poudre with perhaps surplus waters from the Laramie, into Boyd Lake, discharge these waters from Boyd Lake into Fossil Creek, and deliver it from Fossil Creek to early appropriators upon the Poudre, thereby securing an exchange right which would enable the Irrigation District to take water at its intake, to which the appropriators supplied from Boyd lake were otherwise entitled. The waters stored in Boyd Lake could not be carried directly to the lands of the Irrigation District and would be utilized by a system of exchange.

1814 Most of the lands of the Irrigation District are actually east of the divide between the tributaries of the Poudre and the tributaries of the South Platte below the Poudre, although all of this area is considered as part of the Poudre Valley because it is irrigated from the Poudre.

A somewhat detailed investigation of the use of water and of the agricultural conditions on the Laramie Plains was made by me, beginning in 1905 and continuing until perhaps 1908, being completed before the organization of the irrigation district, and the commencement of work upon the East Side and West Side Collection ditches and the tunnel.

1815 In my testimony yesterday I considered that the term "construction work" includes engineering investigations, the survey and running of lines, clearing necessary lines, and the analysis of all of the work done and its relation to the entire project. The general investigation of the work necessary and the relationships of the various companies and their respective properties were all necessarily considered as well, and attention was necessarily given to such regulating works as the McGrew Reservoir and the March Reservoir, and all of this, I believe, is necessary in order to make a final enterprise out of the proposition.

1817 In addition to the construction work which I have mentioned as being performed since 1904, the engineering work in the field with often times as many as four parties, the office investigations and classification of data, the financial efforts of Mr. Hibbard and his associates, were going on continuously and practically all the time.

1818 They had a supply of water and the general plan of working out that problem of supply and a general, natural and inevitable place to put that water. The problem was the connecting up of the two ends of an irrigation system, viz., supply and use. In this particular instance, in a highly developed country with many previous enterprises, it resulted in the problem of requiring the gathering of many enterprises having the same general end, into one large enterprise.

The area possible to irrigate, when this enterprise was originated, was much larger than that now embraced. There is much more available land than is included within the Greeley Poudre Irrigation District. It was natural to investigate and get all the water possible, including rights initiated and principally carried out on the Cache la Poudre, those initiated and carried out on the Laramie River and all their constructions and extensions. In an enterprise of this magnitude, it was necessary to have certain data in order to satisfy persons interested in it, both as to the nature and character of the water supply, which required investigation, and obtaining of data relative to the water supply in the Laramie River. Trips were made to show conditions of areas from agricultural standpoint, amount of water flowing in the streams, and a general investigation of the water supply of the two areas.

1819 The Irrigation District has sources of supply other than from the Laramie River, and in 1907 some work was done

to make such other sources available, by constructing the Mitchell Lakes and reservoirs, which were developed as a small system prior to 1906 by individuals, and in 1906 by a corporation, which was absorbed in 1907 by the Laramie-Poudre Reservoirs and Irrigation Company.

1820 The Greeley-Poudre Irrigation District's system is divided into two general divisions, the "Mountain Division," and the "Plains Division," and by Paragraph 15 of the general contract of 1909 it was provided, "that the work of completion to be done by the Company, meaning the construction work, hereunder, shall *be* for the purposes of this contract be classified into two divisions, namely, "The Laramie River Division," and "The Plains Division," and each of said general divisions may and shall for the purposes of this contract and for the payments to be made hereunder be further divided both numerically and by name designated as hereinafter set forth; and relative hereto, it is mutually understood and agreed that this contract shall be taken and held to be severable as to said mentioned divisions and sub-divisions hereinafter described as aforesaid, and not entire as to the whole; and the Company shall be paid for each part of the contract, payment upon the entire contract price for construction work as set forth in the following schedules, and if work as described in schedule No. 1 shall be completed and sold to the District, then that schedule shall be followed; and if the works described in schedue No. 2 shall be completed and sold to the District, then that schedule shall be followed; provided, that upon each monthly estimate upon any of the uncompleted portions of the works to be completed and sold to the District hereunder there shall be paid to the Company 85 per cent of the estimate thereon for work done and materials furnished during the month upon which such estimate is based, and the remaining 15 per cent shall be retained until the completion of the works upon which such estimate is made, and the amount to be estimated and paid shall be such amount as the value of the amount done shall bear to the total amount to be done upon the work upon which the estimate is based." In the schedules subjoined to Paragraph 15 of the contract, the Mountain Division is given as being composed of forty-six different units distributed among the following classifications: West Side Ditch, East Side Ditch, McIntyre Ditch, Tunnel Reservoir, Link Lakes Reservoir, Laramie River Tunnel, Mitchell Lakes Reservoirs, rights of way and clearing thereof.

1821 The Plains Division in this schedule consists of units numbered from 47 to 117 inclusive, distributed among the following classifications: Poudre Valley Ditch, Laramie Poudre Canal, McGrew Reservoir Outlet Ditch, Pierce Lateral, Central Lateral, Enlargement and Extension, Nunn Lateral, Larimer County Ditch Enlargement or Reservoir Lateral Ditch, March Reservoir, McGrew Lake Reservoir, Reservoirs Nos. 5, 6, 7 and 9, Cobb Lake Reservoir, and Camfield Reservoir.

This system has two distinct and independent sources of supply; that from the Laramie River and that from the Poudre River basin and the tributaries of the South Platte, and it was so designed that

the Poudre Valley Canal could divert water from the Poudre River and also from the northern tributaries of the Poudre intercepted by the canal and from the tributaries of the South Platte as far east as Crow Creek and intercepted by the canal wherever there was surplus water. We estimated that the amount of water available outside of the Laramie River source would be between 80,000 and 100,000 acre feet per annum as an average.

1822 It was reported to the District by Prof. Carpenter, who was employed to make a report upon the water supply, that there available from the Laramie River from 70,000 to 100,000 acre feet, from the Poudre River from 60,000 to 90,000 acre feet, from Doudy lakes, being of the Mitchell Lakes group, 2,990 acre feet, from Douglas Reservoir, 5,833, from flood waters of the Lone Tree and Crow Creeks, 3,000 to 10,000 acre feet, making a total of from 142,000 to 179,000 acre feet.

The Poudre Valley Canal diverts water from the main Cache la Poudre River, in Section 15, Township 8, Range 70, and is designed, with its extensions, to carry all of the water supply to the lands of the Greeley-Poudre Irrigation District. Its point of diversion is such that it can divert all of the surplus waters of the Cache la Poudre River, the Big South Fork and its tributaries, the Little South Fork and its tributaries, the North Fork and its tributaries, and the other tributaries of the main stream above the point of diversion. It also intercepts and collects the waters of Hook and Moore Creek-, Park Creek, Box Elder Creek, Sand Creek, Coal Creek, Rattle Snake Creek, Lone Tree Creek, Little Owl Creek, Robinson Creek, Owl Creek, Eastman Creek, another Coal Creek, Wild Horse Creek, another Sand Creek, and Crow Creek, as well as all other unnamed creeks and channels west of Crow Creek draining a portion of southern Wyoming and all that portion of northern Colorado lying north of the Poudre River and within its drainage basin, and also that portion of northern Colorado and Wyoming lying north of the South Platte River and west of Crow Creek.

1823 My estimate that the system as at present designed would divert approximately 25 per cent of the run-off of the Laramie drainage basin in Colorado, is not based upon independent investigation, but upon the published reports of the state engineers of Colorado and Wyoming, and of the Geological Survey relating to the flow of the Laramie River near the state line, and to the flow of the streams and creeks intercepted by this system.

1824 In making this estimate, I have not taken into consideration the Plaintiff's Exhibit M, but assuming that the facts as therein shown that the run-off at Glendevey was 38 per cent of the run-off at Woods in May and June, and was 49 per cent of the run-off at Woods in July, August and September, I do not believe that my estimate would be changed, as there is a run-off from the watershed during the rest of the year, and the amount available at Glendevey is not equally the same as is available for the system. In my estimate I was considering the amount available at the outlet of the tunnel.

1825 The Collection system can be operated from about April first until November first; some years it may be a month earlier or a month later at either end of the season, and the tunnel itself can be operated throughout the entire year, the direct diversion through the tunnel being about one-fourth of the total, this direct diversion being the water from the entire watershed above the junction of the east and west forks, except the diversion by the Skyline Ditch. The mean period of diversion for the entire system would be from about the first of May until the first of October.

1826 The percentage of the flow of the Laramie River above Glendevey, which would not be diverted by the present system, would be small, being the flow from nine or ten square miles in the bottom of the valley. Assuming that the records of the stream for 1911, 1912 and 1913 show that approximately 85 per cent of the run-off at Glendevey occurs between May first and October first, I still think that the percentage of the flow of the stream that would be diverted by this system would be about 25 per cent.

The length of the tunnel is 11,368 feet, and the contract price per linear foot for excavation was $32.50. In giving the cost of the tunnel, I included the necessary plant and equipment, the approach cut and control works at the inlet end, and the control works
1827 at the outlet end. The plant which was built by the company cost about $100,000, and has been dismantled and removed, the salvage being very small.

1828 Its cost is certainly part of the expense of constructing the tunnel. I included about $15,000 or $20,000 as covering, in my estimate, the expense of the approach cut, and $8,000 as the cost of the control works at the inlet, $5,000 or $6,000 as the cost of the control works at the outlet, about $5,000 for engineering expense and $20,000 for the lining. A portion of these amounts has not been paid, about $100,000, I think.

The plan is to divert the water of the Laramie River into the Poudre River, where it will run down to the Poudre Valley Canal, and through that canal and its extensions to the eastern limits of the Irrigation District, a distance of about 190 miles including the channel of the river and all of the works. When turned into the Poudre River the water passes under the supervision of the water officers of Colorado, who determine how much shall be diverted from the river into the Poudre Valley Canal after allowing for losses by seepage and evaporation which would not be much in the channel of
1829 the river, but which would be considerable considering the entire distance. So far as I know the state officers have never fixed any percentage as representing the loss of such water in the ditch. The managers of the Poudre Valley Canal have fixed a percentage of loss about which I am not just clear. The percentage has changed several times, and I believe has been different for different users. For small quantities of water I believe that deductions as high as 60 per cent have been made, this being for water diverted below the Michigan River ditch into Chambers Lake at the headwaters of the Poudre, and carried about the same distance as water would be carried from the Laramie River. This percentage

was fixed by the water commissioner in order to force the state engineers to make some definite investigation and rule, and I assisted in that investigation, which resulted in a final determination to fix the percentage of loss in the river channel at five per cent. From my investigations at that time it was also determined by the ditch companies interested that the loss in the Poudre Valley Ditch over a distance of 16 miles would be about 40 per cent so long as the ditch carried a small head of 40 or 50 second feet. With a larger head in the Poudre Valley Canal, the percentage of loss would decrease, and perhaps might become as low as 20 per cent for the sixteen miles, or even lower if the total capacity of the ditch were used. The water would have to be carried about 20 miles beyond this sixteen mile point to reach the average point of distribution in the Irrigation District. I would say the average flow in the Laramie River at Glendevey during the latter part of July, August and September would be about 75 second feet.

1832 An analysis of all the data available shows that about one acre foot of water per acre delivered at the land is sufficient for the proper irrigation of the land in the Poudre Valley, and this duty of water is several times higher than the duty of water on the Laramie Plains.

1833 In 1905 the plan of this project as previously made by Mr. Duvall was outlined to me and the system as constructed is substantially the same as was contemplated in that plan. The tunnel as constructed is on exactly the same line as was used by Mr. Duvall, at the west end, with a slight variation at the east end. I do not remember the location of the west end of the tunnel as located by Duvall by course and distance, and I do not have the maps by which to locate it. The final maps were never filed in the office of the state engineer, but there was no change on the location of the tunnel from the location shown on the maps filed in that office.

1834 From time to time, as surveys were made of different portions of the irrigation system, maps and field notes were filed in the office of the State Engineer, which represented the plans of the Company at the time of filing as proposed for each individual unit.

1835 It was here admitted, that the following maps, marked for identification, were true copies of certain maps filed in the office of the State Engineer of the State of Colorado: Plaintiff's Exhibit N, filed October 15, 1902, showing the Link Lake Ditch and feeders; Plaintiff's Exhibit O, filed May 9, 1904, showing the East Fork Ditch and reservoir; Plaintiff's Exhibit P, filed Oct. 6, 1904, showing the Laramie Tunnel ditches and feeders; Plaintiff's Exhibit Q, filed Sept. 24, 1906, showing the Laramie Tunnel, ditches and reservoirs; Plaintiff's Exhibit R, filed July 8, 1908, showing the Laramie River Reservoir; Plaintiff's Exhibit S, filed Sept. 28, 1908, showing the Laramie River, Sand Creek and Lone Tree Ditch.

Each of the projects shown on these maps, with the annexed statements, excepting that shown on Exhibit S, constitute a part of the

Greeley-Poudre Irrigation District's system. The project shown upon Exhibit S was investigated in connection with the system, but abandoned as not feasible, and it was not intended or proposed at the time the map was filed, to construct this Sand Creek Ditch, taking water from the Laramie River at the Glendevey Reservoir and carrying it north through Wyoming and south into the tribu-
1838 taries of the North Poudre. This ditch was abandoned when the map was filed. The ditch was investigated as an alternative to the Laramie River tunnel. Prior to the time this survey was made in 1908, we had made a preliminary number of investigations of this route, and we were satisfied that it was not practical, and this more complete investigation was made upon the demand of certain interests so as to absolutely satisfy the parties that this Sand
1839 Creek ditch would not be practicable. I believe that Mr. Camfield and Mr. Iliff, who with Mr. Shields were the principal parties interested in the Greeley-Poudre project, were the persons requiring this investigation.

It was here admitted, that six blueprints, marked "Plaintiff's Exhibit T," were copies of certain maps filed in the office of the State Engineer of Colorado, on Jan. 8, 1909, being a general map showing the systems of the Laramie-Poudre Reservoirs and Irrigation Company.

It was never intended to construct all the work shown upon these maps. The maps cover and bring together all the
1840 previous filings, and show all the different means of accomplishing the same general end—the irrigation of the land in the Greeley-Poudre Irrigation District. Many investigations were made to determine the best means of accomplishing this end, and these were incorporated in the various filings and in this map, which was the last filing made by the Company. Both the tunnel and the Sand Creek ditch, which runs through Wyoming, and the Glendevey Reservoir are shown on this map. It was known at the time the map was filed, that the cost of the Sand Creek ditch was prohibitive and that no possible relations could be brought about which would make it feasible. It was included in this map because
1841 at all times there were interests adverse to this system, the interests seeking to obtain some foothold in the Company, so that it was necessary to protect whatever was done by filings, so that if the matter should come up in the future there would be record evidence of what was at one time covered. It was not our purpose to use these filings to enable us to force any extortion.
1842 The map filed May 9, 1904, locates the west or upper end of the tunnel, near the middle of the south line of the northeast quarter of the southwest quarter of Section 7, Township 8, Range 75. The map prepared October 6, 1904, by Mr. Duvall, locates the upper end of the tunnel, close to the middle of the east line of the same forty acre tract, and about 1,000 feet distant from the previous location. The first map filed by me locates the upper

end of the tunnel a little south and east of the middle of
1843 the west line of the northwest quarter of the Northwest quarter of Section 6, about a mile and a quarter from the location shown on the map filed October 6, 1904, filing map being file No. 5448 locates the west end of the tunnel about 1,000 feet to the north and west of the location shown on the map filed October 6, 1904. The tunnel was actually constructed on the line shown on the map filed October 6, 1904, and not on the lines shown on the subsequent maps, it being discovered that the location then made was better than the locations made in January, 1909.

1844 The survey represented on the map filed in 1902 covered only a part of the upper Rawah Ditch and the Collection ditches from the Link Lakes. On the map filed October 6, 1904, the West Side ditch was shown extending from the lower Rawah Creek only about two miles, and crossing the valley to the east side by a pipe or inverted syphon. On the map filed Sept. 24, 1906, the West Side ditch was shown as extended to connect with the tunnel site, and in the filing of January 8, 1909, the Tunnel Reservoir was added to this plan, the previous filings making no provision for a reservoir at that place.

1845 The changes in the Laramie River project were about as follows: The lines shown on the map of 1904 were extended to make a continuous ditch on the west side from the Rawah Creek, intercepting all the West Side tributaries to a point opposite the tunnel. Changes were also made in the design and capacity of the East Side Ditch, due to the changes made on the West Side, and it became apparent that a regulating reservoir would be the proper thing at the entrance of the tunnel, and this was incorporated as the Tunnel Reservoir, which in a large measure had the same function as the East Fork reservoir proposed in 1904. The East Side and West Side ditches would not have carried water to the East Fork Reservoir, but would have connected directly with the tunnel. From the standpoint of regulation it would make no difference whether the reservoir was at the tunnel or above it. The East Side and West Side ditches were not surveyed to enter the East Fork Reservoir, but it was planned to get water from the Upper Rawah Ditch into the East Fork, although this does not appear in the filings.

1846 The original plan of the Tunnel Reservoir contemplated a dam eighty feet high, the idea being that we would investigate the entire available site and then construct a lesser reservoir as other considerations might determine. The dam in the Laramie River was not built at the place shown on these maps, but was placed upstream at a point not shown on any filing. My plans provided for the 53 foot dam, but I do not know what size dam has been constructed. The plans were changed about 1911, when financial reasons made it necessary to cut down as much as possible on that end of the construction which would permit finishing later on without materially impairing the system.

1847 Cross-examination by Mr. John D. Clark:

The two major considerations in connection with this project were the water supply and the expense of conducting the water to the land. It was understood from the first that at least 125,000 acre feet must be delivered at the land, and reservoir facilities for about 100,000 acre feet were provided in the plans. This would permit sufficient storage to carry a considerable supply of water from a plentiful year into the next year, as the water could be carried direct to the land from the streams in the high water year without using the water in the reservoirs. It was contemplated that water would be diverted from the Laramie River from about the first of May until the end of the irrigation season in varying quantities, and sometimes perhaps much more than would be required for the immediate needs of the lands and at other times less, and the reservoirs were to regulate this supply. The water derived from the Poudre watershed would be taken during the flood water season, from about the first of May until the middle of June. It would be dur-
1848 ing that period that the water must be secured for storage in the reservoirs. At other periods of the year the prior reservoirs in the Poudre Valley would be taking all the water in the stream, and in the latter part of the season there would perhaps be a supply from the Laramie River which could be accumulated. The substantial flow which could be taken from the Laramie River would come at the same time of the year when the flood waters of the Poudre would be available for storage, so that the only period when it would be possible to divert water direct to the land would be the same period when water could be stored in the reservoirs, and it was for this reason that it was determined to construct a reservoir in the bed of the Poudre River.

1849 No reservoir facilities of consequence were afforded in the basin of the Laramie River. The small reservoirs contemplated at the head of the Rawah Ditch would conserve only a small flow. These were natural reservoirs upon which it was proposed to do some work.

The basis of the project might be considered as the water diverted from the Laramie River, although in the final plans the burden was cast upon the watershed of the Poudre somewhat more than upon the watershed of the Laramie. The watershed of the Laramie was considered as very certain, whereas that of the Poudre is subject to change, and the numerous appropriations having priority
1850 over this project would lead to some uncertainty in connection with the supply of water from the Poudre River. The amount available from the small creeks entering the Poudre River from the north is uncertain, as these are very erratic streams, floods occurring in some years three or four times a year and then not at all for a period of years. The bulk of the expense of the project is attributable to the efforts to bring water from the Laramie River and to store it.

About October, 1909, Professor Carpenter was employed to make an exhaustive survey of the water supply, his employment coming

from the interests considering the purchase of bonds, I believe. I assisted him to a very small extent by furnishing data upon which to make his report, and I am familiar with it, and am familiar with the use made of the report in establishing the Irrigation District on a substantial basis with respect to its water supply, and in connection with the sale of bonds. Before his examination I had reached the conclusion as to the available water supply, and my conclusion agreed with his, that the amount available from the Laramie River was a trifle in excess of 70,000 acre feet. By this I mean
1851 that this would be the amount of water available from the Laramie River which could be diverted through the works proposed, and could be carried to the land. Unless such an amount were available for application on the lands themselves, the water supply would be insufficient. I wish to correct this statement, as I did not understand the question. I mean that 70,000 acre feet is available at the Laramie River, and that considering the system of exchanges and storage, I would think that about two-thirds of this amount would reach the land to be irrigated. Professor Carpenter's report and conclusions were based upon the project which
1852 was then in course of construction, and which has been constructed substantially along the lines then contemplated. We usually considered the amount available from the Laramie River at from 60,000 to 75,000 acre feet, 70,000 perhaps being a little bit more than the average for any long period of years, and that this was one-fourth of the flow of the stream at the state line.
1852 Since leaving this project in February, 1911, no data relative to stream flow has been brought to my attention which would change my opinion as to the relative amount of water diverted from the Laramie River through the tunnel. I am not familiar with the data collected by the office of the State Engineer of Colorado since 1909 or 1910 relative to the stream flow at the
1853 state line or Glendevey. My conclusion as to the duty of water in the Poudre Valley is based upon my personal acquaintance with the canal systems, the amount of water taken at the head of the canals, the records made by the ditch superintendents and water commissioners, and the general records of the ditch companies. It has been based upon information gathered ever since 1902 and 1903, and is in part upon the reports of the amount of water furnished by the various canals in the Poudre Valley during the past four years. I do not consider that the least amount furnished as shown by these reports as the duty of water in the Poudre Valley. My conclusions upon this matter are based largely upon the record of the Larimer County Canal, owned by the Water Supply and Storage Company, of which Mr. Edwards is the president, and which is conducted on perhaps the most conservative lines of any canal in the Poudre Valley.

I would estimate the capacity of the Laramie-Poudre tunnel, in the neighborhood of about 1,000 cubic feet per second. It was constructed with the purpose of taking the largest flow occurring in the

river, as it would be no cheaper to construct a smaller tunnel.
1854 In the final operation of the system it may be possible to divert a certain amount of the winter run-off from the East Fork and West Fork, stored in the regulating basin at the head of the tunnel. Perhaps 75 to 85 per cent of the run-off of the Laramie River in Colorado comes between May first and November first, and it might reach 90 per cent. The flow from May to November in 1911 at the state line was, I believe, abnormally low, whereas the flow in 1912 was about normal, such being the conclusions reached in some investigations in which I was interested made for
1855 hydro-electric development of the Poudre. I believe that this condition was true of the Laramie watershed as well as of the Poudre watershed. I would consider that the report of the State Engineer of Colorado, of a flow of approximately 160,000 acre feet at the state line from April 12 to November 30, 1912, was small.

Redirect examination.

By Mr. Delph E. Carpenter:

1856 I did not intend to convey the idea that 100,000 acre feet storage capacity did not represent the limit of the irrigation possibilities of this system as to any one year. Referring to the map, Exhibit 1, I will explain that the waters obtained from the Laramie river watershed through the Cache la Poudre river, are taken through the Poudre Valley Ditch in such quantities as are perhaps required from the immediate needs of the system. It was intended to have a reservoir on the Poudre river in the bed and channel of the same, by which the floods or peaks of the floods of the Cache la Poudre river and also of the Laramie river, would be conserved and regulated. Delivering that water from this reservoir to the Poudre Valley Ditch to the extent the same would be able to carry it, it would be possible to regulate the amount of water required for the area to the greatest possible extent. If climatic conditions demanded a very large amount of water for a short time, the McGrew Reservoir could furnish a large portion of that from waters previously stored in there. The largest body of land is situated under that reservoir. Capacity of inlet canal was designed and considered to be the minimum for the reason that the loss should be reduced to the minimum. Its carrying capacity would at all times be practically its maximum. The water would be kept
1857 running at about the maximum capacity of the canal. Delivery of water to a large portion of the land tributary to the McGrew Reservoir could be accomplished by having a large distribution system at that point. Two laterals of large size were designed and practically built for that purpose.

McGrew reservoir has a double function, that of regulating the flow and that of a storage basin. Water used in irrigation of lands embraced in District, particularly on lands in upper portion of district above central lateral, would in few years develop return waters in natural draws and drainage channels of that area. It was designed and contemplated from the outset to develop and use those

return waters, and this led to the construction of reservoir capacity under the central portion of that area to conserve and catch and hold the waters of return character that would flow throughout the entire year. March and Camfield reservoirs were designed and built for that purpose. They are also to be used for the purpose of storing waters from the rivers and as regulating basins. They have the same possible use as the McGrew Reservoir because there are lands below this reservoir and lateral extension covering those lands. If water were running down the channel to McGrew Reservoir at any given time, greater than the then immediate demands, this surplus water would undoubtedly be stored in McGrew Reservoir temporarily
and until such time as it would be required for the lands.
1858 This reservoir would rise and fall with the demands of land
owners for water. I might add that perhaps the practical operation of that system will make it necessary to keep the water as high as possible at all times. The upper reservoirs are the ones that will be filled the most; as much as possible in the bed and channel of the Cache la Poudre river, those upon the Laramie river, and then the McGrew Reservoir and the lower reservoir will be reserved until capacity of Upper reservoir is exhausted. It is advantageous to have water above lands as high as possible in order to bring the best service.

Greatest fluctuation in the water would be occasioned by amount of water coming in and demands of system below. Irrigators prefer to apply water directly from ditches. The canals will be kept operating as the necessity demands. The reservoirs will serve as regulators to facilitate the delivery through ditches. This function of regula-
tion is in addition to the usual function of storage. Storage
1859 may be considered the filling of a reservoir of fixed capacity
and drawing it out according to the demands of the lands served, without refilling during that season. Usually refers to storage of waters in one season of the year for use in another, while in regulation the reservoirs would not only be used for storage, but also for holding back the water for limited periods of time for distribution according to the crop demands, while the inlet to the reservoir would supply it at a uniform rate, depending upon supply. Supply and demand, speaking in a broad way, would determine the amount of water carried over from one year to another in the reservoirs of this system. If the supply of any one year would exceed the demand, there would be some remaining for the next year. The water supply fluctuates from season to season. The demand is not as variable as the supply. There are seasons when the demand is a little greater than others, or a little less than the aver-
age, but the variation is small. Supply often varies as much
1860 as 300 per cent. That is, by using the low and the high year
as a basis of calculation. I used the low year as a basis. Probably 50% below and 50% above normal would be a better way to put it.

In describing the work performed on Laramie River portion of Greeley-Poudre system, I did not include the amount of work done on the reservoir, commonly known as the Tunnel Reservoir. About

$20,000 was expended there. Particular function of that reservoir is for the regulation of the flow of water into the flow of the tunnel. All water received from collection ditches and tributaries of the stream will naturally discharge into tunnel reservoir and from there can be regulated through the tunnel into the Cache la Poudre river.

It was constructed on a smaller scale than originally sur-
1861 veyed. The diminution of the reservoir would, if anything, increase the flow of water in the river below. Without the reservoir, the diversion capacity of the system would be very little different.

The original plans contemplated an East Fork Reservoir. The plans relating to that have been abandoned and the Tunnel Reservoir substituted. The site of the East Fork Reservoir was more of a natural reservoir site than that of the tunnel reservoir. The first consideration involved the cheapest site, but the delivery of waters from the Upper Rawah into that reservoir so as to be regulated through the tunnel caused the substitution of the Tunnel Reservoir.

If I stated in cross-examination that the last work done on the Upper Rawah Ditch was in 1907, I undoubtedly had in mind the larger construction, as I had previously testified that there was work done there in 1909 and 1910. We always went up there to repair that ditch, keep it in shape and run such water as was tributary to the stream through that Ditch each season. The Hardy Brothers worked there the years 1908, 1909 and part of 1910. I would not presume to say that work had not been done there in 1912 and 1913. I have not had charge of the work during those years.

1862 The costs of construction which I gave to counsel for the plaintiff did not include on any unit the overhead expense, such as office expenses, administration and engineering. The figures represented total amount paid to contractors for that portion of the work done by contract. It did not include any money expense of clearing right of way, which is a separate account and was not included in that. It was more general and could not be separated into each unit. The figure of $47,000 which I gave to counsel for plaintiff as cost of Upper Rawah Ditch, did not include engineering and overhead expense. That merely included the actual excavation work.

1863 In 1906 there was a ten-year term agreement entered into between Mr. Hibbard and others, with the Water Supply & Storage Company for use of the Sky Line Ditch temporarily during the construction of the tunnel. A reciprocal arrangement between the parties for diverting through the tunnel at other times. So that the water of the Sky Line Ditch, belonging to the Water Supply & Storage Company might be diverted through the tunnel after its completion. That was the arrangement in the contract of 1906. It is undoubtedly the instrument dated September 26, 1906, and recorded in Book 250 at page 125 of the records of the County Clerk and Recorder of Laramie County, Colorado.

I consider that the lien existing for some work on the tunnel will be paid, at any rate, the work has been done.

Referring to maps examined by me designating various ditch and

tunnel locations which maps were marked plaintiff's Exhibits O to T, inclusive, I will state with particular reference to the tunnel that it is upon the line surveyed by Mr. Duvall. There is but a slight difference in the general location between the Duvall Survey
1864 Line and the Tenney Survey proceeding. Tenney's survey was of more of a preliminary nature, and at time of year when detailed consideration was not possible. An advantageous location from which to start was selected and a traverse line run across the divide without detailed examination. This survey was made in March. Considerable snow was on the ground and the survey was of a preliminary nature and was followed by a more definite survey by Mr. Duvall, at which time more consideration was given to the exact portal location.

We followed the Duvall line with our construction the only difference being in respect to the grade and elevation. The Duvall tunnel contemplated water to be taken from the West and East Fork of the Laramie, by means of a ditch and bring it around to the toe of the hill to the steeper and more solid portion of the mountain side. Upon detailed examination and with full consideration of all the collection and regulation problems, it was decided to lower the entrance end of the tunnel and I believe it was made 40 feet lower, so as to require an approach cut and to be able to take the water from the bed and channel of the Laramie river. The present tunnel is directly under the Duvall line. The Duvall line had a slightly different grade than that which was finally adopted and a different entrance elevation, so it is, on the whole, just about below the Duvall line.

The change was entirely one of construction consideration, and it neither increased nor decreased the demands from the river in the smallest degree.

An enterprise of this nature could not possibly be constructed without preliminary investigation, without detailed examination and final computation along all possible lines to get feasible results. I think Mr. Duvall made other surveys of tunnel lines than the one finally selected by him.

A tunnel line is designated on a map filed by me or under my direction, with west portal about a mile or a mile and a half further down stream. The east portal of that tunnel was at about the same location as the east portal of the present tunnel. If the tunnel had been constructed on this lower line there would have been but a very slight extra demand for water from the stream. It might have been possible to lower the collection ditches on each side of the valley to some extent which would increase the watershed slightly. It would have been very small, due to steep hillsides upon which these ditches are located. A distance of 100 feet would make a very small area as far as run-off is concerned. Even if such a tunnel had been constructed it would have accomplished the same end.
1866 It is a fact that the construction of the tunnel was the culmination of efforts beginning with Link and Akin and early designated by Tenney and Duvall surveys. There is no substantial departure from the original idea. The other surveys,

such as the Boulder Ridge Ditch and others, were the necessary investigations to satisfy the parties owning interests in the Company and the new parties that came in from time to time, contending for more investigation and further analysis of the entire system, and as each part was done it was filed upon and rights protected as much as possible. They represent in record form the various sidelights upon the enterprise.

At no time was the tunnel plan abandoned. We never had an investigation that suggested the possible abandonment of the tunnel. It was so apparent almost on its face, owing to the natural conditions, that it was very hard to figure out any means whereby the tunnel would be improved on.

The two lower collection ditches as now constructed have no apparent different effect upon the stream than would the collection ditches determined by Mr. Duvall in 1904. He planned to drain with his system the same watershed now drained by the system as partly constructed. I simply substituted tunnels through solid rock
which he avoided by siphons.

1867 When I have been speaking of the Duvall map, I refer to plaintiff's Exhibit P, being map of 1904, No. 1722. I commenced work on the Laramie river Reservoir in the fall of 1906. The date given on the map is 1908. That indicates the time that the final and definite survey was made on the reservoir site, and the investigation of its possible use in connection with the system. The Boulder Ridge and Sand Creek Ditch was the outlet of the reservoir. The construction of that reservoir as a part of the inter-watershed diversion was abandoned along with the abandonment of the idea of the Sand Creek Ditch.

There was some extortion practiced in connection with the conflicting filings. It is a fact that engineers and others may file any
number of maps they wish in this state on the same project.

1868 Many conflicting filings may be made by divers parties upon the same general project. The Sand Creek Ditch and Laramie River Reservoir inter-watershed system would have diverted some little more water than does the present system. That system would also have obtained the waters from the portion of the watershed lying between the two collection ditches, some portion of the waters from McIntyre Creek and all water that escaped and flows over the collection ditches as now constructed. It would also have
intercepted the water in the streams crossed by it in its course.

1869 There was an investigation made for an extension of the lower collection ditch from Rawah Creek to McIntyre Creek. Such a line is not practical at the present time. It would have intercepted the waters of McIntyre Creek at a point above the crossing of the State road with McIntyre Creek. The State road runs due west from Glendevey. It is within the range of possibility that at some time a diversion may be made by an extension of the lower collection ditch around to McIntyre. I intended that possibility to been included in my statement of the final development of the system.

Referring to losses of water in the Poudre Valley Canal, there are several sections of the canal in which the losses are very heavy.

These sections have been built along a steep hillside in material that was of a porous and shaley character that permitted a large percolation of water. These are the same sections that the District contemplates lining with concrete. The loss in the canal will in a large measure be eliminated by the contemplated concrete lining. The future diversion will not be subject to the same criticism as has past diversions. Continuous operation of the system will reduce the loss each year and the losses will always become less.

1870 I made investigations with water officials to determine the loss in evaporation and seepage in the quantities of water conveyed in the Cache la Poudre river from Chambers Lake to the headgate of the canal of the Water Supply & Storage Company. The actual loss was never really determined. It resulted in showing a very small loss, much smaller than was first anticipated, so that the arbitrary amount of 5% was decided upon by both parties in interest as being equitable. That was rather in excess of the actual loss. The distance between the Greeley-Poudre tunnel and the head of the Poudre Valley Canal is less than from Chambers Lake to the head of the Larimer County Ditch, and the loss should accordingly be less.

When I stated that the greater portion of the expense of securing water was on the Laramie river portion, I did not have in mind the channel reservoir on the Poudre. The greater expense is in fact on the Poudre river side. That reservoir is to be used along with the rest of the Poudre units jointly for both the waters of the Poudre and the Laramie. Such a reservoir is imperative for the maximum but not the minimum use of the waters of the Poudre. It was necessary to obtain such maximum use in order to warrant the construction of so large an enterprise. The water obtainable

1871 from the Cache la Poudre watershed is such that at times it comes in very large quantities. In order to make this water available by means of reservoirs away from the channel of the river, it would require an inlet ditch, the cost of which would be prohibitive for the amount of water obtained, if the site should be at any distance from the river. A reservoir in the bed and channel will catch and hold and receive all the waters in whatever quantities it may come, and at every season of the year. The channel reservoir will be of material help in storing water during times of extreme cold months and waters obtained from Laramie river during winter season. It is impracticable to run water into reservoirs remote from the river at that time. $42,300 was expended in engineering on the system from 1905 to 1911. All of that was essential. This amount is considerably less than usually expended on a system of equal magnitude.

1872 Recross-examination by Mr. N. E. Corthell:

The water which was run through the Upper Rawah Ditch in 1909 and 1910 was water which was tributary to the ditch, and which before regulation works were put in it was necessary to run through the ditch and discharge out the lower end at the West Fork

of the Laramie River. The water went down the stream and no use was made of it. The determination to lower the tunnel about forty feet from Mr. Duvall's survey was reached after the final plans were filed in January, 1909, and before work was commenced on the tunnel. The possible future extension of the West Side Collection Ditch from McIntyre Creek would add a drainage area of perhaps thirty square miles.

Redirect examination.

By Mr. Delph E. Carpenter:

1873 The various dates noted on the various maps as the dates of commencement and indicated on Exhibits O to T, inclusive, indicate the dates of actual commencement on that portion of the works. In each case the date was noted on which we started surveying each portion. These dates do not indicate the date on which the first survey was begun on the system. All surveys were done upon the same general system. My present knowledge of this system extends to surveys made by myself or under my direction.

(End of Transcript, Vol. 4, defendants.)

1874 ZAC T. DUVALL, a witness in behalf of defendants.

Direct examination by Mr. Delph E. Carpenter:

Zac T. Duvall, civil engineer. Engaged in practice of profession 35 years. Age 60. Have been associated with construction of ditches for irrigation and practical application of water to land for 35 years. Have lived in Colorado for past 47 years. Resided on my father's farm 15 miles south of Denver from 1869 to 1875. Made a study of ditch construction and application of water on my father's farm and on farms in vicinity. During these years I surveyed ditch. From 1876 to 1881 was at Deadwood, S. D. While there was U. S. Mineral Surveyor. Did engineering on two placer mining ditches, the Spearfish Ditch and on the Black Hill Placer Min-
1875 ing Company's flume. Flume was 18 miles long. It was located, designed and constructed under my supervision as assistant engineer. These ditches involved diversion of water for placer mining purposes.

Spearfish Ditch was an inter-watershed diversion from Spearfish into Whitewood and Deadwood watershed at Lake and Central City. The other was in the same valley, out of Spring Creek.

In 1881 was on Union Pacific Railroad. In 1882 and 1883 was at Silverton, Colorado, in the San Juan Country on mining surveys. That involved construction of ditches for power. I surveyed some of these canals. Was deputy U. S. Mineral Surveyor for Colorado during those years. From 1883 to 1885 was engineer on the North Poudre Canal, taking water from the North Fork of the Cache la Poudre river, and in employ of The North Poudre Irrigation Company. Work was located northwest of Ft. Collins, Colorado. My services in connection with that system consisted in the completion of

the mountain division and plains division of the system. We
1876 put the water through it and started construction on Reservoirs Nos. 1, 3, 5 and 6. First mile of this canal is constructed in mountains and remaining seven miles of canal are on more level plains, not so rough as first mile. Construction involved three tunnels.

Referring to defendants' Exhibit No. 1, the North Poudre canal commences in Section 13, Tp. 10 N., R. 71 W. It runs southeast. It is located below the reservoir noted on the map as Halligan Reservoir.

In 1886 was on the Denver and Rio Grande Railroad, engaged in civil engineering. In 1887 was on Dolores No. 2 Canal in Montezuma County, in the western part of Colorado, engaged as engineer. This canal diverted its water supply from the Dolores river. Waters thus diverted were applied to beneficial use on the head of McElmo River. I was Chief Engineer for the enterprise, and Mr.
1877 E. S. Nettleton was Consulting Engineer. From 1889 to 1891 was on the Amity Canal and the Colorado and Kansas Canal. These are on the Arkansas River. The Amity Canal is on the north side of the river, opposite Lamar, and the Colorado-Kansas Canal is on the south side of the river. My duties were the same on these canals as on the Dolores No. 2 Canal. Mr. Nettleton was also consulting engineer. I was Chief Engineer. Completed the Amity Canal to a distance of about 61 miles. That is now one of the largest canals in the Arkansas Valley. It has been enlarged since I was there. We constructed about 12 miles of the upper end of the Colorado-Kansas Canal. It was an old canal and we enlarged it from about 12 feet to 30 feet on the bottom.

In 1899 and 1900 was Assistant Engineer on the Board of Public Works in City of Denver.

In 1904 I made surveys of Link Lake Ditch. In 1905 was engineer on Mountain Supply Ditch Company, constructing small reservoirs in the valley in the spring of the year, and in the summer was engaged on Cameron Pass Reservoir and Peterson Lake Reservoir. In fall went back to the valley and worked on small ditches and reservoirs for the company. I refer to the Cache la Poudre Valley. The valley work was near Fort Collins.

1878 The Mountain Supply Ditch Company's system involves inter-watershed diversion, over Cameron Pass from Michigan Creek, a tributary of the North Platte in North Park. These reservoirs I have named are about five miles north of Cameron Pass on the Joe Wright Creek, where the Cameron Pass Reservoir is located. Chambers Lake is at the head of the Cache la Poudre River. Three streams, Joe Wright Creek, Trap Creek and Fall Creek discharge their waters into this lake. The Mountain Supply Ditch system involves the bringing of water from the North Platte drainage area in North Park over and into the Cache la Poudre drainage for application on lands north of Fort Collins, Colorado.

In 1905 was again engaged in engineering on Cameron Pass and Peterson Lake Reservoirs. In 1906 was on Mitchell Lakes for a short time and was later in Garden City, Kansas, on the U. S. Sugar

& Land Company enterprise. Was building No. 5 reservoir
1879 and enlarging the inlet ditch from the Arkansas River. This reservoir covers 3,080 acres at high water line and the ditch was enlarged from 20 feet wide to 40 feet wide a distance of 12 miles. About $300,000 was expended under my supervision as engineer.

In 1909 was south of Sheridan, Wyoming, on the Big Horn Reservoir for the Reed Investment Company. The enterprise was rather small. At high water line it only covered 134.7 acres, and held about 1,620 acre feet.

During summers of 1910, 1911, 1912 and 1913, was engaged on Chambers Lake, Lost Lake and Laramie Lake for the Water Supply & Storage Company. That is the same Chambers Lake I have heretofore designated as being at the head of the Cache la Poudre river. That work involved a reconstruction of Chambers Lake and Lost Lake. They are mountain reservoirs. This work was done under my engineering supervision. Chambers Lake had previously broken twice. Lost Lake is about half a mile north of Chambers Lake. It is right on the divide between the Cache la Poudre and Laramie river drainage. I constructed a dam at each end of the lake. Lost Lake originally discharged its waters into the Laramie river. It now discharges into Chambers Lake and the Cache la Poudre river.

Laramie Lake is about three-quarters of a mile north of Lost
1880 Lake on the Laramie River drainage. It naturally discharges its waters into the Laramie River. It now discharges into Lost Lake and thence into the Cache la Poudre.

The Sky Line Ditch conveys water from the West Fork of the Laramie River over the divide into Chambers Lake. This same company also has a small ditch on Cameron Pass, bringing waters over from the Michigan river, which is located in North Park. This water is brought over the divide into the Cache la Poudre. They also have what they call their Grand River Ditch, about 7½ miles long, constructed at an elevation of about 10,000 feet and diverting waters from the headwaters of the Grand River, which, if not thus diverted, would naturally flow into the Pacific Ocean. They
1881 are diverted and carried by this canal over into the head of the Big South Fork of the Cache la Poudre and thence down to the Water Supply & Storage Company's ditch at Fort Collins.

This Company irrigates lands immediately adjacent to those of the Greeley-Poudre Irrigation District. The Ditch is commonly known as the Laramer County Ditch. Waters derived from these five inter-watershed diversions which I have mentioned constitute a part of the supply for the irrigation of the land under the Water Supply & Storage Company's Laramer County Ditch. This canal also depends in part upon the Cache la Poudre River for its water supply. It is necessary for the Laramer County Canal to have the combined supply obtained from both the Poudre and the inter-watershed diversions in order to irrigate the lands served by it. This Company also has a reservoir system, of which the three reservoirs which I have mentioned are a part. In Chambers Lake, the water- from the Poudre, the Laramie and the Michigan rivers are commingled and

stored. This natural lake is utilized by this company as a storage and collection reservoir.

My first acquaintance with the Greeley-Poudre system was in 1904 when I was engaged as engineer for the permanent loca-
1882 tion of a tunnel. Also had charge of engineering on Upper Rawah Ditch. This was permanent location. I ran preliminary lines for the East Side Collection Ditch and the West Side Collection Ditch. R. Q. Tenney, of Fort Collins, Colorado, preceded me in laying out the preliminary lines for the tunnel. Mr. Beach had preceded me in the preliminary surveys of the Upper Rawah Ditch.

May 22nd, 1904, I went to the Laramie River to engage in this work. Myron Akin, of Fort Collins, employed me in behalf of his associates and himself. I was under the immediate direction of Wallis A. Link, while engaged on the work. I began work on the Laramie River Tunnel of the Greeley-Poudre System May 23, 1904. I found evidences of preliminary survey which had been made by R. Q. Tenney. I did not vary to any considerable degree from that preliminary line. I located the west end of the tunnel about 200 feet north from where his stake was, for the reason that where his stake was situated there was a great deal of drift from a gulch which had washed down and I moved over to get under a ledge of rock so that the entrance of the tunnel might be near to the surface and in the solid rock. The change avoided timbering in the loose material at the west end of the tunnel. The east end of the tunnel I located at the same place as had Mr. Tenney.

I had five or six men in my party and was engaged in the engineering works in the Laramie River Valley for Akin, Link and associates from May 22 to October 10, 1904. About two weeks were consumed in making the tunnel survey. I ran two lines of tunnel at that time. The one which I commenced about 200 feet north of the west end as located by Tenney was the one I finally selected. The other line I ran was about 80 feet south of the one I finally selected. The one about 80 feet south was a little longer than the permanent tunnel selected. It came out at the same place on the east side that the Tenney and permanent lines came out. All three surveys terminated at the same point on the east side.

1884 I also located the inlet ditch for the tunnel from West Fork of the Laramie River across the East Fork and into the tunnel.

Plaintiff's Exhibit P represents the survey that I made during the season that I was there. It indicates nothing else than the surveys made by me. The tunnel line located on the map is the one finally selected by me. The inlet ditch of which I spoke is noted on this map. It commences at point on West Fork of the Laramie River, from which the N. W. corner of Sec. 7, Tp. 8 N., R. 75 W. bears north 7 degrees, 19 minutes west, 3863.7 feet. From that point it is run easterly across the East Fork of the Laramie River to west entrance of the tunnel. This ditch was constructed to carry waters from the West Fork to the East Fork and to the tunnel. The waters of the Upper Rawah Ditch are discharged into the West Fork and

thence down that stream and into this inlet ditch and then into the tunnel.

1885 I have been on the ground since the tunnel constructed by the Greeley-Poudre Irrigation District and the Laramie-Poudre Reservoirs and Irrigation Company was completed. The line of tunnel thus completed is the same as the line of tunnel indicated on the map, plaintiff's Exhibit P. In addition to locating the inlet ditch from the West Fork to the West Portal of the tunnel, I constructed about 500 or 600 feet of the canal from the creek and turned water in from the West Fork of the Laramie river June 10, 1904.

That was the first actual excavation work on any part of the Laramie river system. Water ran through that portion of the inlet ditch which we constructed from the West Fork. After constructing this portion of the ditch, I went to the outlet end of the Upper Rawah Ditch and commenced permanent location of that canal to Rapid Creek, so that right of way could be cleared for excavation, and afterwards continued survey through to Rawah and McIntyre Creek. The line thus permanently located by me was practically the same from the outlet end of the ditch to Rapid Creek as the line located by Beach. From there to McIntyre Creek I selected a line a little lower down than the Beach line to avoid expensive construction south of Camp Lake. It had no effect one way or the other on the

1886 water supply. So far as diversion of water is concerned, the line I selected was practically the same as that laid out by Beach.

We were able to get up to lower end of this Upper Rawah Ditch to start our surveys July 4, 1904. We could not get up there earlier on account of snow at head of Fall Creek and Rapid Creek. Snow was too deep. We could not do anything.

Crews of men had been working on the Laramie River system before I went there in 1904. A road was made from the mouth of the West Fork up to the Sky Line Ditch, our first camp. That road was necessary as all our supplies came in that way. Construction of highways in such regions is a necessary prerequisite to excavation work upon ditches. Road construction in such cases compares with the necessity of road construction in mining enterprises. When I arrived on the Laramie river, in May, 1904, the road had been constructed up to the Sky Line Ditch. Between June 10th and July 4th, 1904, I commenced work on the lower collection ditches. I commenced on East Side Ditch at the tunnel and located the line north for about 3,000 feet to the first pipe line across the Laramie River Valley. This pipe-line is noted on the map, plaintiff's Exhibit P, as the Fall Creek Line. At the west end of this pipe line and on the West Side of the valley I located two ditches, one from the Springer Creek south to Rapid Creek, and one below Rapid Creek and Fall Creek to the end of the pipe line. I had previously located the pipe-line of Fall Creek, making that system complete over to the East Side Ditch.

My idea in proposing to use a pipe-line from the West Side Ditch to the East Side Ditch was to avoid expensive construction on the

west side below those two small stretches of ditches. It would have required tunnels, rock work, etc.

1888 Prior to July 4 we had also constructed a road from the camp at the head of Sky Line Ditch to the lower end of the Upper Rawah Ditch. On that road we raised 1000 feet in elevation in about a mile and a half. We also constructed log house at head of Sky Line Ditch and Camp No. 1. When I first went into the valley on May 22, 1904, I located a weir for the purpose of measuring waters that came down from this Upper Rawah Ditch, near the head of Sky Line Ditch. It was so situate that water could be diverted either into the West Fork or the Sky Line Ditch. The weir was not constructed.

Was engaged with my engineering party in engineering work on Upper Rawah Ditch during summer of 1904, from July 4th to August. Immediately after engineering Wallis A. Link proceeded to clear right of way and blow out the stumps. He had a

1889 force of men and teams. We afterwards let a contract to Walthall & Ianson to commence excavation. They commenced excavation near outlet end of Upper Rawah Ditch, at point where the waters discharge down into the West Fork from the top of the hill. They had contract for excavation of 9700 feet of work. Work was divided into two classifications, earthwork and solid rock. There was no loose rock classification. All rocks measuring a cubic yard and all rock in place were rated as solid rock. Remaining portion of work was estimated as earth work. Mr. Link continued clearing right of way and as he cleared, I re-located line and put in slope stakes, or cross-section stakes. Mr. Link worked the rest of the summer clearing right of way with his force of men and teams. Snow on October 10th stopped him, although he remained a short time afterwards. I left October 10. I finished my engineering work on this ditch August 5th. I ran the permanent location about 7½ miles to McIntyre Creek. At that place the McIntyre

1890 Creek was just a little brook at that time of the year. There is no large channel there. It is about five or six feet wide and probably a foot deep. Plaintiff's Exhibit P represents line of ditch thus permanently located by me in 1904. In locating Link Lakes I used Mr. Beach's surveys.

I completed engineering work done by me on two lower collection ditches October 1, 1904. I worked on those ditches during August and September after leaving Upper Rawah Ditch and completed both surveys, one on east side and one on west side of Laramie River. Those completed lines are indicated on the map. One is called East Side Ditch, Deadman & Nunn Creek Ditch. The first part of the West Side Ditch we called the Rawah Pipe Ditch and the other one we called the Fall Creek Pipe Line. These

1891 two last named ditches together constitute what is now called the Lower Rawah, or West Side Collection Ditch. Mr. Hedke can give more exact location of these two ditches as now constructed than can I. Plaintiff's Exhibit P represents work done in the year 1904. I did not assume to represent any other work done by any other engineer prior to that time.

The sentence appearing in statement of claim on Plaintiff's Exhibit P "and work was commenced on additional ditches and pipelines going to make up this entire claim August 6, 1904," is the date of completion of surveys. I commenced the work actually on May 22, 1904. I don't know how that date occurs in the statement. The dates that I have previously given are the correct dates. I have refreshed my memory by consulting a diary kept during the work.

1892 Estimated carrying capacity of tunnel I located and designed was 1000 cubic feet per second. I had full engineering party with me during all this work in my department throughout the year 1904. I had the assistance of engineer R. Q. Tenney for a short time and Mr. Norvell was instrument man and assisted me in mapping. Activities in construction of ditch line were going on during all time I was there. Both surveying and actual excavation. The first work was clearing right of way before we commenced final location.

A road had been constructed into this work on the Upper Rawah Ditch prior to 1904. It came up from State road near head of this location and was continued over to Camp Lake. In 1904 a road was constructed up West Fork and along line of Upper Rawah Ditch to Rapid Creek and then over Grassy Pass to Camp Lake, so that the two roads joined. These two roads were necessary before construction could begin on this system. They were necessary prior to permanent survey work done by me, although connections of the two were not made until later. In making my survey I had to use pack animals to complete the upper line. I made use of the roads up to the ditch line. These roads were of value in

1893 connection with this enterprise, both for construction and engineering. Prior to construction of these roads supplies could be brought to this line only by pack animals from the Sky Line Ditch. That is not a practical method of transporting machinery, supplies and men. During summer of 1904 we built log house near head of Sky Line Ditch and one on Rapid Creek near where ditch line crosses the stream. Headquarters for work done on Laramie River that year was at Lanning's Place. Our supplies were brought in by teams to Lanning's place and other teams would take them over and bring them up onto the line of work. That was a freight station. An employee was kept in charge of that station during part of summer. Lanning's cabin is in N. E. quarter of Tp. 8 N. R. 76 W., about 2 miles northwest and down stream from mouth of West Fork. It is on floor of Laramie Valley.

In addition to running the ditch lines I traced the correction line from the township corner to find the corners along the lines of the Upper Rawah Ditch and also retraced the township line along the Deadman and Nunn Creek location. This involved considerable time and labor for the reason that in many places corners were not in. Corners were found in a rough, rugged country in many places, in dead timber and timber.

We had light snow storms pretty nearly all summer of 1904. They were of short duration. We had a great deal of rain. Snow

drifts were lying on the ground on the line of the Upper Ditch up to August 5th. This canal is located in the regions where the snow falls the year round.

1895 By barometric computation the lower end of the Upper Rawah Ditch is 1,700 feet higher than the west portal of the tunnel. The point of diversion of the Upper Rawah Ditch on McIntyre Creek is in the neighborhood of 1800 feet higher than west portal of tunnel.

I have had considerable experience with mountain construction over a long period of years. This class of construction requires much more time than it would if located on the plains and it is much more expensive. The comparison is quite startling. It is illustrated by prices we have to pay in that class of work. We paid 35 cents a cubic yard for earth work there that would cost 12 or 14

1896 cents in the valley. To illustrate the time consumed, I was three seasons building Chambers Lake Reservoir in which 53,000 cubic yards of material were used and could have done the same work in the valley in probably three months. This Chambers Lake is much more accessible than the Laramie River System. There are good roads from Fort Collins to Chambers Lake and more conveniences in every way, such as telephone connections, plenty of material, etc. Elevation of Chambers Lake is 9,100 feet according to barometic observation. Cost of construction increases with increase of elevation in this mountain work. The working sea-

1897 sons shorten as the elevation increases. On plains regions we can work pretty nearly the year around in ordinary seasons. On Upper Rawah Ditch we could only work from July 1 to October 10th, that year, 1904. Even during that time work was not as convenient or easy of accomplishment as similar work involving similar materials would have been on plains region, because of elevation, expense of getting material in and climatic conditions. It was very wet. Rain stopped the work. It is very difficult to keep men early in the fall on work of that kind situated as high as it is. Even during summer months it is not as easy to keep them, as it is on other work.

Organization of a working force on mountain work, followed by necessary abandonment and necessary re-organization the next seasons interposes an obstacle to rapid construction. In fall snows come, and men are anxious to get away for their season's work in the winter on the plains. It is almost impossible to retain men in late months. For illustration, we had all of the Ianson teams in his stables from the 1st of October until October 10th, on account of not having drivers. He could not keep them and he quit on the 10th and went out. There was no strike. That is a common experience on that class of work. We had the same experience on the Sky Line Ditch and also on the Grand River Ditch. This class of labor requires more skilled men than does plains work, on account of using powder, rock work, etc. It is higher priced labor. Early winters on these high regions usually brings about a spirit of discontent.

In 1905 I made a survey of another tunnel to the north of the

present Greeley-Poudre Tunnel, that is the west entrance of another tunnel to the north of the present one. It came out at the same place as the present tunnel on the Poudre side. This tunnel is
1898 located on plaintiff's Exhibit P. I ran the line from near the point marked "Mill" on Exhibit P. This line was some 2,000 or 3,000 feet longer than the one located. I never did anything further than merely locate this line. I reported it to my employers and put it on the map that they have in their office. That line was contemplated by me in 1904. I did not run it that season because I did not have sufficient time. It was completion of work started in 1904. In 1904 and 1905 I ran three tunnel lines; one indicated by tunnel line appearing on plaintiff's Exhibit P; one coming out of Laramie river a little south of west portal of that tunnel and discharging into the Poudre at the same point, and one coming out of the Laramie river about a mile and a half north of the west portal of the first tunnel named and also discharging waters into the Poudre river at the same point. The one found on plaintiff's Exhibit P was selected. It is the one on which the present tunnel is located.

Cross-examination by Mr. N. E. Corthell:

1900 According to the map designated "Exhibit 1," the Laramie County Ditch system with its extensions, extends into the Greeley-Poudre Irrigation District and is so situated that it would water a considerable part of the land within the District. I have never been in that region so do not know whether lands within the boundaries of the District are watered from that system. According to this map, the ditches marked "Pierce Lateral" and "Central Lateral" are extensions of the Laramie County Ditch.

The west end of the tunnel has been somewhat lowered from the survey I made, but I do not know how much. As now constructed, it is designed to take water from the level of the stream opposite the upper end, whereas my survey required an intake ditch to get the water into the tunnel, some of this ditch being built the year I was there. Water was run through it, but no use whatever was made of it. I do not think it was completed, and I do not know whether it is now a part of the present system. I do not know that any work was done on it since 1904.

1901 The upper Rawah Ditch which I located was designed to gather water in the higher elevations northwest of the west Fork, and we could carry it either through the Sky Line Ditch into Chambers Lake or down the West Fork into the tunnel. I was engaged in the survey of that ditch from July 4 to August 5, 1904, and the construction work commenced, according to my diary, on August 9th. The work commenced on August 6th with the clearing of right of way and blowing stumps out. On July 28, 1904,
1902 Mr. Link did a small amount of rock work at the outlet end of the ditch, and on August 6th had charge of the work of excavating on the north side of Rapid Creek. When I was last in

the Laramie Valley no connection had yet been made between the Rawah Ditch and the Sky Line Ditch.

1903 When we finished the work in 1904 we had a road along the line of the Upper Rawah Ditch clear to the head of the ditch at McIntyre Creek. Work was done to station 67 from the lower end of the ditch about 6,700 feet, although it was not all completed over this portion. The contractor was given credit in two estimates for 8,358 yards of excavation. The men employed by the contractors were largely laboring men from Fort Collins, who seemed to want to work in the sugar factory during the winter and quit work in the mountains when it commenced to snow.

1904 We used as headquarters a ranch about two miles below the tunnel, from which point there was an open traveled road down the Laramie River to the Railroad at Laramie City, and also a road passing over the hill to Chambers Lake.

The work in the vicinity of Chambers Lake which I have testified about, consisted in rebuilding the dam to the height of 46 feet, requiring 53,000 cubic yards of earth; building concrete culverts, rebuilding Lost Lake, and improving the outlet at Laramie Lake. Up to the fall of 1912 we spent $44,700 on Chambers Lake, and the cost of the open cut into the lake I do not know.

1905 Work cannot be carried on economically after October in the upper part of the Laramie Valley where the tunnel and collection ditches are located. Sometimes, if the winter is not very severe, some work is done after the first of October. I do not know where the Laramie, Hahns Peak and Pacific Railroad passes the same range of mountains, nor whether work on that road was carried on continuously during the winters of 1907-08, 1908-09, and 1909-10. Tunnel work, which is not exposed to the weather, could probably be performed during the winter. I do not know whether work was performed on the tunnels of the West Side Ditch during the winters or not.

My knowledge of water conditions in the upper Laramie Valley is confined to observations made in 1904. I have not been over these works since they were constructed. I do not know how they conform to the plans I laid out, with the exception of the tunnel. I have not been over the Upper Rawah work since I left there in 1904, and know nothing of that work since that time.

Redirect examination by Mr. Delph E. Carpenter:

1906 I was over on Mountain Supply System in 1903. I then heard of an enterprise on the Laramie river under Mr. Akin and Mr. Link in that year. That was the year previous to the time I made my surveys.

Stipulation.

It is stipulated that the estimate given by Mr. Duvall to Ianson & Walthall for work done during 1904 is an estimate on the same work checked over and re-checked by Mr. Hedke in 1905.

(Defendants' Exhibit 51 offered in evidence, being exact copy of Plaintiff's Exhibit P heretofore referred to in testimony of Zac T. Duvall and Charles R. Hedke, the same being a copy of the map of the Laramie tunnel, ditches and feeders, as prepared by said Zac T. Duvall and as covered by his testimony heretofore offered.)

WALLACE A. LINK, Fort Collins, Colo.:

Direct examination by Mr. Charles F. Tew:

1907 Live at Fort Collins, Colorado. There for 12 years. Lived previously on Laramie river in Colorado at point of present reservoir site of Laramie River Reservoir. It is sometimes called Big Park. My house was three-fourths of mile up stream from Glendevey in Sec. 35. It was near dam site of this reservoir. Lived there between 8 and 9 years. Engaged in cattle business. Prior to that time was located on Stuck Creek, Colorado. That stream is a tributary of the Laramie river on west side. Lived about 3½ miles up creek from mouth. Mouth of stream is about ¾ mile south from north line of Colorado. Lived there two years and was in
1908 cattle business. Previously resided in Black Hills about 12 miles east of Laramie, Wyoming, on head of Horse Creek and ran cattle there. Lived there nearly four years. Horse Creek flows eastward and rises in Black Hills on east side of Laramie Plains.

Was raised at City Springs, east of Laramie, about 2½ miles. Came there when nine years old. Parents located there in June, 1871. I made my home there from 1871 to time I went to Horse Creek. Was absent from 1877 until fall of 1880. Attended school in Laramie. Spent my youth in Laramie. Previous to
1909 going to Horse Creek took care of our own cattle and worked for different cattle companies. Worked for Diamond Cattle Company; March and Cooper on Rock Creek; also Balch and Bacon on Riverside Ranch. Worked for Bar Circle outfit at Iron Mountain.

The Laramie Plains was a cow country during those years. Animals roamed at large. The different outfits had brands by which they were known and at round-up times the animals were separated and branded. Until 1886 I worked for these parties. During this time I lived at Laramie, became acquainted with conditions and practices of people on Laramie Plains and business there carried on. Very thoroughly familiar with it. Also thoroughly familiar with country all over Laramie Plains.

From Laramie moved over to Horse Creek and there engaged in ranging cattle and built a ranch there. I built ditches on this ranch. I surveyed them myself with a device of my own. I operated these ditches. Moved to Stuck Creek in Upper Laramie River Valley in 1890 or '91. Built a ranch there. Surveyed ditches and built them there. Used spirit level and straight edge. Used ditches I built. I abandoned them later. Ran cattle there. While
1911 living there traded in Laramie City. Traveled up and down the Laramie River Valley. My ranch, which was in mountains, was 38 miles from Laramie.

Then moved from Stuck Creek to my residence at Big Park. It was then unsettled country where I located. An entry had been made on land where Glendevey is located and small log cabin with dirt roof had been constructed, but parties were not living there. Big Park was then uninhabited. Located my place about ¾ mile
from Glendevey. Big Park was very dry sage-brush land.
1912 During nine years that I lived there I reclaimed it. When I first went there it was unsettled country, not very frequently visited, except along the river where some men would ride for cattle or something like that. It was the home of nearly every wild animal that inhabited the Rocky Mountains. Elk, Deer, Bear, Mountain Sheep, and all other animals such as Martens, Fox, Coyotes, and animals of that nature, inhabited the region. There
are not so many now as there used to be.
1913 There were no irrigation works there at that time. I surveyed the first ditches. I used what is known as the triangle and plumb bob. I made it myself. I first built Link Ditch No. 1. East side of river, about 2 miles long. I did both engineering and excavation. Used ditch entire time I lived there. Also surveyed and constructed Link Ditch No. 2 on west side of Laramie. Used both ditches for irrigation of sage-brush in the first place and then
later for native hay, using water to rot out sage-brush and
1914 make hay meadow. Reclaimed only portion of land under west ditch. Constructed houses and barns. Lived there until 1900. From there moved to Fort Collins. While residing at Big Park did considerable hunting through mountains surrounding. Was over the mountains a good deal. Became acquainted with the entire Laramie Valley.

Have been over and along the ridge or crest of Medicine Bow Mountains, represented on Exhibit 1, from point on inter-state line to southern extremity of Laramie River watershed.. Am acquainted with general trend and course of these mountains. Location is
approximately correct on Exhibit 1. Have been along divide
1915 between the Laramie river and the Cache la Poudre river. Have hunted all over it many times. Location of this Divide on Exhibit 1 is correct. There may be some slight variation. It is a good map of the country. Am acquainted with Middle Mountain. Constructed a road over it to Nunn Creek. There is a road from Big Park to Glendevey. The road runs from there easterly
to Fort Collins. I have traveled that road a great many
1916 times. Traded at Fort Collins when living at Big Park. Also traded at Laramie. In going to Fort Collins went over Sand Creek Pass road, sometimes went by way of Horse Ranch Pass, and at other times by way of Boswell's Ranch down the river past Woods Landing. Used these roads in going to Fort Collins or Laramie. Went by way of Tie Siding in going to Collins.

Steep mountain sides border the Laramie Valley in Colorado. They are very abrupt.
1917 There is highway called Deadman's Canon road or State highway going from Glendevey East to Fort Collins. It runs from Glendevey west over Ute Pass over the Medicine Bow Range to

Walden. It goes through very rugged, hilly country with very long heavy grades. I had contract to build four miles of this road and constructed it for state, from head of Deadman's Creek down to upper end of Deadman Canon. I built nearly 1,000 feet of corduroy with a great many bridges—I don't remember the number. They were across little creeks. Corduroy is made by putting poles on
stringers to construct road across swampy places and sloughs.
1918 Such a method is necessary in mountain roads. That kind
of work is slow and tedious and quite heavy because of the amount of timber handled. These roads have to be repaired frequently.

When first moved to Big Park there was a road up the Laramie Valley which had been used for obtaining ties for railroad construction. Also to haul small amount of freight for the Water Supply & Storage Company. I improved it. Mountain roads rapidly deteriorate. Constructed other roads in Laramie Valley. Was road supervisor in District No. 3, Larimer County, Colorado. Had charge of the entire road district.

Was residing in Big Park at the time they were constructing the
Sky Line Ditch of the Water Supply & Storage Company,
1920 then the Larimer County Ditch Company. Head of Sky
Line Ditch is about 12 miles up-stream from Big Park. Sky Line Ditch was completed in 1892 or 1893, I believe it was on July 4th that they turned water through headgate and let it run through ditch. I was there at the time. Ditch is 5½ miles long. It took the owners three working seasons to complete this ditch after all engineering had been completed.

By working season I mean the months of each year during which work can be carried on. On account of elevation of country snow fall is very heavy. It comes early in the fall and goes off late in spring. You cannot work profitably a new enterprise in vicinity of
Sky Line Ditch before July 1. They established permanent
1921 camps, providing for closing down work each fall and open-
ing up next year. This permits them to begin work a little earlier, possibly June 15 to July 1. Supplies are hauled in the fall before. Supplies cannot be hauled over roads until quite late in spring. You cannot commence work in mountain regions until you can haul in supplies. The time when you have to cease construction in fall is very uncertain. Have seen it cease in September, and in September of 1890 or '91 snow was so deep four horses could
not pull empty wagon and operations ceased. Snows which
1922 will prevent ditch construction usually begin about Octo-
ber 1 of each year. Was along the ditch during the time the Sky Line Ditch was being constructed. Sold them beef and butter, and also cut out timber for their flumes, cut logs for their saw-mill and helped to distribute lumber along ditch. Am well acquainted with location of line of East Side and West Side Collection Ditches of Greeley-Poudre Irrigation District system shown on Exhibit 1. I have known those lines for a long time. Have seen the ditches since they were in course of construction. Sky Line Ditch is built

along mountain side similar to that occupied by these two ditches. Sky Line is at higher elevation. Slope is about the same.

1923 Have observed Sky Line Ditch while in operation. They usually begin running water in that ditch about June 10th to 15th and it continues until November 1st. I have been there when they were opening up the ditch. They cut narrow trench through snow and let the water through. Ditch fills with snow. The snow prevents running ditch in winter. It usually fills in November. When they open it up they start at the lower end near Chambers Lake. It usually takes until about July 10th before they can run the ditch full. Have been acquainted with care-takers in charge of

1924 ditch. It is necessary to carefully guard ditch during operation. Water flow fluctuates morning and evening. More water can be carried if watched than if not. Water comes into ditch below point of intake, there are several little rivulets coming off the mountain side and two or three creeks coming in. Principal supply is obtained from West Fork of Laramie River. Have observed that water runs from 30 to 40 days over diversion dam at head works on West Fork every spring, it never fails. This occurs after they begin operation of ditch. These patrolmen of which I have spoken are engaged for purpose of taking, by means of this canal, all water possible for Chambers Lake. They are men who are acquainted with the system and this particular line of ditch. They never put a new man on that work. The water thus diverted is made available for us in Poudre Valley. This water running over spillways of which I have spoken occurs while patrolmen are watching ditch. Even in low stages of river, ditch loses parts of water diverted, by seepage. Water can be seen coming down mountain side below ditch line.

1926 Was acquainted with mountain side on which ditch was constructed. Was there first time water was run through. Seepage has since appeared below ditch. This appears now where it did not appear before ditch was built. Have been at ditch when it was taking the entire flow of West Fork. Even at such times some water appears in West Fork below diversion. Starts 300 or 400 yards below and keeps increasing, and there is always good stream of water at mouth. Seepage from this ditch is considerably more than from similar ditch on plains.

1927 Impossible to make ditch bank absolutely water-tight where it comes in contact with different rock slides and stratas. Conditions are very different from those on plains. Only difference between Sky Line Ditch and the collection ditches of the Greeley-Poudre system is that the latter are lower down on the mountain side. General mountain slopes are about the same. Those of the Greeley-Poudre system are nearer to the foot of the mountain. About the same class of materials is encountered in construction. The same conditions which contribute to loss of water from

1928 seepage from Sky Line Canal would also obtain for canals of Greeley-Poudre system.

While living at Big Park my attention was called to efforts being made by irrigators in Poudre Valley to secure a further water sup-

ply for lands in that valley. My attention was also called to difference in value of water for irrigation purposes on lands in Poudre Valley as compared with those on Laramie Plains. That was first brought to my attention by construction of Sky Line Ditch, which I understood cost $80,000, and when I compared small amount of water for which they expended this money, it seemed to me that many millions of dollars' worth of water might still be diverted from the Laramie River into the Cache la Poudre Valley.

I knew very well just what the Laramie Plains were valuable for. I was raised on them and rode all over them. Was very familiar with them. I knew the use to which the water of the Laramie River was put on the Laramie Plains. This also came to my at-
1929 tention and consideration when I worked on the Sky Line Ditch. I then realized the value of water and the great difference there must be in the value in the two regions to warrant an expenditure of so large an amount of money in the construction of that ditch.

Am acquainted with location of Greeley-Poudre tunnel. I located it. 1897 first I noticed narrow divide between Laramie and Poudre rivers at point where tunnel is now located and constructed. Was hunting one day and wounded deer. It went up draw or ravine which runs straight up mountain. On top of mountain there is little lake at head of little ravine, and I overtook deer there and killed it, and from that point could look right down west into Laramie river. I looked also off east and compared elevation of mountains on east with bed of river and on west with Laramie river and it was apparent that you would be from 600 to 800 feet higher on Laramie river side than on Poudre river side. It was apparent to eye. Place where I stood at that time is directly over where
1930 the tunnel is now constructed. At that time I figured distance through the ridge would be about 1½ miles. The lake at which I stood we called Deer Lake, do not know what it is called by others. Resided in Big Park about 3½ years after that. At that time took no steps towards completion of system. Had no funds with which to build system such as described here.

I was the originator of the entire proposition as now constructed or planned. I moved to Fort Collins in year 1901, I think it was in fall. Traded in real estate some and got some teams and that winter they raised money to construct Fossil Creek Reservoir. I hauled rip-rap for the reservoir embankment and took 12 shares of their capital stock at $50 a share in payment. That is the irrigation reservoir constructed across the channel of Fossil Creek. Fossil Creek is a small seepage stream. Purchased a small farm in vicinity
1931 in 1901. While living there became acquainted with A. I Akin. He was farming. At that time imported to him information I possessed as to possibility of system to be constructed for diversion of water from Laramie river by means of tunnel, East and West Side Collection Ditches and Upper Collection Ditch. Explained it to him some time during spring of 1902. He was well acquainted with old irrigations in that country and had considerable experience along the line of value of water for farms. I told him what I thought

could be done up there and drew a profile of proposition, and stated if there was anything in it we would own it together. We were intending to promote that proposition.

My purpose in getting Mr. Akin interested with me was to assist in raising necessary funds to carry project into going concern and construction. Mr. Akin had been to my place at Big Park and I was better acquainted with him than I was with any other man in the Poudre Valley and my acquaintance drew me to him and we were neighbors in farming, which naturally induced me to talk with him in regard to this proposition.

1932 I explained to him the proposition and made a map or chart of it. I did not pretend to draw it with exactitude but it was in manner similar to that which had been done on ditches before. I made a sketch map. In making this sketch map I described the tunnel and the collection ditches coming to and feeding this tunnel. Akin and I took trips around Chambers Lake and down the West Fork and East Fork and camped upon what we called Salt Mounds. This is located nearly due west and about 1,000 feet distant from the west portal of the Greeley-Poudre tunnel. I explained to him the system and told him it was a large scheme and all we needed was money. We had the idea but were short of funds.

We adopted a method by which we were to build a part of the system first and employ the same to demonstrate the flow which was obtainable, and also to assist in obtaining money for further promotion. After our first trip to Link Lakes and over that country, we thought that the first thing to do would be to build this ditch and connect it up with the Sky Line Ditch, as this, being a unit

1933 of the whole, would retain our franchise and as well give us revenue to proceed in the construction of the work. It was the cheaper part as well as the best revenue earner of the whole proposition. The idea was to connect that with the Sky Line Ditch and turn it into Chambers Lake and into the Poudre. We were five days on this trip of inspection. We visited Link Lake. I explained to Mr. Akin the line I proposed for this first construction. I had never surveyed the line. I had merely made some observations. I had been over to these Link Lakes on many occasions and knew the country thoroughly. I thought I knew the comparative elevations of necessary ditch lines and also of tunnel. I showed Mr. Akin at that time the line where I thought ditch would go. Later on in that season (1902) we had the line surveyed. The line established by the survey did not vary at all from the line which I conceived and as I explained it to Mr. Akin. The variance would not be more than 100 feet. I remember the surveys made by Mr. Duvall, the engineer who testified just previous to me. The lines which he

1934 established for those lower ditches corresponded just as near as can be with the lines that we had charted. In this connection, I might say there is just one thing to do. If the topography of the country won't allow that, you might as well stop. There is no use to survey at all. If the country will permit of these things you are usually all right, but if not, you cannot overcome these conditions with a surveyor.

July, 1902, first took Mr. Akin with me to view this line, near Link Lakes. The Water Supply & Storage Company were then working somewhere in the vicinity of their Grand River Ditch. We planned to take an engineer back later in the summer and survey the proposition. Frank Beach, civil engineer, was taken up there in same summer to survey the proposition.

1935 Mr. Akin and I paid for work, bearing expense equally. We had him first survey the Link Lake Ditch, what they call now the Upper Rawah Ditch. Survey commenced August 25, 1902. Mr. Beach, Mr. Akin and I were engaged in the work.

There were no roads or trails by which access could be had to this high mountain region where the Link Lakes are located.

1936 The country was heavily timbered and in very high mountains. In order for us to gain access to that country we packed our provisions and bedding on horses. We started from the East Fork of the Laramie and went up the West Fork for some three miles; then went up the steep mountain sides into the heavily timbered country. We passed the Sky Line headgate on our way up. From that point we went directly back into the mountains. There was no road or trail. As I went in I showed Beach a little point called Saddle Back No. 1, and told him we must come out through that point, that if we did not, it would throw us down the hill below, and if we got above that point it would throw us into heavy bowlders. This part of the ditch would have to be abandoned unless we could come through this point and another similar one. These would be what you would call controlling points. Grassy Pass was the other place.

1937 It would be impractical to build the ditch unless we could have made those two points. Little change of conditions sometimes amounts to a great deal in the mountainous country. Failure to make controlling points makes ditch construction impractical. We did not finally construct the ditch through Grassy Pass. The Beach survey ran through Grassy Pass with a cut of 35 feet for a short distance, but Mr. Duvall thought he could come around the mountain east of Grassy Pass cheaper than we could get through. We constructed the ditch the latter way.

With this exception, the ditch is built precisely on the lines that I sketched to Mr. Beach before he made his preliminary sur-

1938 vey. It is still my idea that the ditch should have been constructed through Grassy Pass. His engineering judgment was followed He was engineer in chief and I would not go contrary to him.

Mr. Beach, Akin and I established two or three camps in this survey. We stopped wherever was most convenient.

We were engaged about two weeks on this survey. The weather put a stop to any further surveys in the fall of 1902. We had considerable wet snow and some rain. The last week were on the work it interfered with sighting the instruments. Even that would not have stopped us but for the fact that we had accomplished what we went in there for. We left that country September 17, 1902.

1940 I went by way of Big South Fork of Cache la Poudre river. It was impossible to have done any more surveying or any more construction of any character on that portion of the system in the fall of that year. The snow fell heavy and stayed. Mr. Akin and I were still owners of the projected enterprise. We were partners and not a corporation. We were engaged in reconnoitering, laying out a system and planning methods for its projection and promotion. During winter of 1902 we talked with various irrigationists in Poudre Valley, showed our plans to them and tried to interest some of our home people in the project. The char-
1941 acter of the enterprise was such that it required considerable capital. Mr. Akin and I were of just moderate means.

In 1903, just as soon as it was possible to get to Laramie river, I took one man, a team, provisions and camp outfits and went up there and started on construction of road from state road south to Link Lakes. At that time the State road running east and west and crossing the Laramie Valley at Glendevey post office was constructed, running from Fort Collins to North Park. I started my road from the State road near Little Jinks Creek. I bridged that creek and went back as far as I could get for the snow, and chopped the road out, did the grading, put in bridges, etc. It is mountainous country. It is part of Medicine Bow Range. It takes a good deal of work to construct roads through that country, heavy timber to contend with and mountain sides where you have to grade, little creeks and large ones that you have to bridge. It was wild, unsettled, rough mountain country.

1942 The Link Lakes which I have described are along the upper end of Upper Rawah Ditch. They are located nearly at timber line. The object of building this road was for constructing the system. It was constructed into the same ditch line where I took Akin first and afterwards the engineer, in the preceding year.

The second year we went in as soon as conditions would permit of work. It is impossible to get into that country to work before May.

1943 I constructed a pole bridge 20 feet long across Little Jinks Creek. From there cut out timber back to very steep hill which we had to grade towards Stub Creek. After getting on hill, cut timber from there to creek, there we put in bridge, about 36 feet from bank to bank. From there began to work in dead timber. We had gotten through Jack Pines, the green timber. We chopped very heavy dry poles from there up to top of McIntyre Divide. Crossed few other little creeks where put in small bridges, 4 to 12 feet across. I bridged all creeks. After arriving at the top of McIntyre Divide we turned nearly due south following dry ridge until struck heavy green timber, and side hill around which we had to grade. Course was nearly south from there to Lake No. 4, one of the Link Lakes, at head of Rawah. We made another camp and chopped a road some two or three miles ahead of us through heavy green timber. Some swamps we had to corduroy where we could not get around them. We avoided all corduroy we could. We

put bridge across Rawah about 36 feet long. In this bridge we laid
heavy stringers, and then floored it with poles.
1944 We built road ahead of us and took supplies on wagon.
Would build mile or two of road ahead and move camp up as fast as road was cleared. From Lake No. 4 we built road over to Camp Lake before we moved. From there constructed road to east side of Grassy Pass. We built another camp on east side of Grassy Pass and there intended to build main commissary camp for work to south of that point, so got out a large lot of logs and dragged them up to where we intended to build our cabin. The commissary camp was a necessity in this construction. By the time we got logs all chopped, it was getting late in season and pretty cold and I brought my family, which was with me, back to Fort Collins, and while I was down there was a very heavy snow. I left Bob Lowman up there with camp. Within two weeks after I came out snow was
so deep could hardly get in with outfit. This was latter part
1945 of September. Impossible to do anything further on ditch
that year. Up to this time had no other financial resourses than that possessed by Akin and myself. Resided in Fort Collins
during winter of 1903.
1946 In fall of 1903 we started negotiating with Myron Akin to
find someone who would further finance the proposition and obtained Wellington Hibbard. He resided in Nebraska at that time. Had no previous acquaintance with him. He and Mr. Myron Akin and A. I. Akin and myself and Mr. Jesse Harris met at Fort Collins. We drew up contract whereby they were each to have one-fifth interest in proposition for inducing capital to construct the whole
system. This was consum-ated after three meetings held in
1947 Fort Collins. The line of ditches as we had designated and
designed them were explained to our associates. I made charts showing lines of tunnel and platted entire proposition.

The five of us concluded we had better make survey of tunnel as early as possible and so I took team and number of men with Mr. Tenney and went up there and camped at Lanning Cabin and surveyed line for tunnel. In party were R. Q. Tenney, W. R. Lowman, Dwight Mandeville, and Cooley.

Left Fort Collins March 9th and arrived there about March 12, 1904. Took about two weeks from time we left Fort Collins. We were engaged five of six days surveying. There was a great deal of snow on tops of mountains, it averaged two feet in the Laramie valley from what we call Middle Mountain to tunnel site.
1948 Site surveyed by Tenney in practically same place pre-
viously selected by me, its location was just a matter of difference of opinion as to best place to open tunnel. Mr.
1948 Duvall thought it would be better further north where there
was less slope, and he located it there. West side of this ridge, called Green Mountain, is more precipitous than east side. The western slope of the mountain at that point is about 1,000 feet high and it has a slope of about 1 to 1. The east slope is a more gradual until you get down to half or three-quarters of a mile from the crest of the mountain. It is quite steep down from there to the

portal of the tunnel. It would be almost impossible to go from the west side of the slope with pack animals. A mile or so north of the tunnel is a place where you could get up. It would be four or five miles south of the tunnel before you could get up with pack
1949 horses. After return of survey party to Fort Collins Mr. Tenney made up notes of his survey and Mr. Hedke was engaged with his figuring out distances and other like work with Mr. Tenney. We were active all along the line in raising money until about April 1. About that date it was decided I had better go back again and take men and do some work on the reservoir site which we called East Fork Reservoir and which was intended as equalizing reservoir for the tunnel. So we loaded up grub and camp outfit and went up to Lanning cabin.

Mr. Tenney ran fly line from East Fork Reservoir to tunnel. This was done about March 15th, about the same time we surveyed line over tunnel. At time Carrigan and I went back up we took surveyor's level and ran upper contour of East Fork Reservoir, took height of dam, and chopped off some timber that stood where dam site would be and then I went back down the valley with my team.

1950 It was too early to do work and much engineering with high priced engineers on account of snow. I took Bob Lowman and went back and did considerable work on East Fork Reservoir and also some work on the road up West Fork.

Mr. Duvall had been up to our camp at Link Lakes the year before when I was building road. He seemed to be a man of good practical engineering ideas and good about con-
1951 struction and I suggested we hire him as engineer. I knew him to be practical man for mountain ditch construction. He was then residing in Denver. His services were secured by co-partnership. Arrangements were made with him to come up and do surveying for us in May, and we were expecting him early. So took crew of men up into territory and left some of them there and came back out and got Mr. Duvall and another man and went back up and went to work surveying and making final survey of tunnel. Men had been working on road up West Fork of Laramie River all time I was gone.

Survey was carried on throughout entire summer of 1904 during which time the entire mountain system was surveyed. First commenced surveys on tunnel in May but had to discontinue
1952 on account of snow. Then surveyed up West Fork to lower end of ditch from Link Lakes. All surveys of all ditches now in course of construction were completed during summer of 1904. We had to work here and there as the snow would permit.

The line for the tunnel selected by Mr. Duvall was about the same line as selected by Mr. Tenney and myself. Lines might vary a few feet from one another. Other lines were run to ascertain which was best line.

1953 During 1904 projection was carried on by this co-partnership of five men. Considerable money was raised and ex-

pended during that year, both in surveying and construction. $13,000 to $14,000 was expended in surveying and construction on Link Lake properties during that summer. Upper Rawah ditch was also surveyed in 1904, final line was run and most of it cross-sectioned. The line finally selected was practically the same line as selected by Beach in 1902. The only difference would be the difference of opinions of the two engineers in getting around some obstacle. It was practically the same line described by me
1954 before first survey in my first conversation with Abe Akin. There was great deal of construction work done in 1904 outside of surveying. All necessary clearing was done from West Fork of Laramie River for ditch across to East Fork of Laramie River and to tunnel. Considerable of ditch line was plowed and some of it finished so as to turn water into it from West Fork of river. Ditch required considerable clearing of timber at this point. Work was done on floor of Laramie valley nearly level with west portal of tunnel. Upper end of this clearing was a point lower in elevation than what is now known as West Side Collection Ditch. It was so constructed that water flowing through this latter ditch as well as from Upper Rawah, would be carried across and into tunnel. First clearing in any part of project was on East Fork Reservoir and the next clearing was on this ditch line from West Fork to the tunnel.

1955 It would be impossible to take water diverted or carried by this East Fork Reservoir or the ditch from West Fork of Laramie River to tunnel out of Laramie Valley by any other means than a tunnel. Impossible to take it out by Sky Line Ditch or other canals.

1956 Established construction camps in 1904. We excavated about 6,000 feet of canal on Upper Link Lake Ditch as we termed it, that was the original name for it. That is the same ditch as now known as Upper Rawah Ditch. We also cleared at that time about 3½ miles of timber.

It was necessary to construct a road up West Fork of Laramie River and from West Fork up over the mountain to meet southern end of road coming in from the north to Grassy Pass in order to construct this upper ditch line. We also did little repair work on road between Glendevey and West Fork of river. This was old tie road, constructed in 1876 along the river valley. Repairs were required. Country along West Fork and up mountain side is very hard place to build roads. Springs coming out of mountain side in some places prohibited grading and we had to build up on the lower side.

1957 Camp was established and excavation by force of men and teams was commenced on Upper Rawah Ditch about middle of July, 1904. I was in charge of outfit doing work that season. Work was continued until along in October when snow stopped us. Work was continued throughout all weather permitting excavation. Snow got so deep we could not work without clearning off ditch bank and mixing dirt with snow and this would be disastrous as it would make poor banks, so discontinued excavating and let crew

go. I stayed there longer with 5 or 6 men and continued clearing. During that year we built log cabin and store room for commissary where we expected to leave provisions during winter and have them there for spring. We did considerable of this work on this ditch with teams. On this high ditch the country is a little flatter than it is along the two West and East Side Collection Ditches lower down.

1958 Supplies were hauled in with freight teams hired to transport it to Lanning Cabin from the valley. From the cabin I had a four-horse team that hauled supplies up the mountains to the work. Did not have freighters haul provisions all way up because their horses could not handle the freight on the steep roads. The horses were not used to that character of work. I had four head of mountain horses that were raised in the mountains. Our supplies were freighted from Fort Collins.

We had a great deal of difficulty in keeping men on the work. It is work requiring a special class of men, and in selecting a crew we are rather choice of kind of man we take there, as it is of no use to take a man there and expose him to hardship and have him turn out other than serviceable.

In 1904 in prosecution of excavation and construction work on Upper Rawah Ditch we had 35 men in our camp and the contractor, Ianson, had 18 or 20 men all the time.

During that season did not use the road from the north to bring in supplies because we had not reached the territory that road was constructed to serve. All work north of Grassy Pass was to be supplied by this road from North and South of the Pass from

1959 the road we constructed up West Fork. My gang of 35 men were employed all along line from West Fork of Laramie River to Grassy Pass and around the Pass. The work was prosecuted by this force of men and the equipment that I have mentioned throughout the entire period of construction in 1904. The work ceased only when the snow got so we could not handle the timber to advantage. We left upwards of $1500 worth of provisions in there. It is common practice to leave supplies in commissary cabins in the fall of preceding year when it is expected to further prosecute work in the following season. If supplies are left there you can get in and get to work earlier and at times when it is not possible to haul supplies.

First work of construction following any surveys on this entire mountain system, exclusive of road work, was done on East Fork Reservoir and also on line of ditch leading from West Fork of Laramie River to west portal of tunnel. In August, 1903, Lowman and I did a little ditching up on the south face of the mountain, drawing water back into the draw which we finally connected and turned Link Lake ditch down through. That would be the first place the ground was broken at all, but it was not along any survey for the reason that we did not have to survey it there. It was on side of mountain and along line of creek that ran below and we connected it and threw it into the course that the water would

come down after we turned water in the upper ditch. The
1960 first work along any surveyed line was done on East Fork Reservoir and on ditch leading from West Fork of Laramie River to the tunnel. I mean work of excavation done on the ditch the survey of which had been located and cross-sectioned by engineer. Following close of construction work on account of snow in October, 1904, we returned to Fort Collins.

Snow interfered with road construction work in 1903. We started from the north and worked south as far as snow would let us in spring. When we got to where snow was too heavy for us we went back to valley. Snow was in this condition in June. July 9th, took family and regular mountain outfit and two teams and men and we went back and continued road work.

1961 It was recognized by me and by my associates that it would be necessary to locate ditches and works upon plains of Poudre Valley as well as to construct ditches in mountains.

Poudre Valley Ditch had been constructed out of mouth of Poudre Canon in 1902. I have viewed lands that might be served from extension of this canal. I was along at time survey was made of such extension by Mr. Charles R. Hedke, engineer. He is same engineer who assisted Tenney in checking notes of original survey. He is witness who preceded me in this case.

In 1905 expenditure of both money and time was made in investigation of territory in Cache la Poudre Valley in which to make use and application of water to be obtained by means of the Laramie River system. I was engaged in this work as well as in work in the mountains during that year. Was in mountains during all fore part of season and later in summer we came down and ran survey from reservoirs 5 and 6 of the North Poudre system down to Union Pacific Railroad and beyond. The reservoirs 5 and 6 are
1962 capable of being filled from the Poudre Valley Canal.

Poudre Valley Canal is upper end of ditch for carriage of water from Poudre River in Cache la Poudre Valley to the Greeley-Poudre Irrigation District. Mr. Hedke made two surveys from Reservoirs 5 and 6 for an extension of Poudre Valley ditch to Union Pacific Railroad and beyond. Generally speaking this line of survey is indicated by the ditch line leading out towards McGrew Reservoir and shown on the map Exhibit 1 attached to answer of corporate defendants.

In 1904 the principal place of business of those interested in this project was in Fort Collins. Mr. Hibbard was financial promoter of proposition. He resided all the time in Fort Collins after entering into project. He engaged in no other business than the projection of this system and was continually employed in promot-
1963 ing it. He made several trips east, met people, financial firms, and bond brokers, to promote the proposition and raise money.

The co-partnership had engineers in field the most of the time from 1904 on. Concerning surveys made in 1905, will state that I heard testimony of the witness Charles R. Hedke, who just preceded me. The surveys as he described them for the year 1905 works are correct. He was the engineer who did the surveying.

During 1905 parties were brought to view the works in its different extents and parts. Principally Mr. Lawrence and a man by the name of Bethune came out to see the proposition and were pleased with it and were going back to finish up deals. Mr. Lawrence and Mr. Hibbard went to Chicago to consummate the deal but Mr. Bethune died in Springfield on his way back and that stopped the financial negotiations with them. Lawrence was an engineer.

Walter Fox came out in the interest of Swift and Donovan
1964 of Chicago. They came out after Mr. Fox had been over the proposition with me and had taken six weeks to make up report on entire proposition, land, water and all. It was quite late in summer by the time they got there.

In 1905 I was in mountains from about April 1 until sometime in August or latter part of July. Excavation work was not going on in mountains during that summer. We did not have the funds. Mr. Hedke came up with Ianson in 1905 and viewed the work Ianson had done on Upper Rawah Ditch. Hedke measured it and settled a dispute between us and the contractor concerning estimates. My only interest in those mountains was caring for the property of the co-partnership in that locality. I was engaged all summer in caring for the ditches and other work. On the contract work I personally had all of the clearing of the right of way from
1965 bowlders and large rocks. Method of removing solid rock depended entirely on mountain sides. We undermined rock on lower side and put giant powder on upper side and thereby rolled rock out of way. By this method we rolled rocks 10 feet square out of right — Upper Rawah Ditch.

In 1906 I was still connected with enterprise, but during that year I disposed of my interest in project. During that year, work of financing, surveying and planning was going on continually.

During 1902, while working on the Upper Rawah or Link Ditch with Mr. Akin, I took a number of photographs.

Defendants' Exhibit 52, a photograph, was taken July 1, 1902, by Mr. Akin and subject is myself and Camp Lake. Camp Lake is one of Link Lakes. This Photograph was taken at time I was showing Mr. Akin line of Upper Rawah Ditch before any survey.

Defendants' Exhibit 53, is photograph taken in July, 1902, on same day as Exhibit 52. It is a picture of West Fork of Laramie River, the whole country on the West Fork of Laramie River looking west to Medicine Bow Range. The snow covered peak showing in background of picture is crest of Medicine Bow Range, and is extreme west end of watershed of West Fork of Laramie River. This range is dividing line between Laramie River and North Park. View in picture is taken from east looking west.

Defendants' Exhibit 54 is photograph taken by Mr. Akin in July 1902 on same day that Exhibits 52 and 53 were taken, showing the mountain higher up, looking off into the head of the West Fork of the Laramie River, and showing my saddle horse with bed tied behind saddle. That is saddle horse I used in showing him the country, and when we were climbing the mountains to get back to the place.

Defendants' Exhibit 55 is photograph taken by Mr. Akin on day succeeding taking of Exhibit- 52, 53 and 54, and shows snow bank along crest of Medicine Bow Range. I am standing on snow bank. Locality where picture was taken is on divide between Laramie Valley and head of North Platte River. It is above Chambers Lake. The drift is a bank of perpetual snow. The water running from this snow bank drains into Rawah Creek.

Defendants' Exhibit 56 is photograph taken by myself in August 1903 and shows four head of horses. Location is on east side of Grassy Pass and represents our road camp and is just short distance above commissary cabin. View is looking east. Photo-
1968 graph generally shows character of mountain and timber country through which these roads were constructed. Upper Rawah Ditch goes around mountain on left hand of picture, goes to east and across Billy Creek to center of picture.

Defendants' Exhibit 57 is photograph taken by me in 1903 during summer. It is photograph of Link Lake No. 2 at head of Rawah Creek and above where point of Upper Rawah Ditch comes out of Rawah Creek. View is looking southeast. Part of Medicine Bow Range near timber line is shown in picture. Picture taken
1969 in August. Snow appearing in crevices and depressions of Medicine Bow Ranges are perpetual. The lake is No. 2 of the Link Lake System.

Defendants' Exhibit 58 was taken in July, 1903, and shows Link Lake No. 3 of the Link Lake System. I took picture. View is looking east.

Defendants' Exhibit 59 is photograph taken about the same time as Exhibit 58. Taken in August 1903. Shows Lake No. 5 of Link Lake System. Direction looking east.

Defendants' Exhibit 60 is photograph taken by me at same time and is picture of Lake No. 7 of Link Lake System. Direction northeast towards outlet of lake.

1970 Defendants' Exhibit 61 is photograph of Lake No. 8 taken two weeks later by me. Latter part of August, 1903.

Defendants' Exhibit 62 is picture of same lake, No. 8.

Defendants' Exhibit 63 is photograph of Lake 9 of Link Lake System. Mountains near background are near crest of Medicine Bow Range. I am standing to right of picture. Taken July 1903. Snows shown in background are perpetual.

Defendants' Exhibit 64 was taken latter part of August, 1903. It shows my road camp with myself, Robert Lowman and my little girl, J. C. O'Connor, and Billy Briggs. This camp is on
1971 east side of Grassy Pass and near junction of the two roads, the one from the south from the West Fork, and the other from the north from the State road. This is the furthest camp south we established in 1903, when constructing roads. It is where we were when we were snowed in in September.

Defendants' Exhibits 55 to 64 inclusive show general character of the timber mountain country in which it is necessary to construct the collection ditches described. The same mountain range, and character of country extends to the north into Wyoming.

There were no existing roads or means of travel into that country, prior to the roads which I constructed for the purpose described in 1903 and 1904. There was never a wagon in there until we built that road. No men have habitations in that region.

Defendants' Exhibit 65 is a photograph showing first survey from Laramie River Tunnel, taken by me in March, 1904. Shows the surveyor's chain and the tracks of the head rod man and Mr. R. Q. Tenney. Black line along snow is surveyor's chain. Loca-
1972 tion is along shore of Emerald Lake lying directly over Laramie River Tunnel on crest of Green Mountain Range. Picture taken during Tenney's survey looking west over to Medicine Bow Range.

Defendants' Exhibit 66 is photograph taken in July, 1904, by me. Shows surveying crew which I had on Laramie River in 1904. Men in picture are Myron Akin, Wellington Hibbard, Zac T. Duvall, engineer, William Carrigan, Edward Sisson, Robert Lowman, Burnette Jordan and Dwight Mandeville, and another man. It shows our wagons. View is looking east down West Fork of Laramie River. Shows main surv-ying party employed in 1904 in making surveys of system in Laramie River Region, including tunnel.

Defendants' Exhibit 67 is photograph taken by me and showing Lanning Cabin on Laramie River below where tunnel is now located. It is on floor of Laramie River Valley. Mountains in background preclude view of Medicine Bow Range. This is cabin used as transfer or commissary cabin. West Side Collection Ditch leading to the tunnel comes right around the mountain side shown in picture.

Defendants' Exhibit 68 taken June, 1904, by me. Cabin is cabin No. 1, a transfer cabin part way up mountain side from the Sky Line Ditch on top of mountain, where Link Lake Ditch drops over the mountain side down into West Fork. Cabin was built June 1, 1904, under my supervision. Men in photograph are "Old Ben," Billy Carrigan, Dwight Mandeville, Zac T. Duvall, engineer, Burnette Jordan, and Robert Lowman. All these parties were working at that time on the system. The cabin was one of the necessities for construction.

Defendants' Exhibit 69 is photograph of main commissary cabin. Taken by me October 1, 1904. The two men in picture are Duxbury and Jordan. Cabin is located on line of Upper Rawah
1974 Ditch. Its construction was necessary for use in constructing canals. Stored supplies in it for coming season.

Defendants' Exhibit 70 is photograph taken October 1, 1904. Men in picture are working under me in Upper Rawah Ditch. I am in picture but men are too numerous to name. Location is near commissary cabin on Upper Rawah Ditch. This gang worked on clearing a right of way for the canal. These are the company's men. Contractor's men are not shown. They were engaged in another place. They had their own camp.

Defendants' Exhibit 71 taken August, 1904, and showing teams of Mr. Ianson, contractor engaged in construction work on Upper Rawah Ditch. Also shows his horse tent and part of his sleeping

tent. Shows a plow team and one of his slip teams. Taken
1975 during prosecution of excavation work on Upper Rawah Ditch at location little south of where my crew was working.

Defendants' Exhibit 72 taken about July 12, 1904, at Glendevey. Team shown is mine and load of supplies and tools for construction gang on Upper Rawah Ditch. Man driving is Robert Lowman. Supplies were hauled from Fort Collins for use on Upper Rawah Ditch. Photo shows one of four horse teams. This team belongs to me.

Throughout my testimony wherever I have frequently mentioned the Link Lakes Ditch I refer to the same ditch sometimes known as the Greeley-Poudre system described as the Upper Rawah Ditch. The collection ditches of the system are three in number. They are the Upper Rawah Ditch, which I called the original Link Lake Ditch, and the lower Rawah Ditch which comes out down near the Laramie River and goes back to the the tunnel, and the Deadman Ditch or East Side Collection Ditch which runs from Dead-
1976 man Creek to the tunnel.

Defendants' Exhibit 73 is photograph taken in June, 1904, by me. Shows flume on Sky Line Ditch about a mile and three quarters below headgate where ditch is taken out of West Fork of Laramie River. Construction work shown in this picture is similar to that required along the line of the West Side and East Side Collection Ditches of the Greeley-Poudre system, except that the latter are nearer the foot of the mountain. Direction in photograph is nearly south. Observer is looking at the East Fork of Laramie River and towards Chambers Lake, about 2½ miles from observer. The Laramie River tunnel of Greeley-Poudre irri-
1977 gation district is northeast of point at which observer is standing. Mountains shown on east side of picture are part of Green Mountain Range, through which tunnel runs.

Defendants offer in evidence their exhibits 52 to 73 inclusive with privilege of substitution of copies.

I used Link Ditch for irrigation for Big Park for a number of years. Constructed in 1894 and irrigated about 100 acres. Constructed Link Ditch No. 2 in 1896. It has been in use ever since. Serves about 50 or 60 acres. Constructed for reclamation of sage brush and willow land in the meadow.
1978 The land is only suitable for hay land owing to the altitude.

During time I resided on Laramie River I observed difference at season of year when high flows occurred in streams emptying in from the east side and west side of the drainage area. The creeks draining from the east side of the valley run earlier and cease sooner than those from the west side. I have known the high water from the east side to start in April while at the same time the west side had not started. The freshet from the east side continues from 30 to 40 days. During this time the rise on the west side
1979 would hardly be noticeable. The flow on the west side begins to rise about the time of the fall of the freshet flow on

the east side. On the west side begins about latter part of May and continues to run up until July 4. Runs 60 to 70 days. About three months is usually consumed between the first rise on the east side and the close of the freshet on the west side. It varies with
1980 years. The flow rises and falls with the temperature. In cool days the flow is less than on warm days.

Deadman Creek, including its tributary Nunn Creek, supplies possibly a greater amount of water to the stream than Stuck Creek which lies to the north and near the state line, although the latter creek runs so rapidly it is very hard to judge as to the volume of water in it. Stuck creek is a stream of heavy flow. The
1981 other streams of continuous discharge into the Laramie River in Colorado not intercepted by Greeley-Poudre system are all larger than Deadman Creek. They are Grace La Garde, Stuck and Beaver Creeks. There is no comparison between these creeks and Deadman. Forrester and Fox Creeks are good flowing streams but not so large. In Wyoming are Beaver and Johnson Creeks, which are quite similar to Deadman, but are not to be classed at all with any of these other creeks. Taking all these other creeks together they make a good amount of water. McIntyre Creek is a great deal larger than Deadman Creek. The amount of water intercepted by the Greeley-Poudre system of works at the upper end of the McIntyre would make no appreciable difference in the flow of the stream. There are a number of smaller streams which flow into the Laramie river from the west side, northerly from the Greeley-Poudre system.

Am acquainted with Sand Creek. It is tributary of the Laramie River, rising in Colorado, no part of which is intercepted by the Greeley-Poudre system. It continuously flows water into the State of Wyoming from the Colorado watershed. Jimmy Creek drains land on east side of the Laramie River watershed in Colorado and discharges into the river. No part of it is intercepted by any of the Greeley-Poudre system.

Cross-examination by Mr. N. E. Corthell:

1982 When I lived in the Laramie Valley I was engaged in the farming, ranching and cattle business, the kind of ranching business that is carried on in the valley, covering between eight and nine years, in Big Park, and about a year and a half on Stuck Creek. After selling out I bought a farm in the
1983 Poudre Valley south of the Poudre River, about 3½ miles from Fort Collins. I worked on that farm one summer, and sold it less then a year after bought it. Since that time I have lived in Fort Collins. I was living in Fort Collins, but still owned the farm, when I interested Mr. Akin in the Laramie River Project, and went up to look over the ground. At that time we did not know upon what land we should use the water. We first had in mind the use of a part of the water upon land in the neighborhood where my farm was located. There is a general feeling on the part of the owners of land under all of the
1984 ditches in the Poudre Valley that more water is needed, and generally speaking, it was the shortage of water in the valley

that led me to consider this proposition. My idea was to obtain a supplemental supply in addition to the water furnished from the Poudre River, and to use this, if there was enough, upon other lands.

My attention was directed to the region of the present Poudre Irrigation District when I made my first [illegible] with the Poudre Valley, and I first thought of this [illegible] in connection with the Laramie River diversion in the [illegible] the suggestion coming from Mr. Hibbard and Mr. [illegible] our partnership was planned in 1903, November. The [illegible] was formed and contracts drawn up in the winter of [illegible] and I sold out in 1906.

[illegible] were a number of personal differences of opinion [illegible] dislikes which led to my selling out. One reason [illegible] to the plan which had then been adopted and was [illegible] of securing an interest in the Poudre Valley [illegible] that ditch to the land we intended to irri-

[illegible] had the duty of finding capital for the enter- [illegible] up to the time I sold out, he had not succeeded in [illegible] When I was in the enterprise we had not considered any [illegible] conditions. We had counted only on the cost of the [illegible] project, and we had not gone into the Poudre Valley [illegible] matter, and when I sold out I had no interests in the [illegible] the Poudre River, my interest being confined to the [illegible] diverting water from the Laramie River.

The cost of the work which I had planned was estimated at about $2,000,000. In 1903 no money was expended on [illegible] in 1904 about $14,000 was expended on construction work and [illegible] but not including surveys, and no money was expended on [illegible] work in 1905. I cannot say as to 1906. I do not know how much was spent on engineering in those two years. Up to the close of 1906 the entire amount expended on construction work was $14,000, but this does not include expenses of roads and cost of transportation, moving, and establishing camps, all of which I believe should be included in construction work, and which would bring the total expenditures in the mountains up to $18,000 or perhaps $20,000. This work was practically all done on the
1989 Upper Rawah and Link ditches. No considerable amount was expended on the Lower Rawah or the West Side ditches nor on the tunnel or reservoir, but about $1,300 or $1,400 was expended on the East Fork Reservoir.

1990 Surveys for the system were entirely completed in 1904. In 1876 a road was constructed running the entire length of the valley, by a tie outfit, the road extending from above the tunnel to Laramie City. This road was afterwards used by the ranchmen in the valley, who kept cattle on the range, feeding them during storms and bad weather from November until the first of May,
1991 during which time cattle find little grass. During most winters these ranchmen are able to travel by this road down the river to Laramie City, but there have been seasons when the

people living above the mouth of Nunn Creek could not travel with horses. Below Glendevey the country is open in the winter.

1992 I know the general location of the Laramie, Hahns Peak and Pacific Railroad which extends over this same range of mountains west of the Laramie River, about thirty miles from Davy's (Glendevey) to Fox Park on this road. In passing over the mountains, this railroad rises to an elevation of about 9,000 feet. The Denver Northwestern and Pacific Railroad, sometimes known as the Moffat Road, also crosses this general range of mountains about fifty miles south of the tunnel, I should say, rising to an elevation

1993 I believe of nearly 12,000 feet. The Laramie Hahns Peak and Pacific Railroad was being built about 1911. I do not know whether work was prosecuted on either of these two roads continuously during the entire year.

1994 My plan in developing this work was to commence near the point of intersection with the Sky Line Ditch and extend the line of that ditch northwesterly as funds for that purpose were obtained, in order to tap the drainage area lying above the ditch line and to carry the water from that area through the Sky Line Ditch into the Poudre Valley. If this plan had been carried out I would have been able to get an increasing amount of water as the work was extended, and the work done in 1904 was planned with that end in view. A connection was made with the Sky Line Ditch, and 30 second feet or possibly 75 second feet was carried by the Upper Rawah Ditch into a gulch at the lower end of that ditch, running through that gulch into the West Fork of the Laramie River at a point above the diversion works of the Sky Line Ditch, and in this way the connection was made with the Sky Line Ditch and water was carried into the Sky Line Ditch. I never saw any of this water diverted into the Sky Line Ditch, but I do not see how it could avoid being taken in. We cut a ditch across a small flat near the West Fork of the River, but never diverted water from the Upper Rawah Ditch into it. I do not know whether any connection with the Upper Rawah Ditch was ever made.

1996 We originally planned to use some of the water diverted through the Upper Rawah Ditch and Sky Line Ditch into the Poudre River ourselves, either directly or through an exchange system, and to sell the rest of it for a supplemental supply for other lands, and thereby secure funds to help work out the rest of the Laramie River diversion system, including the tunnel. This plan has not been carried out, and no water was sold at any time. The Upper Rawah Ditch as originally planned was to be about seven miles long and about 6,000 feet of this was completed in 1904, and work of clearing and other work was done for about three miles. No further work was done in 1905 or 1906. The work of excavation in that country is a small part of the work of construction.

1998 Mr. Duvall and I once measured the flow of Rawah Creek, and in a rough way I have sought to ascertain the flow of the other creeks and have compared their flow with that of the Rawah. I never kept any record of the flow, and my testimony as to the general size and volume of these tributary creeks is based from obser-

vation of the flow of the streams at different times, and by a comparison in my mind of those streams with others which I have seen measured. Stream flow records were taken by some government engineers.

Cross-examination by Mr. John D. Clark:

1999 Practically all of the irrigated land in the Laramie Valley in Colorado is native hay land from which the hay is cut. Until I left that country I was quite familiar with all the meadows, but cannot estimate the total acreage irrigated, although it is several thousand acres. The irrigated places commencing at the State line are the Bliler ranch, the Martin or Grace Creek ranch, Mansfield ranch, Jim Detro's lower meadow, Tamerlane Forrester's meadow, Jim Detro's upper meadow, the Harry Tatham ranch including a portion of the O. P. Yelton ranch, the Joe Smith ranch, also including a portion of the O. P. Yelton ranch, Gleneyre, Homer, Pol-
2000 lock's ranch, the Gleneyre ranch upper meadow, Jim Smith's ranch, the Baldwin Ranch, Davy's Blennerhassett, Davy's Glendevey ranch, the Victor Stuart Ranch, the Harris Ranch, the Shipp Ranch, the Fortune Ranch, the John McNabb ranch, the Springer ranch and the Lanning ranch, the last few named being above Glendevey. The irrigation commences a couple of miles or so below the tunnel and increases below Glendevey, where the valley widens. All of these ranches are principally in the floor of
2001 the valley. The land most remote from the river which is irrigated is Elton Mansfield's place, which is on a sage brush flat about a mile and a quarter from the river. Parts of the Forrester, the Detro, and the Tathan ranches are irrigated from tributary streams. Practically all of the land which can be irrigated has been placed under irrigation, although perhaps 500 acres would be available if a diversion high up on the stream should be made onto the sage brush flats, but only native hay could be grown, and this would not justify the expense. The total acreage in the Laramie Valley in Colorado that could be irrigated is very small, and substantially all of it that can be profitably irrigated has been placed under irrigation.

2002 We had an arrangement with the owners of the Sky Line Ditch to carry our water for a percentage. About 130 second feet had previously been carried through their ditch, which was practically its capacity, and we had no arrangement for its enlargement. During the flood period in May and June the owners of that ditch had enough water to fill it, and we would have none of our water carried through it during that time.

2003 The West Side Collection Ditch was included in the plans perfected by me, and as constructed, does not perform all of the duties which would be performed by the Upper Rawah Ditch. The seepage on the mountain sides is very great, and it is always advisable to turn the water into a direct channel as soon as possible, and a large part of the water which would be caught by the Upper Rawah Ditch would be lost if it were not picked up above the West Side

Ditch. The amount of such loss could not be ascertained. I do not believe that the plans of the Greeley-Poudre Irrigation District contemplate the use of the West Side Ditch alone, and I know the District spent several thousand dollars in construction work on the Upper Rawah Ditch. We did not contemplate a smaller Upper Collection ditch on the east side because the mountain was lower, causing a smaller run-off tributary to such an upper ditch, and there
are a great many canons, making the cost of con-
2004 struction excessive. I would have constructed the Upper Rawah Ditch under any circumstances, partly in order to conserve the water as stated, and partly to secure a current revenue through the carriage of the water through the Sky Line Ditch.
2005 The Upper Rawah Ditch, as I planned it, should not cost over $20,000. $14,000 was expended on this ditch and the roads, and about one sixth of its length has been completed, and a great deal of the expensive part of the work, such as building roads, establishing camps, etc., was included, and a further expenditure of $6,000 might not be enough to complete the ditch.
2006 The principal object in constructing the Upper Rawah Ditch at that time was to secure a revenue from it, during the time we were engaged in the larger work. We knew that with it completed it would be only a matter of a short time until we could secure the investment of capital for the construction of the whole system, and we considered the Upper Rawah Ditch as a good investment at any rate.
2007 From 1902 until I severed my connection with the enterprise, my associates and I were consulting with men interested in irrigation projects in order to interest them in this system, and we also approached farmers on both sides of the Poudre River from the upper end of the valley down to the mouth of the river in order to induce them to take water from us both as a supplemental supply and for the reclamation of new lands. Our estimate that the system we proposed would cost about $2,000,000 was made in the fall of 1902, and we had no occasion thereafter to change this
2008 estimate. This estimate covered the Upper Rawah Ditch, the Lower Rawah Ditch and the East Side Collection Ditch, in fact the mountain end of the whole proposition. I never made any estimate on the work on the east side of the mountains. We anticipated that we would get an average flow of about 200 second feet for this expenditure. We knew that in the winter time we would not get this amount, but contemplated the storage of a portion, either in the mountains or in the Poudre Valley. We estimated that it would cost us $30,000 to construct a ditch which we surveyed in 1905, which we called the High Line Ditch, covering lands on the
2009 south side of ahe Poudre River and south of Fort Collins. The construction of this ditch was not still in contemplation at the time I severed my connections with the enterprise. The other possible construction work in the Poudre Valley which we contemplated was the extension of the Poudre aVlley Ditch, which Mr. Hedke and I surveyed in 1905 and 1906, but the survey of which was not completed while I was interested in the project. I do not

know what the estimates on this ditch were. Mr. Hedke
2010 first became connected with this enterprise when he went over Mr. Tenney's notes on the tunnel, and later he was employed by the contractor to check up the work on the Upper Rawah Ditch, and by the partnership on the survey of the Poudre Valley Ditch extension.

The extension of the Poudre Valley Ditch was brought to our attention by Mr. Hibbard, who became interested with us in the winter of 1903-4. The preliminary survey was commenced in 1905, and was not completed when I sold out my interest in the project. It was determined to carry this Poudre Valley Ditch exten-
2011 sion out at that time.

2012 I am familiar with the File No. 1417, made in the name of Myron H. Akin in May, 1904, covering the tunnel, the East Fork Reservoir and other portions of this system. At
2013 the time this was made the two lower supply ditches were contemplated, but surveys had not yet been commenced. We had included the cost of these lower ditches in our estimate of $2,000,000 to cover the whole mountain system, but did not have any separate estimate of their cost. The estimate of the cost of the ditches and tunnel as shown on this filing is $189,200, but I do not know who made it, and to my mind it is unreasonable.

2014 I am thoroughly familiar with filing No. 1722, made October 6, 1904, in the name of Harry L. Munroe. This was made on behalf of our association. It shows the tunnel, the West Side Supply Ditch, the East Side Supply Ditch and the Upper Rawah Ditch, and was made for the purpose of combining our entire project as it was then contemplated. The estimated cost of the whole project is given in this filing as $375,000. This was the last filing made by our partnership before I left it.

Redirect examination by Mr. Charles S. Tew:

2015 Am acquainted with ranches in Laramie Valley in Colorado. In response to certain questions on cross-examination I listed meadows and ranches in the valley and the owners. Testimony pertained to ranches irrigated from the main stream, except in one little variation where I spoke of small piece of meadow belonging to Mr. Tatham and Detro and also Mr. Forrester, these are irrigated to a certain extent from a small ditch out of La Garde Creek. Up these side streams or tributaries there are small ranches. They are all small hay ranches. They are devoted to hay raising because of the elevation. That condition prevails throughout the tributary valleys in Colorado. It is the only agriculture
2016 that is carried on. That condition does not change with the crossing of the interstate line. The same condition continues on down to the lower or northerly end of the Laramie Plains. The yield of the hay on these meadow lands is about the same as on the Laramie Plains.

The Laramie River has much less fall and is not so rapid as it crosses the Laramie Plains as has the Cache la Poudre River on the easterly side. I have been familiar with the culture of wild

grasses for hay for about thirty years. My observations of their practices and results did not cease with my moving to Big Park. I went up and down the river to Laramie City. Had opportunity to notice results of climatic influences on conditions in summer.

2017 Speaking of snow fall, there is a greater difference between the fall southerly from a point about three miles north of Glendevey than from that point down the river. From that point south the snow begins to get quite deep and generally increases as you go up the river.

The wind conditions on the Laramie Plains have something to do with the lay of the snow. If we had as much wind on the Laramie as they have on the plains, there would be less snow on the level. The wind on the plains is generally continuous. The hardest current begins about at the south end of Sheep Mountain and is general from there north over the entire country. This mountain is near the southern end of the Laramie Plains. It is located near Woods Landing. The Plains extend considerably south of that point, but in going down to Laramie there is where you strike the Plains first. The wind does not blow as hard there, generally speaking, as it does lower down.

2018 There are no trees of any size on this high country called the Laramie Plains. Only cottonwood along the streams, principally on Big Laramie. There are few cottonwoods on Little Laramie. There is nothing to break the wind except the range grasses.

There are very good ranches on the Laramie Plains of a natural meadow along the Big and Little Laramie. They are all native hay meadows. The ranch business is similar to the business along the river in the upper regions of the stream in Colorado. It is carried on in the same way. Grasses are grown for hay. Hay is put up in the summer to prevent starvation in the winter.

Seasonal conditions govern irrigation on hay meadows on Laramie Plains. If season is cold and damp they don't usually put water on as early as when seasons are dry. Water is usually taken from stream about middle of May and turned off about July 10, not later than that. My description applies to meadows of

2019 natural hay. The principal portion of the land which is irrigated is devoted to that.

There is sage brush flat of about 500 acres in upper valley of Colorado that might be reached by ditch from river. It would be fitted only for native hay. Crop is not sufficiently valuable to warrant expenditure of money necessary to construct works to irrigate this flat. The flat is much better soil than on the Laramie Plains, unless it might possibly be in one vicinity.

2020 I spoke of some maps exhibited to me with statements of estimated cost. These were not statements made by me concerning cost. I did not have charge of preparing surveys and descriptions of ditch lines. I was the explorer in a sense, the forerunner of the proposition and directed where those lines should

be run. If we could not have made our objective point, the tunnel, from those streams, then it would not be feasible.

In the spring the Sky Line Ditch is first opened at what
2021 they called Three Quarter Creek. They then open up ditch above that point by shoveling for the entire length. They cut a trench through the snow in order to get the water through to cut the snow with water, and they continue that on to the head of the ditch and it is very often June 15 before we get the water running. During this time the water in the West Fork of the Laramie River is running down the stream. I was thoroughly familiar with this condition and practice for many years prior to the time when I designed the work in 1902, described in my testimony.

The carrying capacity of Sky Line Ditch is about 130 cubic feet per second. That is not supplied entirely from West Fork of Laramie River. There are times, after canal is opened, during which it cannot carry all the flow of the West Fork.

I had no purpose to enlarge this Sky Line Ditch nor right to enlarge it in any of my plans. I could not have used that canal in any year, either temporarily or otherwise, until the ditch
2022 was fully opened to the head gate. This canal is burdened to its full capacity until July 15 of each year and we could not have obtained carrying capacity in the ditch prior to that date. After that date it might be possible for them to have carried some other water. We would never have been able to obtain carrying capacity in the canal to its capacity of 130 cubic feet per second. They would have always had at least 30 cubic feet of water in their ditch from the West Fork. All the water that we were intending to carry in the Upper Rawah Ditch would be carried through the tunnel to the east side. Upper Rawah Ditch was built to carry 200 cubic feet per second, it was planned to do that. Waters of
2023 that ditch when running to its capacity, could not be carried, except as to a minor portion, through the unused capacity of the Sky Line Ditch. This carriage could also have occurred only in a small part of the irrigation season. Just a short time in the summer.

It was not our plan to use the Sky Line Ditch as a permanent means of conveying water from the Upper Rawah Ditch. We would not have built the Link Lake Ditch or Upper Rawah Ditch to carry 200 cubic feet per second, when we knew that the company owning the Sky Line Ditch would not enlarge their ditch. We did not feel that it would be feasible to enlarge their ditch to carry the water on account of the kind of construction involved. One of objects of building this ditch was to carry water into Poudre Valley during time remainder of construction was going on. That was not the only reason for constructing this ditch first. The object was to construct the Upper Rawah Ditch first, to demonstrate that there was a water supply that could be obtained and carried into the Poudre Valley. The water which we could gather in Upper Rawah Ditch and carry through the limit of unused capacity of Sky Line Ditch would not bring sufficient return to warrant all the construction work necessary on this whole system as I have described.

2024 If Upper Rawah Ditch had not been completed, then the West Side or Lower Collection Ditch should be completed to a very much greater carrying capacity than now planned. It is far more feasible, considering the mountainous conditions in that vicinity, to build the two ditches on the west side of the river as now planned than it would be to build one large ditch where the lower ditch is constructed and of sufficient capacity to handle the water now carried by both the ditches. It is much safer to divide the capacity in the way it has been done. By this means more
2025 water is captured, conserved and conveyed to the point desired and a great deal more rapidly than it would be on a single line lower down. Then you have two capacities instead of one, if one should break the other would be working. Water means money; that is the purpose for which we were constructing the ditches.

All these matters were considered and talked over by me with my associates when we commenced construction of this upper ditch. Mr. A. I. Akin and I met with considerable opposition with regard to this upper ditch but we insisted on building this upper ditch because our knowledge of conditions was superior to that of our associates. We had better knowledge of conditions of water flow in different streams intercepted and requirements of diverting this water. Also recognized necessity of intercepting the seepage water and conveying it to point where we wished it.

Following the plan advocated by Akin and myself, work was done on Upper Rawah Ditch first. That was in 1904 and continued in 1907. This upper ditch was sold later to the Greeley-Poudre Irrigation District.

2026 When I spoke of the water being turned into Poudre Valley to supplement supplies there, I did not mean it was to be applied to lands already irrigated. It was intended for new lands as well as supplemental supplies for old lands. It was not necessary at the outset to choose the particular area on which the water should go. There is large area of arid land in Poudre Valley fitted for agricultural purposes. There is demand for water as soon as it is obtainable by any possible arrangement. As new waters are obtained, old ditches are sometimes extended to cover lands possible of reclamation at their lower ends. Ditches sometimes are built to take in new areas. The supply of land fitted for agriculture by irrigation is very great. When we did our work in 1902 we knew there was a large area which could be served by ditch on south side of river. They have since covered a portion of this area through the Louden Ditch. We also figured on something like 17,000 acres south of river, and so had Mr. Tenney and Mr. Duvall survey ditch around above Pleasant Valley Ditch. Although we knew
2027 these areas generally, we had made no detailed observations from which we could ascertain cost of construction of ditches to them. We also knew there was area which could be reached by ditch on north side of Poudre River and lying above the then irrigated area of the valley. The requirements of ditches to reach these lands could only be determined by survey. This my associates

and I proceeded to do. This work was in management of other hands than mine. I had charge of the mountain end of project, not the plains. The problem as to just what lands in Poudre Valley this water could best be conveyed could only be determined by survey, expense and investigation covering considerable time. Even older ditches are still doing that kind of work.

This kind of work was going on under engineers and continued through 1905, 1906 and 1907. It will continue for years. It has never been fully completed in any irrigation sections that I
2028 know of.

I knew that Poudre Valley Canal was constructed for purpose, so far as possible, of reaching new areas and was being constructed in 1902, 1903 and 1904. I think it was started in winter of 1901. That canal leads towards the lands now included in the Greeley-Poudre Irrigation District. That is same canal my associates and I extended as the Laramie-Poudre canal. Was on two surveys of extension of that line.

Redirect examination by Mr. Delph E. Carpenter:

In my cross examination I referred to filing 1722 which is same as Defendants' Exhibit 51, made by Harry L. Monroe. That is same filing identified by Mr. Duvall and pertaining to surveys made by him. This map does not pretend to show anything else than surveys made by Mr. Duvall.

Also referred to filing 1417, State Engineer's office number. That pertained to Mr. Tenney's survey and the contour line of East Fork Reservoir survey made by me. The tunnel line is Tenney's
2029 survey. The tie lines of west portal of tunnel are Mr. Tenney's Alsotie lines from west portal to dam side of Reservoir. This map is signed by R. Q. Tenney as engineer; so far lines I have described as surveyed by him, this merely attempts to show those lines and nothing else, outside of East Fork Reservoir. If this reservoir is omitted from Exhibit 51 it does not signify that Mr. Duvall did not see reservoir. I do not know whether he did any work on it.

Actual cost of construction is the true gauge and not mere estimates by engineers. Estimates have nothing to do with real cost, as we found out. So far as actual cost of construction is concerned, estimate might just as well be fixed at one cent. Management is generally cause of extra cost and that is one reason estimate of
2030 engineer does not get closer to true cost. At any rate, statement of Harry L. Monroe that estimated cost would be $375,000 was not signed by me and never would have been.

Carrying capacity of Sky Line Ditch is 130 cubic feet per second.

Recross-examination by Mr. N. E. Corthell:

2030 The Upper Rawah Ditch was constructed to carry 200 second feet of water, but I do not remember the dimensions or grade. The capacity was never ascertained from measuring the act-

ual flow of water in it, but by measurements of its cross section and grade.

2031 The 17,000 acre tract in the neighborhood of the Pleasant Valley Canal and the tract in the Louden Ditch country which we thought of using our water upon, are both on the south side of the Poudre River, and aside from these two tracts, our plan was to turn the water into the Poudre River, knowing that the demand would come, from whatever source could not be foretold. It
2032 was this general demand for a supplemental supply and for the irrigation of new land that we had in mind, excepting as to the amount we might use ourselves. The water could
2033 be used any place in the valley, and as the highest ditches were the Poudre Valley Ditch on the north side and the
2034 High Line Ditch on the south side through which water could best be carried to new lands, our idea was to connect it up with either of these. In 1905 the negotiations for the Poudre Valley Ditch were begun, and were consummated after I left the project.

Redirect examination by Mr. Charles F. Tew:

2034 Negotiations with different carriers and selection of exact line of canal to reach new land for water was not under my personal supervision or control. That matter was left with Mr. Akin because of his greater familiarity with conditions in
2035 Poudre Valley. He had lived and farmed in that section. He was more familiar than I with areas needing water. Then too, the proposition was entirely too large for any one person to think of doing. If they were going to handle the irrigation end in the Poudre Valley, my part was to develop the mountain system. I am not so familiar as the rest of them were with the plains end of it.

High value of land in Poudre Valley and great benefit obtained compared with use on land in Laramie Valley brought me to study problem of bringing water from Laramie Valley. I knew that it was possible to bring large amount of water to Poudre Valley where it could be used to greater benefit. In this proposition I was given charge of scheme and method of accumulation and carriage of water to be diverted from Laramie River to Poudre River. My opinion generally prevailed on that topic.

I was generally acquainted with economy in operation of ditches and high state of development and matters of exchange indulged in in Poudre Valley. Also had general acquaintance with
2036 location and use of reservoirs. Also knew that water obtained late in growing season was of higher value.

I knew generally there was not sufficient market for all the water I could bring from Laramie River if used exclusively for supplemental supply to lands already irrigated. As a matter of precaution we made provision for an area upon which to place this water we might obtain. While we might rent some of the water, our object in making these surveys along the line of Poudre Valley Canal was to make provision for use of water later to be obtained from Laramie

Valley. Being on independent footing we could thus deal with the entire situation. The system, to be feasible, required collection system upon the Laramie and distribution system in Poudre Valley.

I was in charge principally of construction and arrangements of plans for collection end on Laramie river, and Mr. Akin and his associate in planning, laying out, establishing and building distributing lines on the plains.

2038 Mr. A. I. AKIN, Fort Collins, Colorado.

Direct examination by Mr. Delph E. Carpenter:

Abraham I. Akin, Fort Collins, Colorado. Lived there since spring 1880. Farming during those years.

Am same Abraham I. Akin early identified with project of Greeley-Poudre Irrigation District on the Laramie River. Am same Mr. Akin who was identified with Wallace A. Link who has just testified. My brother, Myron Akin, was later identified with project.

This project first called to my attention in spring of 1902 by Wallace A. Link. Made first investigation trip to Laramie River in Colorado in July, 1902, with Wallace A. Link. Went up there with him to look up prospect of bringing water into Cache
2039 la Poudre River. We took teams from Ft. Collins and went up Laramie River and from there packed up to what is known as Link Lakes, and were gone about 6 or 7 days.

August, 1902, I took an engineer from Fort Collins. Met Mr. Link at Chambers Lake and we went down Laramie and packed up to Link Lakes and ran survey line from upper lakes across to West Fork of Laramie River. Frank Beach was engineer who ran that line. He began his survey August 25, 1902, that was day he actually began on ground. There were three of us in surveying party. We were engaged in this survey about 15 days. During that time we surveyed line of Upper Rawah Ditch to connect with that what is known as Link Lake No. 4, situated on Rawah Creek. A snow storm interrupted our labors. We also ran out of food.
2040 Snow was too deep to do any more work that fall.

Mr. Beach made plats of survey made by us and we filed that, Mr. Link and I, with State Engineer.

(Defendants' Exhibit 74 offered in evidence.)

Defendants' Exhibit 74 is a copy of map prepared by Mr. Beach. I have also checked over statement of claim attached to map and think it is correct copy of claim prepared by us. Am familiar with line of Upper Rawah Ditch as now constructed. The present line is nearly same as location shown on this map. The variation begins at Rapid Creek near Grassy Pass. The ditch from Grassy Pass to Laramie River is now constructed. There was quite a departure from the orignnal line above Rapid Creek to avoid heavy cut through Grassy Pass. By making a drop just above Rapid Creek, ditch could be run around on grade and strike river on little better

ground. It made no substantial difference in ditch other
2041 than mere convenience in construction.

Exhibit indicated that we began work on August 25, 1902. Statement of claim indicates carrying capacity of ditch to be 224 cubic feet per second. That was size of ditch contemplated by us at the time. On exhibit the ditch and reservoirs are termed Link Lake Diten and feeders and Link reservoir. That was afterwards changed to Upper Rawah Ditch.

About $350 was expended by Mr. Link and me in making this survey. Each party bore one-half of the expense.

2042 I last saw the Greeley-Poudre Irrigation District System of works on Laramie River in September, 1913. System now in process of construction is same system early conceived by Mr. Link and me. The ditch indicated on Defendants' Exhibit 74 is a part of the Greeley-Poudre System.

In July 1902 in addition to inspecting the land occupied by Upper Rawah Ditch, we looked over general lay of country all up and down Laramie River and also the tunnel site. We checked over the ground in a general way for the entire system. The only surveying done in 1902 is shown on Defendants' Exhibit 74. We had no other data from which to prepare further maps.

In spring of 1903 Mr. Link went up with man and started construction of road from state road up to Link Lakes. He worked for a while and then came back and went back again and stayed
2043 all summer. He stopped work for a while, owing to snow being too deep after he got to mountain side up toward lake. Road work was done so we could get supplies up to Link Lake Ditch. Work on that system could not have been carried on without that road. It had to be built. No one other than Mr. Link and I was in any way interested in the construction of this road and it was not constructed for any other purpose than to aid construction on this enterprise. Since constructing the road the Forest Reserve has been created and the road is now used by employees of the service. I assisted in construction of road and also took supplies up to Mr. Link.

In 1903 I tried to interest some of ditch companies down there with us in development of this project and took Mr. A. H. Rice up to look it over and also conferred with directors of Poudre Valley Reservoir Company, the owner of the Poudre Valley Ditch that has been referred to in other testimony in this case. That canal is a part of the present system. I took matter up with the board of directors of the company in 1903 in August. Object was to get them to run water through that canal out to plains. These plains are same territory now constituting Greeley-Poudre Irri-
2044 gation District. Poudre Valley Canal was then partially constructed. They have been working on it since that time.

Continued to be associated with this enterprise to present time. Further efforts were made after 1903 toward absorbing Poudre Valley Canal as part of this system. Mr. Hibbard and my brother Myron were working with Poudre Valley people at same time. They made some kind of agreement to run water through the canal. They

had some stock in the canal company. Various negotiations were carried on with company.

2045 They went over the work of the system with us later, in the fall of 1906. Negotiations terminated in purchase of Poudre Valley Ditch by the Laramie-Poudre people.

Myron Akin, my brother, became interested with Mr. Link and me in the spring or early winter of 1904. Mr. Harris was partner of Myron Akin in real estate business and he came in at same time. Mr. Hibbard came in a little later.

All of Mr. Hibbard's time was devoted to promotion of this enterprise. He continued in service until killed, March 25, 1910, in automobile wreck on way to tunnel when they were constructing the tunnel.

2046 In 1904 we had surveying party in field on Laramie River from early in spring until October. R. Q. Tenney was first engineer who went that year. Mr. Zac Duvall went up later and stayed until October. Mr. Tenney began his survey March 12, 1904, on tunnel.

(Defendants' Exhibit 75 offered in evidence.)

Defendants' Exhibit 75 is copy of map of East Fork Reservoir ditch from West Fork to East Fork of Laramie River and tunnel line from Laramie to Poudre River. It was mapped by R. Q. Tenney as engineer. That is a map, or copy of a map, prepared and filed subsequent to the Tenney survey of ditch I have spoken.

May, 1904, Mr. Duvall went to work. Have heard Mr. Duvall's testimony. He covered the situation very fully. I can and do corroborate what he said in that regard.

In 1904 construction work was carried on on Upper Rawah Ditch. First work done in 1904 was in construction of ditch from West Fork to East Fork of Laramie River and to tunnel. During period of construction of 1904 I was there nearly all the time, back

2047 and forth from Fort Collins. Have heard testimony of Mr. Duvall and Mr. Link concerning the construction work going on in 1904. They stated the facts in that regard.

About $20,000 was placed in this enterprise at the conclusion of work in 1904. No construction work was going on that year on plains distribution end of system. Negotiations were continued all the time under supervision of Mr. Hibbard and my brother, Myron H. Akin. I was not identified to any degree with these negotiations. I was with surveying gang out on work, running lines and other work on Laramie River and looking after things up there.

2048 August, 1904, Mr. Link started excavation on Upper Rawah Ditch line at lower end. Ianson and Walthall started work August 10. I have photographs of the work completed during the season of 1904 on Upper Rawah Ditch.

(Defendants' Exhibit 76 offered in evidence.)

Defendants' Exhibit 76 is picture taken about 1,000 feet above lower end of ditch of Upper Rawah Ditch, where it drops into West Fork of Laramie River, around the rock point. Ditch line was

constructed around rather than through point. I took picture late in 1904. It shows conditions as they existed in that year. I have photographs which, though taken at later date, show conditions at close of work in 1904.

(Defendants' Exhibits 77 and 78 offered in evidence.)

Defendants' Exhibit 77 is photograph of end of ditch where it drops into West Fork of Laramie River, where Link started to cut in 1904, showing water coming out of end of ditch. Shows conditions as they existed in 1904. Defendants' Exhibit 78 is
2049 ditch line where Isanon and Walthall did their work, just above Fall Creek and below Rapid Creek. It was taken subsequent to 1904 but shows conditions that then existed. Shows ditch lines and way it was constructed.

Was with surveying party of Zac Duvall during most of season of 1904. Have seen Defendants' Exhibit 51, known as Duvall's map. It shows Upper Rawah Ditch and two gathering ditches, the East Side Ditch and West Side Ditch, two pipe lines and the tunnel line. Mr. Duvall did no engineering work on other units or parts of this system than those shown on the map, Exhibit 51. Only difference between Duvall survey and present West Side Collection Ditch, is that it is carried on side of mountain to tunnel instead of crossing river with pipe line as designed by Mr. Duvall.

Mr. R. Q. Tenney did no surveying as chief engineer other than that indicated on Defendants' Exhibit 75, known as the Tenney Map. He was with Mr. Duvall for a short time on Upper Rawah Ditch. Diversion system portrayed on three maps, Exhibits 51 (Duvall Map), 74 (Beach Map) and 75 (Tenney Map) is practically the same system first conceived by Mr. Link and me in our expedition in 1902. Beach survey was preliminary. Tenney survey was also preliminary. Duvall survey was definite location.

Mr. Duvall was engineer in charge of work of excavation as well as definite location of lines. He was kept busy all the time until Ianson came out in fall.

2051 Harry L. Monroe came into the associations of individuals interested in the project in summer of 1904, just before we started work on Upper Rawah Ditch. He advanced money in connection with starting the work. Later severed his connection with the firm.

In 1905 and 1906 efforts of myself and associates were directed principally towards the distribution end if the system, on Poudre River side. To taking water through Poudre Valley Ditch out to plains east of Nunn and Pierce. Charles R. Hedke was engineer for association of individuals during that period. I have heard his testimony given in this case. He described correctly the work done by him or under his supervision during those years.

The Laramie Reservoirs and Irrigation Company was formed September 19, 1906. It succeeded the association of individuals. Up to September 19, 1906, Mr. Hibbard, my brother and I and part of the time Mr. Harris and Mr. Monroe constituted the owners of

this system. The Laramie Reservoirs and Irrigation Com-
2052 pany succeeded to all the rights to water, construction work, camp supplies, and all other property, including filings on Laramie River and interest in the Poudre Valley Ditch on the Poudre, theretofore belonging to individuals.

The Laramie-Poudre Reservoirs and Irrigation Company succeeded the Laramie Reservoirs and Irrigation Company. March 19, 1907, the Laramie-Poudre Reservoirs and Irrigation Company was organized. They succeeded to all the rights, titles and property theretofore owned by the Laramie Reservoirs and Irrigation Company.

A contract to run water through the Poudre Valley Canal was the result of the negotiations carried on with The Poudre Valley Reservoir Company during years 1905 and 1906. Water to be carried for use on land from ditch extending east from end of present Poudre Valley Canal.

2053 During 1905 and 1906 the association of individuals and the Laramie Reservoirs and Irrigation Company expended considerable money to further the enterprise. Up to October 1906, $31,736.90 had been expended by the association of individuals and the company on this enterprise. We had also expended $4,998.00 in purchase of property on Laramie River.

At the beginning of work in 1907 (March 1), my associates and I had expended on the system, outside of purchase of properties on Laramie River, $34,045.01. In both ranches and work we had expended $46,079.32. During 1905 and 1906 my associates and I had borrowed money on the property to do the work. Mr. Hibbard and my brother had been working nearly all the time to interest capital to help build the system. They spent considerable
2054 money in putting forth these efforts. That money was expended entirely in connection with the system.

In 1907 in mountain division we let contract with Ianson for use of his teams and equipment at so much per team, we to furnish all supplies. We furnished the men and Ianson was to be foreman of the outfit and took charge. We also made contract with some Greeks that just came from construction work on Moffat Road, to go up and do part of work on Upper Rawah Ditch. We also made contract with Hokosana, a Jap, to do part of the hand work or pick and shovel work on that ditch where we could not use teams. We proceeded to excavation work along line of these contracts.

Work was carried on during season of 1907 from July 1 to October 1, when snow storms started in and we had to come out. I have photographs representing conditions along line of Upper Rawah or Link Lake Ditch at beginning of work in 1907.

(Defendants' Exhibits 79 and 80 offered in evidence.)

Defendants' Exhibit 79 is photo of ditch line above Fall Creek on divide between Fall and Rapid Creeks, showing bottom of ditch where we shoveled it out to get teams through to Rapid Creek in early part of July, 1907. Mr. Burgess Coy, engineer in charge of work, is standing in ditch and snow shows on both sides. We had to shovel road up to get Japs' camp there on Rapid Creek where they

had to do their work. Mr. Coy was working under Charles R. Hedke as chief engineer of the whole system.

Defendants' Exhibit 80 is photo taken a little further north of photo shown in Exhibit 79 and on slope going down toward Rapid Creek in timber on road which Mr. Link and I constructed across that country in 1903 and 1904. Photo shows bunch of Greeks that we took up there, shoveling snow out of road. Photo taken July, 1907.

Various parties with whom we contracted proceeded to carry out their work in 1907. Hokosana sent up his crews of men. Had about 100 Japs working there all summer. They did pick and shovel work. Their contract was from Rapid Creek south. I took photographs of these Japanese laborers while they were at work that season.

2056 (Defendants' Exhibits 81, 82 and 83 offered in evidence.)

Defendants' Exhibit 81 is picture of Mr. Ianson, foreman of the work that was being done on Upper Rawah Ditch in 1907. He was under Mr. Coy as engineer and Charles R. Hedke as chief engineer. Mr. Coy is in center of picture and foreman of Jap gang is sitting on left of picture and Mr. Ianson is at left of Mr. Coy. Taken just south and west of Rapid Creek along ditchline of Upper Rawah Ditch.

Defendants' Exhibit 82 is photo showing Japs at work on ditch line. It was taken by me in 1907.

Defendants' Exhibit 83 is photo showing portion of Upper Rawah Ditch where it comes around Rocky Point above Rapid Creek and to the south of the creek. This work was done by Japs. Photo is taken very near the south portion of their contract work. They scattered out over whole contract in little bunches. The bank was very high and in many places they had to shovel the dirt twice to get it over the bank. They had a platform up on side of bank and one man would throw dirt up onto platform and another man would throw it over the bank with shovel.

2057 The Greeks did heavy rock work where heavy bowlders were in ditch. They were better rock workers than the Japs. We put them wherever we had difficult work with rocks. The Greeks did not succeed in their contract and we put foreman over them under Ianson and did the work during the latter part of season by force account ourselves. We employed the same Greeks. I took photos of these Greeks at work during 1907.

(Defendants' Exhibit 84 offered in evidence.)

Defendants' Exhibit 84 is picture of some of Greeks working on ditch bank, there is heavy bowlder deposit at this point. They are throwing dirt up on bench and over bank. Location just north of where Fall Creek crosses line of Upper Rawah Ditch.

We got excavation along line of Upper Rawah Ditch entirely completed to point above Rapid Creek. Then there are portions above Rapid Creek and towards Camp Lake where the work is

finished. Right of way is cleared of timber to Camp Lake.
2058 Capacity of ditch as completed from Rapid Creek to West Fork of Laramie River is 224 cubic feet of water per second of time. The ditch intersects various branches of Rapid and Fall Creeks.

Work was done on this ditch subsequent to 1907. The ditch was broken in a few places and in 1908 I sent some men up there to fix up those breaks. We ran all the water that came down that summer and the ditch was again broken in two or three places and during this year, 1913, I took a man and went up there and fixed those breaks in July and August. I had charge of the men that did the work that Mr. Hedke testified about. They looked after the ditch while they were up there, and worked on the ranches, and built roads on the Laramie River the rest of the time.

Plans for constructing the remainder of this Upper Rawah Ditch, adopted subsequent to 1907 were that after 1908 they started construction work on the tunnel and the two collection ditches in the valley, the one from Deadman and the one from Rawah, and it was decided that we could do the remainder of the construction
2059 work on the Upper Rawah Ditch cheaper with maintenance crews than we could by putting gangs up there and keeping them there. After we could get the rest of the system running, we could put our maintenance men up there and have them there in case there was any break in any of the ditches, and at the same time keep them working at construction work on the Upper Rawah Ditch, back to McIntyre Creek.

There never was any intention of abandoning the Upper Rawah Ditch. That ditch is an essential and necessary unit of the system. It has been carrying water and discharging into the West Fork of the Laramie River since 1904.

In summer of 1907 final location of Laramie-Poudre Canal to Crow Creek was finished. While we were working in the mountains with the Japs, the Greeks, and also the gang of white men, Mr. Hibbard and Mr. Ziegler, acting for the company, purchased two under-slung Avery engines and graders and started those at work west of Wellington and east of the end of the Poudre Valley Ditch. They worked those engines until October on that piece of work, and then Mr. Ianson came down with his crew of men from Upper Rawah Ditch and they put him to work on the fill above No. 2 Reservoir of the North Poudre people west of Wellington. They took the Greek crew which we had in the mountain, when they came down, and used them till after Christmas putting in the siphon across Box Elder Creek above Wellington and a siphon under ditch line where North Poudre Laterals cross the ditch near
2060 Wellington. This was crew of 50 men. Had about 50 men engaged on Upper Rawah Ditch outside of Greeks and Japs during 1907. We had on that work during that summer, 50 Greeks, 50 Whites and 75 to 100 Japs. The hardest task we had was keeping men up on the mountain construction work in 1907. It rained a great deal of the time and in many places the work was wet. It was very hard to keep mule drivers up there. Part of Mr. Ianson's

horses were idle on that account. That however is the usual experience in that country. It is especially so after the September or early snows commence to come and when the threshing and best work commence down in the valley. The men break away up there and come down and work on farms.

2061 In 1907 Ianson, after coming out from the mountain work, took charge of the engine crews with grading teams and moved north and east of Wellington. They were put to work there on the ditch where the cut was not over 4½ feet and worked there until Christmas time. The company had let two contracts, for two cuts in ditch. They took engine crews after they got through with north mile near Wellington, and moved them 3 miles east of Wellington on another little grade through there and worked there until along in January and then moved them out into Coal Bank Draw Country. Coal Bank Draw is 12 miles east of Fort Collins.

During 1907 and 1908 other construction contractors were excavating earth along line of Greeley-Poudre Canal. Mr. Lemonds of Nunn, Colorado, had a crew working west of that place, and about 5 miles due west of Pierce. In 1907 Mr. Harry Knowl-

2062 ton finally took contract to build the whole ditch system out to McGrew Reservoir, and in that contract he took over the engines and graders and all camp equipment that the company owned, and took charge of the work and kept going part of the summer of 1908. Think he stopped in June, 1908. Continued to do some little work after that. He kept his contract alive with small gangs. We ran out of money about that time.

Knowlton ceased work at just about the same time that the Greeley-Poudre Irrigation District was formed.

There may have been other contractors in 1907 and 1908 other than those I have mentioned.

Ben A. Johnson of Golden, Colorado, was superintendent in charge of this work on the plains division of Greeley-Poudre system during the construction in 1907. In March, 1907, the company took over the McGrew Reservoir and about 6 miles of its inlet ditch had been completed and incorporated it as a part of the

2063 Greeley Poudre Canal. The reservoir had been constructed with a 25 foot cut and an outlet tube and gate constructed and the cut was filled up where it had been excavated at the gates until it would hold 25 feet of water in depth. The inlet canal was completed back to Eastman Creek. This creek is designated on Defendants' Exhibit No. 1 as east of Union Pacific Railroad in Greeley-Poudre Irrigation District.

These contractors I have mentioned were strung out along the line between the lower end of the Poudre Valley Canal and the McGrew Reservoir during 1907 and 1908. This new ditch constitutes an extension of the Poudre Valley Canal. Mr. Johnson had had charge of construction of Eastman Reservoir and Inlet Canal prior to 1907. He is a civil engineer.

In 1907 Mitchell Lakes Group of reservoirs situated on North and South Pine Creeks were acquired. They were absorbed into the

Greeley-Poudre system. Had been previously owned by Bond Brothers of Trinidad, Myron H. Akin and Jesse Harris. They afford some small water supply for the district.

2064 I should judge about $250,000 was expended in excavation work, enlarging equipment and supervision in 1907. Our work from 1904 to and including 1908 was open and notorious, and open to observation of people in both Colorado and Wyoming.

People in the Laramie River Valley knew of the work in 1904 to 1908. We bought supplies, butters, eggs and other like commodities up and down the river. We were freighting from Fort Collins all the time. People were coming and going from Laramie City at the time we were surveying in the valley and we had parties visiting at the camps there off and on and watching the working. We bought all of our meat supplies on Laramie River.

In 1907 the financial panic temporarily tied everything up. As the result of the panic we had to issue script owing to the fact we were running out of money. We had made arrangements

2065 for more money. The panic caused these parties to fail to keep their contract and furnish us money. The script we issued was a promise to pay, drawing interest at 8 per cent due in six months. We paid the men half in cash and the balance in script. This we did until February, 1908. Then we took the six months' part of the script off and gave them the script straight and paid them half cash until we had to stop work. In 1907 we paid the men who were working on the Upper Rawah Ditch every 15 days in money. The paymaster had to carry the cash. The Greeks would not take checks. The white men under Ianson were paid by checks once a month. The Japs were paid through their contractor Hokosana each month at the office in Fort Collins and he paid his men. I carried the money every 15 days from Fort Collins to the Upper Rawah Ditch for payment of Greeks. We brought the payrolls down, put money in an envelope that belonged to each Greek and went up there and gave him his envelope, made him sign up the payroll and brought it back to Fort Collins and turned it in at the office. During all the time subsequent to 1903 and up to and including 1908 and 1909 there had been a permanent, well-established office of the co-partnership or associated people first and later of the two companies, kept at Fort Collins, with secretary and president there all the time. That office and its

2066 employes had been constantly engaged in financing and clerical work of the system. We also had an office for chief engineer and his crew of men. The engineering crew was engaged in office as well as field work during that time. I carried the work from the field to the office men to work up once a week to work through all along the time.

The other surveys mentioned by witnesses, for example, a line of canals on south side of Cache la Poudre River near Pleasant Valley Canal; survey of ditch from Glendevey around by Sand Creek in Wyoming, and a number of other smaller surveys, were all made to demonstrate that the tunnel was a feasible and the only way of diverting the water from the Laramie River and to demonstrate

and show investors that we had the only feasible way of diverting the water and also of distributing it to the land east of the Poudre Valley Ditch and Fort Collins and that there was use for the water we could divert from Laramie River. They were all of them collateral surveys. They were all made for the common good of the enterprise.

2067 In 1907 and '8, prior to excavation during that year, contracts were entered into with land owners for purchase of water rights in territory now embraced in Greeley-Poudre Irrigation District. These were obtained by Mr. Hibbard. The same lands covered by contracts for water right in 1907 were later merged and incorporated into and made a part of the Greeley-Poudre Irrigation District. The district method and the contract method were merely different means of obtaining the same end. The obtaining of these contracts entailed considerable labor. This was going on as early as 1905 and 1906. Some money was obtained by means of these contracts.

From May, 1903, and thereafter, we intended to put the water to be obtained from the Laramie River on the territory now embraced in Greeley-Poudre Irrigation District, through the Poudre Valley Ditch.

During the years I have lived in the Cache la Poudre Valley I have had occasion to observe the construction of canals both in the mountains and in the valley. Mountain work is much more difficult than plains work. It takes two-thirds more time to build a ditch in the mountains than it does in the valley. It is more expensive. The mountain working season is a great deal shorter than in the valley. In the valley you can work practically the year around.

2068 The Greeley-Poudre Irrigation District was organized April 3, 1909.

Cross-examination by Mr. N. E. Corthell:

2068 The Poudre Valley Ditch was built in 1902-3, and after its construction, about the summer of 1903, we began negotiating
2069 with the owners for a right to run water through it. This ditch diverts water from the main Poudre River and intercepts the tributaries entering from the north. It will carry water from the Mitchell Lakes. In 1909 an extension of the Poudre Valley Ditch as far as Nunn was constructed by the Laramie Poudre Company, but it is not yet completed, and no water has been run through the extension. The Pierce Lateral, crossing the Union Pacific Railroad near Pierce, is not an extension of the Poudre Valley Ditch, but of the Larimer County Ditch, belonging to the Water Supply and Storage Company, and it receives no water from the Poudre Valley Ditch or its extension. The ditch which was completed and turned over to the Laramie-Poudre Company early in 1907 was part of the ditch designated as the Poudre Canal on Exhibit No. 1, beginning at Eastman Creek and running into the McGrew Lake Reservoir,

enabling the storage of water in that reservoir from Eastman Creek.

2070 The memoranda which I have showing the amount of expenditures upon this system up to 1907 were given me by the secretary, Mr. Hibbard, and cover the entire amount expended by our partnership and the succeeding companies for all purposes in connection with the enterprise. Apart from this statement, I have no knowledge of the matter. As I recall, the amount paid Ianson and Walthall for work on the Upper Rawah Ditch in 1904 was between $3700 and $3800, this not including the work that

2071 Mr. Link performed. These contractors had a contract for two and one half miles on the lower end of the Upper Rawah Ditch, but they did not do all the work. They distributed the work over the whole distance, and we completed the work with Japs and Greeks in 1907. Mr. Link worked a gang of men in 1904, clearing the right-of-way through 2½ or 3 miles of timber and excavating along the ditch line both before and after the contractors did their work. The gang he worked of about thirty men was changed back and forth from clearing to excavation from August to October, but I cannot say how much work was done upon excavation by that gang. Sometimes he had as many as fifty men, and I believe never less than twenty-five, there being on an average about thirty or thirty-five working for two months or two months and a half. Part of the time he had four teams upon this work.

2072 There was no construction work done in that country in 1905 nor in 1906, and I cannot give any approximate statement of the amount expended upon work in the Laramie Valley in 1907. In 1908 there were four men employed in the Valley repairing the ditch, these men going up there in June and staying until after the tunnel was commenced in December, 1909. These men

2073 looked after the ranches on the river, cared for the road up the river, kept the ditch in repair, and after December, 1909, commenced clearing the right of way for the diversion ditches on the Laramie River. Until December, 1909, these men did no construction work, and we paid them forty dollars a month and board apiece.

The picture marked Exhibit 76 was taken some time in 1904. No. 77 was taken by Mr. Stuart July 9, 1912; No. 78 by Mr. Stuart July 9, 1912; No. 79 by myself, July, 1907; No. 80 by myself, July 1907; No. 81 by myself July, 1907; No. 82 by myself, August,

2074 1907; No. 83 August, 1907, and No. 84 August, 1907.

The ranches our Company purchased in the Laramie Valley are located below the tunnel on the river and on the McIntyre, and lie some miles below the point where our system begins to collect water. They are irrigated ranches, and were purchased for use as supply ranches to furnish hay and grain.

The Greeks we used in the summer of 1907 had been working during the previous winter upon the Moffat Road which was in process of construction across the Continental Divide south of our project.

2075 We repaired breaks on the Upper Rawah Ditch about the first of August, 1913; we were up there doing surveying work at that time.

WALLACE A. LINK, recalled.

Direct examination by Mr. Charles F. Tew:

2076 I have had experience in construction of ditches on plains of similar size to those now being completed by Greeley-Poudre Irrigation District in Laramie River Valley. In mountains we have to transport our men and provisions for long distances over mountain roads. We have to clear the timber where we intend to work. There is always a great amount of rock work on the surface where the ditch is to be constructed and after this rock is moved the stumps of trees have to be taken off by blasting, and after this is done then the right of way has to be cross-sectioned and then construction in form of excavation begins. After cross-sectioning we have to remove all perishable material from the ground on the lower side of the ditch to fix a place for the bank so as to make a water tight joint. This entails considerable work in the
2077 mountain regions, because the pine needles and roots of trees running through. None of these things have to be contended with on the plains.

On plains work we always are close to town, have roads to transport our commissary stuff on, tools, provisions, and everything of that kind handy. Men are easy to get. Mountain work always necessitates return of men to town at the close of the season's work. On plains there is no preliminary preparation to be made except the establishing of camp and proceeding with actual excavation of ditch. There is no timber or rock to be moved, no clearing of base line of ditch from perishable material and such work.

From 90 to 120 days is the limit of the mountain working season, depending upon the snow fall in the fall of the year or the lateness or earliness of the spring. It is possible to work throughout
2078 the entire year on the plains, barring some exceptional seasons.

Expense of removing earth varies in the two places. On Sky Line Ditch they paid about 50 to 75 cents per cubic yard for loose material and $1.50 for solid rock. On our work we paid 35 cents for loose material and $1.10 for solid rock. No rock measuring less than a yard would be considered solid rock. On the plains earth and loose material is excavated from 12 to 14 cents per cubic yard and sometimes less than that. Have heard of it being moved for 10 cents per cubic yard. Rock work usually costs from 50 to 75 cents.

2079 JOHN R. WORTHAM, recalled.

Direct examination by Mr. Delph E. Carpenter:

(Defendants' Exhibit 85 offered in evidence.)

Defendants' Exhibit 85 is photograph taken by Victor G. H. Stuart, Spring, 1912. Scene is Laramie Valley as it appears when looking towards tunnel from south point of Middle Mountain, showing east and west side mountain ditches, road along side of Middle Mountain and point where tunnel penetrates Green Mountains. It correctly represents locality of system. Dark line of mountain side on right of picture shows line of that portion of West Side Collection Ditch, which has been constructed and so appears on picture. East Side Collection Ditch shows, although not very clearly, on mountain side on left hand side of picture and is marked with arrow pointing to line. Tunnel location is shown by arrow near center of picture and wagon road is shown by another arrow on left hand side of picture with vertical lines at point on road. You are looking up stream of Laramie River in picture. Looking toward head waters of East Fork of Laramie. The collection ditches run up the river towards the tunnel and away from you as you look at the picture. I have placed arrows on picture indicating locations.

2080 Upper Rawah Collection Ditch or Link Lake Ditch does not show in picture. It is back of mountain shown on right hand side of picture. It is at much greater elevation than even the top of mountain shown in picture. I have indicated tunnel location on east side of river. You cannot actually see tunnel portal in picture.

Direct examination by Mr. Charles F. Tew:

2081 On Exhibit attached to answer of corporate defendants I indicate in red color three reservoir sites in bed and channel of river—Cache la Poudre River. But one of these, the Elk Horn, is contemplated for construction.

I have previously stated that all water obtainable from all sources of supply interceptible by works of Greeley-Poudre Irrigation District system are and will be needed for annual irrigation of lands of district. I will explain my reason in following manner:

To be practicable an irrigation project requires three essentials:

First, irrigable lands under climatic conditions suitable for agricultural purposes;

Second, an available sufficient water supply, obtainable within feasible cost of construction and operation;

Third, a system of ditches, reservoirs and works ample for diversion, storage and distribution of water supply necessary for the annual service of reclaimed area.

2082 With all these elements present the project is a success; with any absent the venture is a failure.

The problem of securing ample water supply for a given surface and serving the same in cropping season is as variant and non-uniform as topographies, stream flows and climatic conditions. For

this solution there is required ascertainment of quantity of water annually necessary and character and capacity of works required, properly to distribute the same in sufficient amount and at proper time within cropping season.

There must also be considered the volume of water flow of the streams and supply sources intercepted, the character and fluctuations of this flow, the remoteness in construction and operation, the distance of carriage from diversion to application and attendant loss in transportation and storage, as well as the duty of the intercepted stream to prior appropriation.

In irrigation development the easy constructions are the first indulged and as the area extends expense increases with the attendant necessities of long carriage, reservoir storage and economic use.

In localities where development has reached a high stage and the easy constructions have been accomplished, there often remain large areas remote from the supply of streams, which, with proper systems of canals and reservoirs are feasible of reclamation and may be made highly productive agricultural sections by inclusion into one enterprise of sufficient magnitude that the works may be installed at a feasible cost per acre which may be sustained with profit, provided ample water supply is obtained.

2083 The necessities of such an undertaking are: an area sufficiently large to sustain the construction costs and operation expense, as no single acre can bear this burden, and to provide a system of works and adequacy of supply for the entirety.

On this class of enterprise the whole must succeed or fail together. The total area is necessary to sustain the cost; the total supply required to answer the irrigation demand.

The Greeley-Poudre Irrigation District system is an instance of this class. Here is present the first essential of a successful project, in the existence of 125,000 acres, irrigable and arable at elevation and under climatic conditions suitable for successful tillage.

There remains to render the project feasible the adequacy of works and sufficiency of water supply. While as to the amount required, unanimity of opinion among experts and argriculturalists is not obtainable, nor to be expected, it is safe to say that this area will need at least, and may be properly irrigated by the annual application of 125,000 acre feet of water delivered upon the land. To meet distribution losses an aggregate diversion in excess of this amount must be obtained.

This quantity of water, in view of prior appropriations from the Cache la Poudre and its tributaries is not annually obtainable from that stream, nor is there obtainable in view of its present duty, more than half this amount. The flow obtainable from the Cache la Poudre can be secured only be means of a channel reservoir and the large intake to the district works, so as to impound and divert from the stream the only unappropriated flow annually passing; which is that portion of the freshet discharge in excess of the aggregate carrying capacities of the many direct ditches and reservoir intakes now in operation in the irrigation of the large area already served in this highty developed agricultural valley.

The remaining portion of this district supply, approximately one-half, is obtainable from no source other than the waters of the Laramie River in Colorado by means of the ditches, tunnels and works of the Greeley-Poudre Irrigation District.

With the waters obtainable from the Poudre and its tributaries and the Laramie and its tributaries in Colorado, these Colorado lands may be reclaimed and this project made successful. The loss of either supply or of part thereof must result in its destruction.

The whole area, the whole supply, the whole system of works must be held and operated together as designed and in course of construction, and all the water from every available source must be annually diverted whenever possible, stored when taken out of irrigation season, and economically distributed to accomplish the desired end.

To water this entire area within feasible cost per acre, it is necessary to have works and water supply for the whole area and not a part of it. In order to secure sufficient supply for this whole area, it is necessary that all possible water be obtained from Poudre flow and also from the Laramie flow. There is considerable
2085 difference in the character of these two flows. The Poudre is not thoroughly dependable owing to fact that it has some excessive floods. No part of the area could depend for service upon the unappropriated flow of the Poudre. There is a dependable and steady flow of water which can be obtained from Laramie River by our system of works and can be combined with flow of Poudre. There can also be obtained, from various arroyas, a small flow from flood waters intercepted by system, but this is of no particular consequence. This latter flow is only good for supplemental supply.

In order to deliver water required for annual irrigation of the area of this district, it is necessary to practice economy in storage, carriage and distribution. The system of works of district is both storage and direct diversion in character. It is quite similar to the system of The Water Supply & Storage Company in Cache la Poudre Valley. The Larimer and Weld Irrigating Company
2086 also has mountain works to some extent and also the North Poudre system.

It will be necessary to exchange but a very small portion of the water of the district in making diversion and delivery. Douglas Reservoir is the only reservoir requiring exchange.

Water reappearing within the district from waste, seepage or irrigation above will be re-captured and stored in the March and Camfield Reservoirs indicated on Exhibit 1.

District works are so designed that certain portions of the lands may be served in part by return waters appearing within district. This water will not appear at first application of water but within few years subsequent. It is planned to intercept this character of water whenever it appears. Experience has demonstrated that the quantity of return water is always variant but it is cer-
2087 tain to appear in some quantity. The area included within the district is larger than any of the other areas now served by canals in Cache la Poudre Valley. It will require all of the

water obtained from all of the sources contemplated by the system of district works in order to reclaim this area.

Late development in the Poudre Valley resulted largely from reservoir construction. These have been employed in connection with exchange systems so as to accomplish the greatest possible service of area.

The construction of reservoir system of Cache la Poudre Valley began in the main, sometime in the early '90's after the normal stream flow had been largely appropriated and as the value and utility of late water for July and August, (when the flow is low) began to be more apparent. These reservoirs were constructed to supplement the supplies of ditches then already in operation.

Reservoirs are in general built in natural depressions remote from the channel of stream, across the low line of the rim of which are established the dams wherein outlet devices are installed. These basins are filled by inlet ditches carrying water in non-irrigation time and in irrigation season when the stream flow during freshet or sudden rise is sufficiently abundant to afford flow for all direct ditches and, in addition, an excess for storage.

2088 Impound of the reservoirs is held until sometime in the middle of or late July and August when the most valuable crops are in greatest need and river flow is lowest. At this time reservoir water is employed to supplement the stream and 2088 in this manner the area served is greatly extended and crop results are much increased.

Necessity caused reservoir construction.

Only in recent years has there been commenced the construction of stream-bed reservoirs which, though expensive, are the most efficient. This class of reservoirs are of especial utility under conditions such as those now prevailing in the Cache la Poudre Valley, where all the normal summer and all the winter flow is appropriated by direct ditches and by reservoirs, leaving only in times of freshet an available supply above the present duty of the stream. This is the only flow obtainable. This flow is often of too short duration to obtain through inlets, feasible of construction, the impound capacity of the reservoirs during the flood time. With a channel dam or stream-bed reservoir, all the flow, above that required to fill existing ditches, may be held and used while otherwise it would be wasted and lost.

But one such reservoir of this character has been constructed across the bed of Poudre or its principal tributaries. This is Halligan Reservoir shown upon Exhibit 1 attached to the answer. This reservoir is part of the North Poudre System, and has been in use two years. It has proven of especial value because of low flow of the North Fork of Poudre River at intake point of the North Fork works during the late irrigation season, whereby this system 2089 was frequently embarrassed to effect exchanges by flows from its reservoirs lower in valley, because of there being, at the North Poudre intake, insufficient water in the stream to compensate in equal amount that which could be discharged from the storage below.

The Halligan is of great utility because of sudden flows in the North Fork, often rising to a discharge in excess of the aggregate carrying capacity of all ditches and intakes upon this tributary and the Poudre proper, which floods are generally too short in duration to admit of the filling of the reservoir by inlet ditches.

The Halligan Dam being across the channel, above the North Fork distributing works, the intake of the reservoir is of consequence equal to all the flow, and escapement below is required only to the extent necessary, with the lower stream augmentations, to supply the total capacity of lower intakes.

These interceptible flows sometimes come, though not every year, after the annual June freshets. They are of short duration, of sudden rise and rapid decline, accentuating the necessity of river-bed interception to prevent waste. These excess flows are variable in volume, date and duration, and afford the last opportunity of Poudre appropriation. The volume in general is precari-
2090 ous, not dependable, and valuable only when employed to supplement certain and constant flow.

This development by stream-bed reservoirs is limited to the extent of feasible storage capacity at proper points within feasible cost. The Elkhorn or river reservoir of the Greeley-Poudre which I have surveyed, is of this character.

Some floods of the North Fork will be available to the Elkhorn reservoir though the North Fork empties into the main stream below Elkhorn dam, for, when the North Fork floods are sufficiently copious to answer appropriation demands on the main stream below the confluence, it will leave all or part, as the case may be, of the Poudre flow at Elkhorn during the flush, for conservation there, without injury to senior priorities, and these waters may be discharged, after the flood subsides, into the distributing and storage works of the district below and the capacity of the Elkhorn stand ready for further employment as occasion may require.

The amount of possible storage from this freshet excess, is of course variant with the years, and not dependable as an annual certainty. Some years may afford none, some may give a quantity above the storage possibility. The amounts are variously estimated but it is probable that the supply available will be approximately as determined by experts and it is only by diligence of effort, and economy in management that a quantity sufficient, by this means and by diversions from all sources interceptible, stored and re-stored in time of plenty for time of need, that these district lands may be irrigated and reclaimed.

The necessities of economic use of water for irrigation
2091 arising from the requirement of a limited supply in service of an extended area, has produced in the Cache la Poudre Valley a practice of water exchange among appropriators, in effect inter-linking in a co-operative system, all the canals and reservoirs serving the territory. By means of this method, the duty of water has been extended and many canals, otherwise inferior, are raised to efficiency.

The stream flow is sufficient only in the early portion of the irri-

gation season. During this time all appropriators take and many store.

The reservoirs of a number of later projects lie at an elevation below their ditches, so that when filled the impounded water cannot be flowed upon the lands for which it is needed. Without exchange the storage would be useless and the land would fail of supply in time of greatest need. This requirement is supplied by exchange.

During the low stage of the river, water must pass into the canals of early appropriation. Later ditches with water impounded in storage basins, deliver therefrom to senior claimants and take from the river at their headgates an equivalent of that delivered, and thus late water is supplied to two areas with consequent benefit to all and loss to none.

2092 The total precipitation on the watershed of the Laramie River above the collection works of the Greeley-Poudre Irrigation District will not be taken from the Laramie Valley into the Cache la Poudre Valley. The seepage from the collection ditches of the district will be greater than from ordinary ditches. It will be much larger in volume than would result from the carriage of a like amount of water in a similar length of ditch upon the plains through the ordinary materials in which such canals are constructed. I cannot say, nor can it be determined before operation, what amount this seepage will be. The reasons for certainty of seepage however are here apparent — any observer. The ditches will seep as does the Sky Line Canal, which is built through material in character identical with that along the line of the new constructions. The slope of mountain side on which both ditches are to be operated is of remarkable similarity. The water to be carried in the ditches is clear and because of heavy grade the flow is rapid, holding any silt there may be in suspension and thereby preventing sedimentation; that is, ditches like the Sky Line and Greeley-Poudre Collection will scour. The interstices between the loose rock and bowlders through which these ditches extend will allow the water to pass more freely than from ordinary canals, into the bed and channel of the stream below.

These escapements are not the only losses from the watershed above. The same conditions will prevail in the case of the new ditches as in that of the Sky Line. The precipitation on the watershed above the collection system cannot all be intercepted and carried for the following reasons:

2093 First. Excess flows from intercepted streams and mountain sides at times when the ditch is charged to full capacity.

Second. Loss during winter season, when through stress of weather, it will be impossible to operate the collection system, except as to that portion discharging directly into the tunnel.

Third. Seepage which will escape from the ditches after diversion on the way to the tunnel.

Fourth. Percolations passing down the mountain through the gravel, bowlders and rock through which the collection ditches are constructed.

These flows from the watershed above the work will be of such

quantity that there will be at all times after completion and operation of the system, a running stream in the present bed and channel of the Laramie River from the tunnel reservoir embankment northward to Wyoming, which, augmented from that portion of the watershed in Colorado not intercepted or interceptable by the works of the district, the Sky Line and Wilson Supply or any other works possible of feasible construction to take waters from the valley to more profitable places of use, will aggregate a continuous Laramie River flow at the state line from Colorado into the State of Wyoming greatly in excess of all Colorado diversions; no part of which can ever be diverted or in any manner enjoyed by the State of Colorado or its citizens upon lands of that state. This is also true as to all waters of the stream rising in Colorado and discharging in Wyoming as well as the stream in the latter state, no part of which may ever be enjoyed by the state in which the stream has its rise.

2094 The principal points of control of district works on Laramie River are head gate location of East Side Collection Ditch at Deadman Creek, headgate of West Side Collection Ditch at Rawah, and the location of the portal of the tunnel. From the Poudre River side the point of control is headgate of Poudre Valley Canal. To make it clear, you cannot go further north than Deadman Creek to obtain water for diversion back up stream to portal of tunnel, and feasibility of works on that side of river *are* accordingly controlled by that point. West Side Collection Ditch may, however, be extended northward to intercept McIntyre Creek at point near where present state road crosses this creek. Cost would make project feasible. I designate tunnel as point of control

2095 because that is location of shortest distance between bed and Laramie River and bed and Cache la Poudre and formation of rock seems to be such that tunnel can be driven with safety and without expensive appliances.

There is no other feasible tunnel site by which waters of the Laramie River could be taken out of the watershed. The streams divert at point nearly opposite tunnel and from that vicinity northward, cost of construction of tunnel would be prohibitive. Cost of construction south of present location would locate long mountain ditch carriage and result in loss of more water.

Poudre Valley Headgate is at point of control because at point in cañon of Cache la Poudre River, and it would be impossible to change that location down stream for reason that lands of district as shown upon map Exhibit 1 attached to answer, could not be served, and it is impossible to change the location of the headgate upstream, on account of excessive cost of construction and

2096 operation. As you go upstream cañon walls prevent feasible construction. Cost of present ditch is very great and by moving ditch higher up stream from present location cost would be more prohibitive.

Have data from which am able to state total amount of bonds disbursed by district under construction contract with company. $1,692,780.70 was paid out to company on estimate and $304,000.00 of bonds was paid out of redemption fund of $500,000.00 provided

in contract. In addition there was also paid to company the sum of $1,000,000.00 in bonds.

Resided at Greeley two years prior to engaging in service of district as engineer. Was engaged in practice of profession and interested in developments of character such as this system. Became acquainted with project in general way. Knew generally of project which had first been initiated by Link and Akin and later upon which construction work had been done by company. This
2097 was before I was in service of district at all. Had some acquaintance with location and general character of proposed system under course of construction. Had acquaintance with contractor Knowlton before district was formed.

General plan of system was adopted before I became district engineer, though the district board considered carefully the whole plan and I assisted in this work. There were made some modifications of minor details through the whole scheme. Diversions, carriages, conservations and delivery were found to be on lines of feasible cost, and in main designed upon most economic lines.

Object was to build *so* permanently as possible and at same time to obtain greatest utility. Purpose was to obtain all water possible from the Laramie Valley, the Poudre and all other sources of supply; to store this and by whole system of works to afford district lands and its water consumers a sufficient flow and permanency of works to make tillage of whole area profitable venture by means of system calculated to accomplish greatest possible irrigation achievement economy could devise.

System had many bounds or controlling points. It must all be installed to afford sufficient supply and adequate works to all the lands burdened within limit of cost sustainable.
2098 System must have Laramie water so far as obtainable within point of control and added to this constant and dependable supply must enjoy obtainable flow from Poudre as well, and with both must have system of conservation and distribution to cope with situation. It is not to be presumed that every drop of flow of every stream tapped is to be taken or that completed system, when first employed, will be found perfect in all its parts. Experience will dictate betterments with use. This will continue for years. This is true in all irrigation enterprises. Line of demarkation between completion and maintenance is difficult of discernment. Betterments will come as necessity commands. This is not only true in this system but everywhere in irrigation constructions. Necessity is parent of ditch in all cases and construction is only to meet this necessity. In early constructions lack of rainfall is necessity of first ditch. Amplitude of flow warrants construction of early ditches without diversion dams because there is no necessity. These dams are later constructed as necessity comes. In Laramie Plains, for example, there has never as yet been a need of anything in way of dams but most primitive constructions, there has been no need of water officials to divide and no need of economy. Waste has been the rule because no necessity of conservation.

It is not, in the main, amount of flow, but economy of use and

command of the element that has given rise to the greater developments under irrigation operation.

Cross-examination by Mr. N. E. Corthell:

2099 In 1908 I procured some information about the Greeley-Poudre project by conversation with men in Fort Collins and Greeley who knew about it, and particularly through conversations with Mr. Hibbard, but I did not become connected with the project until June, 1909, and had no personal knowledge of the works prior to that time. During the summer of 1909 my principal work was that of inspection, although I did some surveying that summer throughout the entire district. The District was formed in April, 1909, and the contract was ratified and the bonds voted in
2100 October, 1909. The negotiations and interviews relative to the contract took place during July and August, and the contract was dated September 8, 1909. Under this contract, bonds were issued for the work, and in my testimony of expenditures I have referred to the payments made by the District in bonds.
2101 The construction of the power line to furnish power for the tunnel construction commenced the latter part of October, 1909. The contractor on the tunnel commenced necessary preliminary excavation about Thanksgiving Day, 1909, and the first shot in the tunnel proper was fired on Christmas Day of that year. The only work performed upon the system prior to my connection with it which could be noted upon my inspection was the work upon the Upper Rawah Ditch and the work upon the canal in the Poudre Valley, although there might have been some money spent on maintenance and operation. I would not say that this early work
2102 on the Poudre Valley Canal was primarily adapted to the diversion of water of the Poudre drainage. The original construction was for that purpose, but the extension and enlargement by the Laramie Reservoirs and Irrigation Company and the Laramie-Poudre Reservoirs and Irrigation Company, did not have that object primarily in view. The work upon the plains division was the extension of the Poudre Valley Canal system, but the Laramie-Poudre Reservoirs and Irrigation Company was not an extension of the Poudre Valley Reservoir Company, and the plans of the two latter companies relative to the use of this canal are entirely differ-
2103 ent.

The Poudre Valley Canal and its extensions intercept the tributaries on the north side of the Poudre River, but it does not collect their water because there are prior appropriations, and the Irrigation District can take the water of these tributaries only in times of flood, which is a very uncertain matter.

2104 The Company proposed to construct the Elkhorn Reservoir, with a capacity of 34,500 acre feet. A map for this reservoir, which was filed in the office of the State Engineer, was made by Mr. McFadden, an engineer employed by the Denver Tramway Company, and I believe the filing was made for power purposes. I am not familiar with the negotiations representing that reservoir,

but I know that the Laramie-Poudre Reservoirs and Irrigation Company must furnish the District with reservoir capacity on the Poudre River of 34,500 acre feet, either in the Elkhorn Reservoir or in one or all of the reservoirs shown on Exhibit 1.

2105 The Mitchell Lakes have been in operation for a number of years, how long I do not know, and some of them have early appropriations from some of the creeks. The other portions of this system which could be operated when I became connected with it are the part of the Upper Rawah Ditch now constructed, the Camfield Reservoir, which is in operation whenever there is any excess water in Crow Creek, and the McGrew Reservoir, which can be operated now through its inlet canal from Eastman Creek. The entire system is now largely completed, and there is no more of it which can be operated now than in 1909, although with the expenditure of a very small sum a large portion of it could be put in operation. Of course the Poudre Valley Canal has been in operation all of this time, together with the Douglas Reservoir, the North Poudre Reservoirs 5 and 6, and Bruce Eaton's Reservoir 8,

2106 but no part of the extension of the Poudre Valley Canal is now ready for operation, although with the expenditure of about 50,000, the Poudre Valley Canal and its extensions can be operated from the Poudre River to a point near Section 2, Township 8, Range 64. I do not know whether any use had ever been made of the Upper Rawah Ditch, and when I inspected the ditch in August, 1909, there was no water being run through it, but it was ready for operation and water had actually been run down it.

2107 At the time of the formation of the Irrigation District I would say that about 60,000 acres, or one half of the area proposed to be irrigated has been entered under the Homestead and Desert Acts, and this land can be subjected to the operation of the District only when final patents are issued by the United States, but the only way the desert entrymen can procure patent is by furnishing water which can be secured only from this system, and for such water they will have to pay the same amount as other land owners, and the same is true of the homesteaders if they desire water.

I would say that there was approximately 80,000 acres of

2108 deeded land within the District boundaries.

The lands within the Irrigation District can be irrigated only from the sources of supply afforded by this system, and, on the other hand, these waters cannot feasibly be applied to any other body of land than the lands within the Irrigation District.

2109 The burden of the cost of the system would be so excessive that half of the land within the Irrigation District would not be able to sustain it, and for that reason it is necessary to irrigate the entire area. Since the cost of construction has largely been paid for, this is still true of maintenance cost of the system,

2110 together with the small expense necessary to complete it being sufficient to prevent successful irrigation of any less than the entire amount of land within the boundaries of the District.

2111 I do not believe that anybody can state the precise amount of water necessary for the successful irrigation of these lands. In my opinion if 125,000 acre feet is applied to the land in the District it may be successfully farmed after two or three years devoted to saturating the soil and making the farmers proficient. This amount would be one acre foot per acre applied to the land, and this amount would have to be most economically handled. With any less amount, farming would be a failure. There have been large areas lying within the District and north and east of the District which have been cultivated to different crops without irrigation, but this farming has not been successful. I am not familiar
2112 with the dry farming region in Laramie County, Wyoming, but I am somewhat familiar with conditions in Weld County, Colorado, northeast of the Irrigation District, where a good many people from Iowa and Ohio are trying the so-called dry farming methods. I do not know how successful they are, but before they came in the same land had previously been taken up and dry farmed by others, and had been abandoned, this being a matter of history. In my opinion dry farming in Colorado has been a failure, and unless a dry farmer procures a way for irrigation he will be forced out within a year or two.

2114 The precipitation in the Greeley-Poudre District varies from year to year, but it never occurs at the time when it is most needed. My observation has been that the rains occur in April and May and early in June and that there is no rain of any consequence in July, August or September. The moisture required during the ripening month of August is not obtainable in dry seasons.

2115 I do not know what the average run-off of the Poudre drainage basin is, nor the maximum or minimum. I have made no particular study of this subject nor of the amount of water necessary to satisfy prior appropriations, and my testimony on the subject of the available water supply is based upon reports of
2116 experts. I would say that exclusive of the Greeley-Poudre Irrigation District the total amount of land under irrigation in the Cache la Poudre Valley is between 250,000 and 275,000 acres.

2117 The ditches running through the Greeley-Poudre District from west to east, including the Central Lateral, were not designed primarily to gather up the seepage and return water from the upper ditches, but were built with the knowledge that the amount carried through them from the Poudre River would be augmented by such return and seepage waters. The amount of such return flow is indeterminate and cannot be ascertained until the District has been under irrigation for a long period of years. There is considerable loss from seepage in the first six or seven miles of the Poudre Valley Canal, due principally to the nature of the material through which it is constructed, which can be largely eliminated by improving that canal. In my opinion the loss in the ditches and extensions east of the Poudre Valley Canal would be very much less, but I made no estimate of the extent.

2118 The storage capacity of the different reservoirs of the Irrigation District now considered is as follows: Link Lakes, 2300 acre feet; Cobb Lake, 27,600 acre feet; Dowdy Lake 2990 acre feet; the Elkhorn Reservoir, 34,500 acre feet; McGrew Lake Reservoir, 19,734 acre feet; March Reservoir, 10,350 acre feet; Camfield Reservoir, 4,025 acre feet; Douglas Lake Reservoir, 2,300 acre feet; or a total of 103,799 acre feet. None of these reservoirs have been completed. Work has been done on the Cobb Lake, Dowdy Lake, McGrew Lake, March and Camfield Reservoirs, and one little reservoir called the Dover Reservoir, with a capacity of 322 acre feet, is constructed and ready to store water if any excess water comes down Lone Tree Creek or Wyoming does not
2119 take it away from us. The other reservoirs are not constructed in whole or in part. Douglas Reservoir is constructed and in operation, but the District's interest is in an enlargement which has not been made. These reservoirs are necessary to store water both from the Poudre and the Laramie Rivers during high water seasons, and it cannot be determined until the District has been in operation what part of the water used in the District will be carried to lands directly from the river and how much from reservoirs.

2120 The really dependable water supply of the District will come from the Laramie River, the amount secured from the Poudre River fluctuating greatly and being used to augment the supply from the Laramie. There will be years when the supply from the Poudre River and its tributaries will be practically nothing. Our plans contemplate taking all the water that it is possible for us to take from the Laramie River each year. It is possible to get only a certain amount from that river, and I do not believe that we can absolutely depend on more than half the required amount from the Laramie River. The very great floods on that watershed we cannot consider because we cannot construct works to
2121 take care of them. It is our plan and expectation to take all the water we can get from the Laramie River each year irrespective of the amount of water in that river from year to year. I have made no measurements to ascertain the amount of water which will escape from the East and West Side Collection ditches on the Laramie River, and this amount cannot be determined until the ditches are in operation. My testimony upon this point is based upon observations of the Sky Line Canal which loses considerable water in this way. I have made no calculation of the percentage of water lost through seepage in these mountain ditches nor the amount in acre feet per year, and have reached no conclusions upon that subject.

2122 The capacity of the Sky Line Ditch is 133 second feet and that of the Divide Ditch 200 second feet, my information about both of these dtiches coming from persons connected with them and not from personal examination or measurement.

I have made no personal investigation of the conditions of water flow and irrigation in the valley of the Laramie River in Wyoming.

The drainage area of Cooper Lake, which is included in
2123 the drainage area of the Laramie River basin in the map designated Exhibit 1, might really be termed a drainage area within a drainage area, as there is no outlet from Cooper Lake to the Laramie River, although one might be made. The same was true of the James Lake drainage area which now has an outlet into the Laramie River through the outlet canal of the James Lake Irrigation Company. Before the construction of that canal the waters of James Lake did not find their way into the Laramie River excepting for a possible seepage which may exist, as the elevation of James Lake is higher than that of the Laramie River.

2124 The amount of construction work completed on the different sections of the East Side Collection Ditch on the Laramie River is as follows: the Dead Man Creek division from Dead Man Creek to Nunn Creek is 98 per cent completed; the Nunn Creek division from Nunn Creek to Porter Creek is forty per cent completed; the division from Porter Creek to the Tunnel Reservoir is 14 per cent completed. The contract prices of these three divisions represented are $90,000, $5,600, and $227,700. The percentage of the entire ditch that is completed is 43½ per cent. The amount of construction work completed on the different divisions on the West Side Collection Ditch is as follows: the Rawah Creek division, extending from Rawah Creek to Rapid Creek, 40 per cent completed; the Rapid Creek division, extending from Rapid Creek to Fall Creek, no per cent completed; the Fall Creek division, ex-
2125 tending from Fall Creek to Mill Creek, 61 per cent completed; the Mill Creek division from Mill Creek to the terminus of the ditch, 100 per cent completed. The contract prices for these several divisions are respectively $122,500.00, $16,000.00, $34,980.00, and $18,000.00, so that the percentage of the entire ditch completed is 48½ per cent. I cannot state what percentage of the work upon the diversion dam at the tunnel has been completed. The embankment was originally to have been 56 feet high, but has been lowered so that we now plan a height of 26 feet, although it may be enlarged at a later date. The outlet conduit is 98 per cent completed. The Upper Rawah Ditch, including the McIntyre Ditch, is about 45 per cent completed.

2126 The work which remains to be done in the Laramie Valley is the completion of the cut from the river to the tunnel, the construction of the dam at the tunnel Reservoir and the completion of the East and West Side Collection ditches and of the Upper Rawah Ditch. The contract price of the approach cut from the river to the tunnel is $25,620.00, and 79 per cent of this work is completed. The amounts which I have given as contract prices are payable in bonds of the District, or the District has the option to pay 95 per cent of such amounts in cash in lieu of bonds. Excavation on the East Side Collection Ditch commenced about April, 1910, and on the West Side Collection Ditch about the first of December, 1909, and work stopped on both ditches on October 1st, 1910.

2127 After I was connected with the enterprise no change was made in the tunnel except for the addition of some permanent reinforced concrete lining. No change was made in the line of either the East or West Side Collection Ditches nor in the structures already designed, but some additions were made on the East Side Ditch and the embankment of the Tunnel Reservoir was reduced from 56 feet to 26 feet, reducing the storage capacity of this reservoir from 174,000.000 cubic feet to practically nothing, as the 26 feet dam acts as a diversion dam only, and affords no storage.

2128 On the plains division some work was closed down about May 25, 1910, and the forces were transferred to other parts of the system. Some may have been laid off entirely, but I do not recall how many, and I cannot state what work was closed down in May or in June nor how much nor why, nor how much work had been accomplished by the middle of the summer of 1910. I can give the proportion completed up to this time.

The contract for the tunnel was upon the basis of $32.50 per lineal foot and the length of the tunnel is 11,366 feet. In my statement of the cost of the tunnel I have included the entire cost of the power plant and of all the work that had anything to do with the tunnel as it stands today.

2129 The Elkhorn Reservoir is the only river bed reservoir to be constructed under the present contract. If any further river reservoirs are provided they would be outside the contract. The Halligan Reservoir, constructed within the last two years, is not a part of the Greeley-Poudre System, but of the North Poudre system, and I do not know whether its rights are subsequent to the Greeley-Poudre's or not.

The system of exchange of water in the Poudre Valley is based not only upon agreements but is based upon legal right irrespective of agreement.

2130 I do not consider the fact of the large loss from the East and West Side Collection Ditches through seepage as a merit or demerit of the system. The loss is unavoidable, as the cost of making the ditches water-tight is prohibitive, and if the ditches were made water-tight the District would still have to discharge more water for the benefit of prior appropriators.

Redirect examination by Mr. Charles F. Tew:

2130 In addition to two amounts of bonds which I have stated were paid by district, one from estimate fund ($1,692,780.70) and one from redemption fund ($304,000.00), there was fund of $1,000,000.00 which was paid to The Laramie Poudre Reservoirs and Irrigation Company, for rights and properties which they owned at time of entering into district contracts.

2132 District sold $50,000.00 worth of bonds at 95 cents to company out of total issue of October 4, 1909. Company paid for these bonds at different times, principally in $5,000.00 lots. Paid in cash at 95 per cent of par. Bond for same date of issue as other bonds mentioned. All bonds are secured by district

lands and must be paid by lands served by district works. Lands are all burdened for both principal and interest for total bond issue.

Desert land entry holdings in District are part of land to be served by District works. These lands included in district by petition or contract. This area of non-deeded land was included in district by petition prior to September 8, 1909, date of contract with company. Prior to making contract with company, work
2132 of fixing definite lines and enlisting in project full area to be burdened was in progress. This also applies to land held by homestead as well.

125,000 acres of land both patented and unpatented was contemplated to be served by district works at time of contract on September 8, 1909. Negotiations concerning water supply to be obtained and bond burden to be embraced and borne, concerned irrigation of 125,000 acres. These petitions which I mention are filed in State of Colorado. When entrymen have complied with law they received patents and lands at the same time are automatically made a part of Greeley-Poudre Irrigation District.

It will be necessary in operation of works to use some of storage capacity of reservoirs of District more than one time in each irrigation season. It is necessary in economic management of this
2133 system, to employ some of these reservoirs for purpose of storage of waters available from both Laramie and Poudre at same time. These reservoirs are not to be simply filled from one source and held and discharged but once upon district land. It is necessary to use whole system in order to cope with water flows obtainable from all sources. Dependable supply from Laramie River may be carried directly through district ditches on Laramie to river for its carriage to district lands during time when no water is available for district from Poudre River. At times other than when water is being used direct on district lands, it will be stored in reservoirs for future use of district land. With Laramie waters thus stored, there will also be stored waters obtainable from all
2134 sources including Poudre.

Am acquainted with Poudre Valley. Also had benefit of information of reports of superintendents and others. Have observed ditches being used; water flowing in them. Have noticed crops dependable for supply upon these ditches and reservoirs. Have noticed the different years and times when water was flowing in Poudre River in excess of that taken by several diversions from river. I make my statements from these general observations, investigations I have made, from reports of those engaged in agricultural business and other sources.

I stated that about 275,000 acres of land is now served by
2135 Poudre River. This information I have obtained from superintendents of canals, reports, etc. In addition to that there are various areas irrigated by return water appearing after irrigation of lands above.

Reservoir in channel of Cache la Poudre River will not be used alone for conservation of excess flows of that stream. Will also be

used for storage of water from Laramie River. Storage of water in that reservoir will not be limited to that from any particular source at any given time. It will be necessary to use the capacity of this reservoir more than once each season in order to irrigate the district lands. It can be done. All of district reservoirs must be like-
2136 wise employed in order to serve district lands. All Laramie and Poudre water for district must be obtained from Poudre River through Poudre Valley Canal. It is the main artery of the system.

In addition to Halligan Reservoir, there are also other channel reservoirs in Poudre River. Chambers Lake on main river and Worster Reservoir across channel of Sheep Creek, a tributary of North Fork of Poudre River, are also channel reservoirs. They are small, high on the stream, and of inexpensive construction when compared with the Halligan Reservoir or Elkhorn Reservoir of district. They are so situated as not to be subject to heavy freshet discharge usual to lower portions of river. Chambers Lake
2137 and Worster Reservoir differ from Halligan and Elkhorn, in that they are in some ways more like the reservoirs on the plains and also depend in part for water from inlet ditches, while in the case of Halligan and Elkhorn Reservoirs, the stream itself is the inlet for the reservoir.

$600,000.00 total estimated cost of Laramie River tunnel, in addition to cost of power, steel, drilling, and labor, included construction and installation of power plant and camp and equipment, tunnel equipment (outside of the drill steel), engineering expense, promotion expense, overhead, temporary and permanent linings.

D. A. CAMFIELD, a witness in behalf of defendants:

Direct examination by Mr. Charles F. Tew:

2138 Daniel A. Camfield, Greeley, Colorado. Lived in Greeley or within 25 miles for past 34 years. Located Greeley April 1879. Went to work on ranch about 2½ miles east of Greeley. At end of 9 months rented farm was working on. Farmed there one year and following year bought farm on what is known as Lone Tree Creek, about 9 miles northeast of Greeley. That was then
2139 eastern boundary of irrigated territory. That irrigated territory has been since extended and now extends to east side Crow Creek Valley.

At that time irrigated area in Poudre Valley was very much less than at present. Water supply for certain period of year was much greater than now, but great part of year much less than at present. Greater possibilities for farming now than then. Construction of ditches, reservoirs and more economical use of water has caused improvement.

After farming in vicinity, went into stock business, sheep, cattle and horses. Later located on Crow Creek about 25 miles
2140 northeast of Greeley. I have observed Exhibit No. 1 attached to corporate defendants' answer. My ranch was little south of Foston appearing on that map. Engaged in ranching at

that point from years 1883 to 1895. During that time became acquainted with character of land in district. I ranged cattle, sheep and horses over practically every acre of what is now the Greeley Poudre Irrigation District and had local ranches in other parts of the district. Existing irrigated area extends up to southern boundary of this district as indicated on map Exhibit 1. At time I was in stock business on Lone Tree Creek all north of my place was open range, and antelope were running over it at that time. It is now irrigated by the Eaton Ditch.

In 1883 I started flood water ditch to take flood waters of Crow Creek to irrigate bottom lands, for hay for stock use and irrigated 400 to 500 acres and raised 1000 tons of hay annually there. In 1887 started to build three reservoirs there. Crow Creek extends along eastern border of Greeley-Poudre Irrigation District
2141 lands. When I moved and located on Crow Creek there was constant flow of water in the stream. Water diminished after I moved there. Flood waters did not change but continuous steady flow got less until at the time I left there there was no water at all. Crow creek rises and flows a considerable portion of its distance in Wyoming. It heads in Wyoming and flows down into Colorado. People along this stream in Wyoming took out the water above with the consequence that it grew less and finally disappeared down in Colorado. There are ranches all along Crow Creek in Wyoming and Cheyenne gets its water from Crow Creek. There is continuous flow of water in this stream for considerable distance both north and south of Cheyenne. These diversions in Wyoming diminished the flow in Colorado.

2142 First ditch I constructed from Crow Creek was named Camfield Ditch. Reservoirs were called Reservoirs 1, 2 and 3, and one of ditches was called Outlet Ditch to Reservoir No. 1, and there was ditch called Coal Creek Ditch and Feeder to Reservoir No. 2. There was inlet ditch for Camfield Reservoir No. 3, about four and one half miles long, carrying 400 cubic feet of water per second of time.

Ceased operations in range business in Crow Creek Valley in 1895. Since then have been engaged largely in building and financing ditches and reservoirs. When I sold out, George West and I ran a line and tried to get water into Pawnee Reservoir, from South Platte River and found it would take a ditch about 104 miles long to reach the reservoir. At that time, I found, or thought it was impracticable to run winter water that far. In running that line we discovered two valuable reservoirs, one called Jackson Lake and one afterwards named Riverside Reservoir, both reservoirs are now constructed and in operation. Started surveys in 1895. One
2143 near Orchard, one near Hardin, and one near Kersey, all on north side of river. Pawnee Pass Reservoir lies northwest of Sterling, Colorado. During that winter ran three lines to Pawnee Pass Reservoir each 100 miles long. That is large reservoir and at high water line we ran would hold 7,000,000,000 cubic feet or about 150,000 acre feet of water. It has never been built. Subsequent to

my survey the U. S. Reclamation Service surveyed all one summer on inlet ditch to this reservoir, but only got half of it surveyed.

Jackson Lake and Riverside Reservoirs, discovered by us in our survey, are now built and in operation. At time Mr. West and I started survey, there was no storage of water in lower South Platte Valley and farmers could not raise valuable crops such as potatoes and beets. Crop was largely alfalfa and some wheat.

2144 At the present time there are three sugar factories and there are beets enough to supply these factories in that valley.

At that time there was great deal of land in South Platte valley between mouth of Poudre and state line under ditches but not cultivated. All that land is now in high state of cultivation. Would think the reclaimed area in Poudre Valley is now three or four times as much as then.

Bijou Canal in the South Platte Valley now irrigates section that was then Prairie, not a foot of which was under cultivation. Ditch had been built and abandoned. This canal was started in 1889, and in 1895 was entirely abandoned, gone partly to ruin, and there was not an acre of land under cultivation by the ditch. In 1895 there was not one reservoir developed in Lower Platte Valley. Reservoirs have been constructed since that time. I have been connected with Jumbo or Julesburg Reservoir, situate between Logan and Sedgwick counties in Colorado. It holds about 1,200,000,000 cubic feet of water and serves about 30,000 acres of land. Coming up the river I have been connected with the following reservoirs:—Point of Rocks Reservoir, holding 80,000 acre feet of water. It has dirt dams 87 feet high, about mile long on top and faced with reinforced concrete on inner slope. Inlet ditch of that reservoir is 61 miles and outlet ditch is 60 miles long. Next reservoir is Jackson Lake Reservoir, situated about 4 miles northeast of Orchard, Colo. It is constructed and in operation, and holds about 1,600,000,000 cubic feet of water. Inlet of that reservoir is about 11 miles long. Outlet is to river and supplies Fort Morgan Irrigation District and Hill Rose Irrigation District, besides some smaller ditches along river. Next is Riverside Reservoir, situate about five miles northeast of Hardin, Colo. It holds about 2,505,000,000 cubic feet of water. Part of water is discharged into river and supplies

2145 ditches lower down, but about three fourths of water is owned by the Riverside Irrigation District, which is irrigated by outlet ditch from reservoir 106 miles long. The next is reservoir on south side of river known as Empire Reservoir. It holds about 1,600,000,000 cubic feet and has been in operation several years and is now owned by the Bijou Irrigation District. It has short outlet ditch that runs from reservoir proper to Bijou Ditch.

The only other reservoir on lower Platte river is Prewitt Reservoir. It is situated south of Marino, on south side of river and furnishes water for three or four irrigation districts near Sterling. I had nothing to do with its construction.

2146 Have been engaged in construction and completing these reservoirs ever since 1895. Have followed no other business

than development of lands and construction of ditches, reservoirs and irrigation works, although interested in other business. All systems I have promoted, except Greeley-Poudre Irrigation District, are now in use for irrigation of land. Have used irrigation district methods of organization largely. In every instance, construction cost was to be borne by lands served.

Have been instrumental in construction of following irrigation works in South Platte Valley:

Julesburg Irrigation District, area 28,000 acres in Colorado and 4,000 acres in Nebraska. Latter land not in district. Total bond issue that district, $500,000.00. North Sterling Irrigation
2147 District, comprising 80,000 acres with bond issue of $2,080,000.00.

Hillrose Irrigation District comprising 16,000 acres but with small bond issue. They just bought a million Jackson Lake rights, I think, about $100,000.00 bond issue.

Fort Morgan Irrigation District with area of 44,000 acres with bond issue of $178,000.00.

Bijou Irrigation District, comprising 40,000 acres with $800,000.00 bond issue.

Riverside Irrigation District, comprising 55,000 acres under irrigation but only 40,000 acres in district. Bond issue $1,000,000.00.

Green City Irrigation District is quite small and comprises about 3,000 acres with bond issue of about $42,000.00. I think that is all in the South Platte Valley.

Had to do with the promotion and completion of other reclamation projects than those in South Platte Valley. Was connected with and financed and constructed the Montezuma Irrigation District situated in southwestern Colorado, comprising 55,000 acres with bonded indebtedness of $750,000.00. Also constructed Eden Valley Reservoir in Wyoming but had nothing to do with its financing whatever, and simply took it as a contract from Farson & Son Company and got my pay in cash.

It is my practice, after considering all elements of the district to finance it and construct it from bonds and securities of the district. Other than the Eden Valley Reservoir in Wyoming, I have been compelled to consider the various enterprises from every angle and decide whether or not the enterprise was meritorious for the reason that we had to take the bonds and dispose of them in order
2148 to get our pay. If bonds were not placed on good project there would be loss and failure. During these years I carefully considered each project that I have mentioned. We took into consideration many things but really there are three substantial elements necessary and significant to any good irrigation enterprise. First essential is good land, land that will raise valuable crops, land that is situated near railroads, whose elevation is such that they can raise potatoes, sugar beets, and other high priced crops. The next essential is sufficient water supply, no matter how valuable the land is, if the water supply is not sufficient the project must be a failure. The next essential feature, with land and water, is to construct necessary works to properly bring water to land and to

properly irrigate it. In promotion and construction of these large projects which I have built, have considered these elements in each venture. When new project is proffered, have to take into consideration amount water appropriated prior to your taking water, otherwise you will run short of water. During years of my
2149 engagement in this business, have had to do with all branches of promotion, except engineering and legal part, from consideration of the organization up to the disposal of the securities. A great many projects were brought to my attention and considered by me but not constructed. In such cases, made a study of water supply, land conditions and general feasibility before discarding projects. Have made such examinations for determination of feasibility of projects in Colorado, Wyoming and Idaho and New Mexico.

Have been instrumental in reclamation of about 300,000 acres of arid land in years of my engagement in the business, outside of Greeley-Poudre Irrigation District. Have very closely observed conditions of water flow of lower Platte River from mouth of Poudre eastward throughout years I have mentioned. There
2150 has been large increase of return water. The reservoirs which I constructed receive their supply of water principally during winter. They receive some water in summer time. Every one of them is taking water today. The winter flow of water in the river from the mouth of the Poudre down to the state line is increasing each year. This increase is result of storage and application of water higher up on stream. Part of this water comes from lower Poudre. Major portion of it comes from Platte River and tributaries and secretions from seepage return. There is decided increase of water flowing in river between mouth of Poudre River and head of Empire Canal and it increases from there down to state line. There is increase regardless of discharge of water into
2151 the stream. Increase into the river nearly every mile. Winter water stored in Empire Reservoir is discharged through outlet back into Bijou Ditch and thence to lands of Bijou Irrigation District west and south of Fort Morgan in the South Platte Valley. Seepage from these lands returns into South Platte River.

There is return water to river from reservoirs and lands served by reservoirs on north side. North Sterling, Sedgwick and all those ditches taken out on north side of river. Riverside Irrigation District lands return water to stream. Seepage returns from these districts reach stream above number of reservoirs I have described. In my opinion the operation of these reservoirs will bring about a continual increase of flow of water in the South Platte River from the Empire and Riverside Reservoirs down to the state line and that increase will be every day in the year. It will be a continuous, steady inflow. It will be from return waters from the ditches.
2152 I base my judgment on what I have seen in the South Platte Valley and elsewhere.

Lands which I have been instrumental in reclaiming along the lower Platte, lie comparatively close to stream. Riverside Reservoir Outlet Canal 106 miles long starts at reservoir and runs in north-

easterly direction through part of Weld County and all of Morgan County and ends in Logan County.

It irrigates narrow strips of land not more than 8 miles wide.

Points of Rocks Reservoir irrigates about 80,000 acres of land lying in narrow strip along river and not more than 7 or 8 miles wide on average. The Riverside and Point of Rocks Reservoirs afford irrigation to large portion of Platte Valley on north side of
2153 stream towards state line. Julesburg Irrigation District extends into Nebraska. These three districts are principal systems on north side of river.

Green City, Bijou, Fort Morgan, Hillrose districts are ones with which I have had to do on south side of stream. Have had nothing to do with Prewitt Reservoir.

Developments along South Platte River of which I have spoken are later developments than those in Poudre Valley, where I reside, except the Greeley-Poudre Irrigation District. Prior to my operations in South Platte Valley, there were no reservoirs below mouth of Poudre. The reservoir systems were necessary in order to accomplish the development of which I have spoken. There was not sufficient water supply during irrigation season and reservoir would conserve water that otherwise would have gone to waste for nine months of year. Reservoir systems afford much higher use of water than ditch system for simple reason you have got it in storage when you can draw on it when needed, while in direct system you have to take water when it comes or not use it at all.

2154 The return water, which I have described in South Platte Valley, is from irrigation from lands in the Platte Valley and all tributaries. It comes from irrigation of lands on all tributaries.

Prior to 1890 practically all reclamation in the Cache la Poudre Valley was by means of ditches. Along about 1890 we commenced construction of reservoirs. I commenced later on South Platte Valley. Prior to my construction, Poudre River was taking and using winter and summer flow for irrigation. There were many reservoirs constructed prior to the time I began on the South Platte. No water used in reclamation of lower Platte Valley is from Poudre, except return and seepage water, and occasional floods. The only floods we receive are those which are in excess of the diverting capacity of all the ditches on the Poudre. There is generally such a flow every summer for a limited time. At about the same time there is usually a flood in South Platte Valley and other tributaries of the stream. It does not all come at the same time. Am
2155 acquainted with project known as the Greeley Poudre project, sometimes called project of Laramie-Poudre Company. Am member of board of directors of that company. Was acquainted with lands contained in that project long prior to formation of district. Think I have walked over every section of land in the district. In surface conditions, depth of soil, fertility and the climatic conditions, the lands contained in the district are somewhat better than the lands further south. As you go north from Greeley to Carr Station the lands continually improve. Generally speaking the lands are similar but some of the soil around the Greeley blows

a great deal and comparatively little of the soil in the Greeley-Poudre District blows. It is a heavier soil. It is exceptionally well fitted for culture of beets and potatoes. Also for all other
2156 high class crops grown in Poudre Valley. It will grow cabbage, onions, sugar beets, celery and any other crops. It is 50 to 160 feet higher in elevation than other lands of Poudre Valley. Climatic conditions are exactly the same as those on other lands in Poudre Valley.

After you reach Carr Station, going north, there is a decided change for worse in character of lands. The hills immediately commence to rise very rapidly and quality of soil is not so good. It is rough, broken and rolling.

Early in 1908 I began consideration of proposed system of works, water supply and general conditions surrounding the Greeley-Poudre project. Had thoroughly familiarized myself with everything connected with the project long prior to that time. Became interested through efforts of Mr. Hibbard. Had several meetings with Mr. Hibbard and Mr. Duvall and also another engineer, Mr. Green. Also Mr. Charles R. Hedke, engineer. We went over entire matter and considered everything in Poudre Valley and
2157 on Laramie River. I was already very familiar with the Poudre River and the lands served by it, and had general knowledge of the Laramie River and the use to which water of that stream was placed. Had a general knowledge of use of water at Wheatland for farming. Was very familiar with annual freshet in Poudre very frequently running in excess of demands of ditches. At that time had general understanding of condition of works then in course of construction to accomplish diversions of Greeley-Poudre system from Laramie and Poudre Rivers. They had been working on the system prior to that time.

2158 If works of Greeley-Poudre system are completed, I consider this the best by far of any irrigation project with which I have had any connection. I have never bought a foot of land under any other project with which I have been connected, but from my 33 years' knowledge of this land and its value, I bought two sections in the district and now own them. It is better than any other district in its location, character of crops it will raise and transportation facilities. Union Pacific Railroad has constructed two branch lines through this district at cost of nearly two million dollars. These railroads were built purely in anticipation of transportation business to come from development of this area.

Irrigation upon areas I have described in other districts has proceeded successfully. Between $7,000,000.00 and $8,000,000.00 of irrigation bonds have been expended in construction of works with which I have had to do, exclusive of Greeley-Poudre system. I am person who negotiated sale of bonds. These systems have been in successful operation as follows: Julesburg about 8 years, Fort Morgan about 9 years, Bijou 7 years, Montezuma 6 years, Riverside 4 years, North Sterling 2 years, Green City 7 years and Hillrose 7 years.

After making investigation of Greeley-Poudre project and
2159 considering the possibilities of same from every standpoint, I bought 23 per cent of stock in the Laramie-Poudre Reservoirs and Irrigation Company. Mr. Shields bought the same amount and Mr. Iliff and Mr. Thorp bought in about same time.

Approximately $800,000.00 had been expended before we went into company. This had been expended in promotion and construction of system. Prior to my entering and purchasing stock, I had understanding with stockholders that I would buy only on condition that irrigation district would be formed as that was the only way to finance it so far as I could see. Soon after I bought into the company, we made arrangements for formation of irrigation district.

District finally formed in 1909. I had previously sold be-
2160 tween $7,000,000.00 and $8,000,000.00 of irrigation district bonds to various houses in east like Farson Sons & Company of Chicago, Trowbridge & Niver Company and other similar institutions. Before entering into contract for construction with any districts, always made contract of sale of bonds to some house by which they agreed to purchase certain amount every month as fast as construction work progressed. I made an absolute and actual sale of the bonds. Conditions of contract were that I was to deliver bonds in stages, and then money was to be paid out on estimates of District Engineer and Board of Directors of District.

When I insisted that those lands of the Greeley-Poudre Project be formed into district, I had reference to same area that was to be served under works then in process of construction. September 1908 my company finally made contract with district for completion of project. Payment to be made in bonds.

2161 $5,100,000.00 of bonds were to be issued. Our company was to receive $5,000,000.00 in bonds and also obligated to buy $50,000 bonds from district at 95 cents in cash. At time contract was completed between district and company, company placed in escrow deeds to all property, rights, franchises and works, and everything complete, and by so doing received $1,000,000.00 in bonds. $3,500.00 of bonds were set aside in Trustee's hands to be paid out as construction work on system proceeded, payments to be made on estimates by engineer of district and ratified by district board. After contract was made and ratified, the company accepted contract and proceeded to carry out construction work. Contract was dated Sept. 8, 1909, and we proceeded with work that fall. By terms of contract of sale of bonds, funds were to be furnished in amount of monthly estimates and not to exceed $125,000.00 in cash per month.

2162 All bonds were sold to Farsons Sons & Co., under contract to be paid for in monthly payments beginning March, 1910.

We put men at work at both ends of tunnel as soon as possible and scattered outfit all through plains wherever we could let contracts and also put large forces in the spring on construction of mountain ditches. There were men and teams working on every part of the system.

My company bought controlling interest in Poudre Valley Ditch,

paying $175,000.00 in cash. This we were to convey to district. We also purchased, subject to some outstanding rights, the Pierce Lateral for $28,000.00. We disbursed cash for other portions of the work. We purchased right of way and some reservoirs owned by F. C. Grable, paying $35,000.00 for these. We purchased direct from District $50,000.00 in bonds, paying at the rate of 95 cents cash for same. We also purchased additional stock in Poudre Valley Reservoirs Company for Poudre-Valley Canal, paying cash for it, this with other stock previously mentioned constituted 57 per cent of stock of company. Some of stock was purchased prior to time I went into
2163 company.

Established power plant on Poudre River side of Laramie-River Tunnel to run drills, furnish light and all kinds of power necessary for construction at both ends. It cost $97,000.00. Tunnel is completed. We had large forces of men on mountain work, as well as on plains, in 1910.

Mr. Johnson, State Engineer of Wyoming, sent out letters all over country about time we sold Greeley-Poudre bonds to Farson Sons & Company, which was in December, 1909. Received copy of it. It stated that waters of Laramie River belonged to Wyoming, that we had no right to them and suit would be instituted to stop us from diverting waters from river and using them in Colorado. This was followed up by other letters, so Farson informed me. Clients of his had received numerous other letters to same effect. Not all of them came from same source. I think one came from chairman of a committee at Laramie City. Mr. Groesbeck sent
2164 some. Letters were continual every three or four months.

First it would be State Engineer, then Governor came here once or twice and every time they came they gave out interviews to papers telling about suit they were going to bring against Colorado, and these interviews were given to United Press and sent all over country, and every so often we would receive letters from Farsons with these clippings that their clients had sent them and finally they got to be so numerous and so widely distributed, that bond sales practically ceased altogether. Farsons were unable to live up to their agreement or anywhere near it. There was no provision in our contract that released them from any such cause. Nevertheless they did not pay. After that time members of our company bought large amounts of bonds, and when our money ran out we borrowed large amounts from banks and signed notes and put up our own bonds as collateral to those notes in order to keep work going. In this way I spent considerable portion of my private fortune.

2165 These threats and interviews, so reported and reviewed through press, and circular letters from Mr. Johnston and others, most decidedly interfered with carrying out of construction work long prior to institution of this suit. This practice of giving out interviews and mailing letters commenced immediately after the ratification of contract by district during latter part of 1909. Project had then been in process of construction for a number of years previous. After commencement of this suit, efforts to prevent further sale of securities were a little worse. Effect of these letters and this practice has been to make it impossible for Farsons or individuals

to sell these securities to the public, and that in turn has had the effect of shutting down works largely or altogether.

From January, 1910, until December, 1911, work continued on project with large force and continued after December, 1911, and into 1912.

District still holds $2,340,000.00 of their bonds. The balance, with exception of $300,000.00 held by Mr. Iliff, Trustee, has been used, either sold directly or used as collateral, to get money and put into the works.

2166 Project has ample water supply and sufficient works to make it feasible if all water contemplated can be obtained from the sources to be tapped. It will stand out preeminent above all other districts in these regards. If district is prevented from obtaining the water supply from watershed of Laramie River, to be intercepted by its works, it will be a failure. It is necessary that the district have the use of all water obtainable from the Laramie River source.

Lands of Greeley-Poudre Project are now arid, grazing lands. For such purposes their value is about $5.00 per acre. That
2167 is only available use to which this land may be put without irrigation. From my knowledge and experience of lands in vicinity, these same lands would have value of from $75 to $100 prior to cultivation and as soon as water supply is assured. This would be in addition to bond burden of $40 per acre. Lands will enhance in value. Values will ultimately be $125 to $250 per acre, depending upon location and improvements.

Cross-examination by Mr. N. E. Corthell:

2167 First surveys in the Platte Valley in which I was interested were commenced in 1895, and first construction work upon these projects commenced, I think in 1897. I do not recall that the year 1896 was exceptionally dry. Since that time I have
2168 been almost exclusively engaged in promoting construction of irrigation systems largely through the organization of irrigation districts. I have been interested in the organization of more districts in Colorado, probably, than any other person, but I have not organized a majority of them.

The enterprises I have described in the South Platte Valley have been largely dependent upon the return flow from the irrigated lands in the valley of the Platte and its tributaries, this return flow showing a continuous increase as irrigation is extended. I believe that more than 50 per cent of the water with which 300,000 acres of land in these districts has been reclaimed comes from return flow and the balance of the water is derived from the winter flow, which is stored, and the thirty days of flood water in the summer time.

2169 I am familiar with the lands lying immediately north of the Greeley-Poudre Irrigation District, which have a sale price of seven or eight dollars an acre and are substantially of the same quality as those in the Irrigation District.

2170 I became interested in the Laramie-Poudre Reservoirs and Irrigation Company in the fall of 1908, before the organiza-

tion of the Irrigation District. The process of organizing the District continued for quite a long time. There was one group which was very anxious to have the District extend farther north, and I spent perhaps $15,000 in endeavoring to find a possible route for a ditch from the Laramie River around the mountains so as to get water as far north as Carr Station. That required six or eight months and we found the plan impracticable. This survey was made partly in the fall of 1908, and most of it in the spring and summer of 1909. We decided upon a tract of land that should be embraced in the District at the time of the organization of the District in April, 1909. The number of acres in the District was approximately the same when it was organized as now. Every entryman upon Government

2171 land signed a contract to include his land in the District and pay taxes until patent was secured. All this was done about the time of the formal organization of the District. I did not buy in to the Laramie-Poudre Company until the other people interested had agreed to the organization of an irrigation district. Mr. Shields purchased his interest at the same time, and Mr. Iliff and Mr. Thorp bought in three or four months later, the four of us acquiring the controlling interest.

2172 The books of the Company and the statements of Mr. Hibbard indicate an expenditure prior to the time we bought in, of $800,000, covering all kinds of construction work, promotion work and organization expense. In December, 1909, our Company purchased the shares in the Poudre Valley Ditch which were owned by the North Poudre Company, and we completed the payments on these shares in January or February, 1910.

2173 I do not have any of the circulars or newspaper articles which I stated were put out by the Wyoming people relative to this project, but I believe I can procure them and will do so, and I will also furnish the letter written by the State Engineer of Wyoming which I have mentioned. I remember that the Farsons once showed me a letter sent them by one of their clients and written either by the State Engineer of Wyoming or by a man named Fuller, and I will try to procure this letter. I will also endeavor to procure the letter I referred to written by Judge Grosbeck.

About March 1910 we commenced to encounter difficulty in selling bonds, which had been sold readily and at a more rapid rate than the contract called for prior to that time. I believe it was not until the fall of 1911 that we began to lay off men on the work, but I will be able to refresh my recollection as to this date.

2174 There had been no default in the payment of interest by any irrigation district in the South Platte Valley in 1910, and only two districts in that valley had ever defaulted, the Riverside for the year 1910 and the North Sterling for the year 1911. By the time these defaults could have affected the sale of bonds the sale had already stopped. Farson & Sons sold the bonds of the North Sterling District, and one half of the bonds of the Riverside District. In the last two or three years there has been no market whatever for Irrigation District securities.

Cross-examination by Mr. John D. Clark:

2175 The Laramie-Poudre Reservoirs and Irrigation Company raised money they had spent before I entered the project by the sale of stock and bonds. $375,000 of stock had been sold at par or above par, and the balance of the $800,000 had been raised by the issuance of bonds. I do not believe that more than 15 per cent of the amount expended was for the purchase of lands and water rights in the Laramie Valley. The purpose of buying these lands and water rights was to use the water on the land of the Greeley-Poudre Irrigation District. If the water was used on the hay land in the Laramie Valley the early part of the season and on the lands of the Irrigation District the rest of the year the diversion would not injure the Laramie Valley lands, but if the water was diverted into the Poudre watershed the whole year round, the Laramie Valley ranches would of course be injured. The Company bought the lands as well as the water rights.

2176 I do not know how much of the expenditure of the Company before I entered it was for promotion expense. In my experience with irrigation projects, promotion expense has been very small.

The other men interested in the Company had no plan for financing this project which appealed to me as being at all feasible. Bond Brothers, who held a controlling interest, were wealthy, and they had invested a large amount in the Company, but I do not know whether they intended to use their own funds to complete the project. I and my associates contemplated the use of our own funds only for the purchase of stock, and intended to secure the bal-

2177 ance of the money necessary to construct the system by the sale of bonds. We expended in the neighborhood of $300,000 for stock. I did not agree with the plan that was proposed for the financing of this system when I entered the Company, and did not want to proceed with it. $400,000 of bonds had been authorized at that time, and I believe they contemplated an additional issue, refunding those already issued. I think they were considering the issue of $3,000,000 of bonds in the future. When I became interested in the project, I did not propose to enlarge it by increasing the acreage to the irrigated, and the extent of the system we proposed to construct was not changed from that contemplated by Mr. Hibbard. The additional $2,000,000 which we proposed to issue over the $3,000,000 of bonds proposed to be issued by the former

2178 controlling interests, was to furnish $1,000,000 for the work already done, and to take care of the difference between the par value of the bonds and the amount of cash procured for them.

Redirect examination, by Mr. Delph E. Carpenter:

2178 I lived in Crow Creek Valley during portions of early '90's. Have observed some dry farming that went on in eastern Weld County during '90's and previous. Little towns, Keota, Buckingham, and several other towns along the line of the railroad sprung up and got to be towns of 300 to 400 people, along

about 1890, 1891 and 1892. In 1895 there was nothing there. There were thousand of acres under cultivation in the early '90's that were subsequently abandoned entirely. Buildings and fences and all improvements in inclosures where farming had been attempted were sold to men in the irrigated district and hauled off to other lands along the Platte and some of them over to Greeley. In 1900 that entire country was back to cattle and sheep again. There were no dry farmers left. There were no buildings left in these towns outside of the section houses. There was school house at Buckingham which later burned down.

2179 Present generation of dry farmers is attempting deep cultivation somewhat. They are attempting to farm the same and even more extensive areas without the use of water than they were in the early '90's.

Market for the Greeley-Poudre bonds had depreciated for the reasons I have given, prior to the default of any other districts.

Recross-examination by Mr. N. E. Corthell:

2179 The present method of dry farming has arisen within the past ten years.

2180 A. A. EDWARDS, a witness for defendant.

Direct examination by Mr. Fred Farrar:

A. A. Edwards, Fort Collins, Colorado. Age 62 years. First came to Colorado in September, 1869, from Pennsylvania. When came here in 1869 remained about ten months and returned to Penn. July 1870. Fort Collins was my residence between 1869 and 1870. Again returned to Colorado in August, 1876. Located at Fort Collins. That has been my home since August, 1876.

Since August, 1878, first worked on farms and ranches and then in railroad office at Fort Collins about three years. Worked in flouring mill business about one year. Elected county treasurer and occupied that position 5 years. That was from 1886

2181 to 1890 inclusive. After that was in abstract business and still have interest in company, but in 1891 became interested in irrigation business. Was secretary and member of board of directors of The Water Supply & Storage Company, organized in 1891. Filled office of secretary 3 years and was then elected president and manager of company and held that position until January, 1910. Elected president of company in 1895 and held that position until 1910. As secretary of company from 1891 to 1895 had charge of books of company and was also treasurer. Was also member of board of directors during that time. These positions brought me in touch with administration of affairs of company. In July, 1910, I took position of manager of The Laramie-Poudre Reservoirs & Irrigation Company and occupied that position until September, 1911. Early in 1912 was elected secretary and manager of The Mountain Supply Ditch Company and still occupy that position. During that time The Mountain Supply Company and the North

Poudre Irrigation Company consolidated, so now the latter company is the owner and operates the system that I had charge of.

Have done some inspection work for the United States
2182 Reclamation Service. This work consisted of inspection of construction work and operation features on four projects of the service. My work required reports and recommendations. Inspected and reported on Belle Fourche Project in April, 1913, Sun River, Milk River, and Huntley project in June and July, 1913. Belle Fourche Project is in South Dakota. Other three are in Montana. I reported on quality and character of construction in different structures and on operation and relation of management towards settlers under project. Reported on feasibility of proceeding with construction work which had been suspended by the Reclamation Service on Sun River Project. Original estimate of that project was $10,000,000.00 and they had expended ten per cent of that and question was as to going ahead and expending ninety per cent and completing project. I reported recommending that they go ahead and they have since let contract for construction of the main system.

Have been member of board of directors of The Poudre Valley
Reservoir Company from 1910 to present time. This project,
2183 the Mountain Supply Ditch Company and the North Poudre Irrigation Company as well as the Water Supply and Storage Company are all located in the Cache la Poudre Valley in northern Colorado. They all serve lands in the Poudre Valley.

Have been on State Board of Agriculture since 1905 and am president of board. Been president 5 years. This board has charge of State Agricultural College and Colorado Experiment Station. Experiment Station is part of Government Experiment Station. That is, it receives money from Government for experimental work under Hatch and Adams Acts of Congress. Station also has charge of expenditures of state appropriations for experimental work. Work of station is not limited to immediate vicinity of College.
2184 It extends over every part of Colorado more or less. In general work of Station is in prosecuting experimental and research work in all different lines of agriculture, live stock and other similar branches.

We are carrying on co-operation work with the Bureau at Washington on Irrigation Investigations. Have erected irrigation laboratories at College during last year and are conducting experiments in connection with the Bureau of Irrigation Investigations at Washington. The work in laboratories consists principally of experiments in measuring water.

I am also commissioner of finance for City of Fort Collins.

In coming to Fort Collins in 1869, came on Union Pacific Railroad to Cheyenne from Omaha, and from there to Fort Collins traveled overland. There was no railroad across or in Poudre Valley at that time. In fall of 1869 Denver Pacific Railroad was constructed across valley to Greeley. It was built from Cheyenne south towards Denver. It reached Denver in spring of 1870. This
2185 road now constitutes a part of Union Pacific Railroad It was first railroad constructed in northern Colorado. It crosses

Poudre Valley in Weld County from northwest to southeast and runs southwest along Platte into Denver. Line of road is at right angles to trend of Poudre River.

From September, 1869, to July, 1870, I traveled through the Poudre Valley from Laporte to the South Platte River. Laporte is situate at point where Cache la Poudre emerges from mountains, about 4½ miles northwest of Fort Collins. In 1869 Laporte had population of about 200 people. Fort Collins was not then incorporated. It was about size of Laporte. Troops had left Fort Collins two years previous.

2186 Towns of Windsor, Eaton, Ault and many of these other small places were not then in existence. Greeley was not in existence when I first came.

In 1869 Poudre Valley was almost all of raw prairie lands. There was some farming close to streams on first bottom, small farms raising grain, oats and vegetables, stuff that was marketed in mining camps in mountains. Principal crop then raised was native hay. This was limited to Poudre Valley bottom. There were then small ditches close to river. Irrigated area at that time consisted of strip of land on each side of stream. There were ranches scattered along stream from mountains to mouth of stream. Mouth of Poudre River is about 4 miles east of City of Greeley. Strip of land cultivated in 1869 would vary from one-fourth to one mile in width.

In 1869 would say about 4,000 to 5,000 acres were under irrigation. That is a mere estimate made from recollection.

2187 On each side of this narrow strip thus irrigated the lands of the valley were prairie grazing and unfenced lands. Native prairie only.

August, 1876, returned to Poudre Valley. Came over Kansas Pacific Railroad to Denver and drove across country from there to Fort Collins. Denver Pacific Railroad was then in operation between Denver and Cheyenne. Nearest railroad station to City of Fort Collins was Greeley. Greeley is 25 miles distant from Fort Collins in straight line. No railroad in Fort Collins in 1876. In 1876 Greeley was organized and had population of 1000 to 1200 people. Greeley was in connection with colony recommended by Horace Greeley and organized by N. C. Meeker. In 1876 Fort Collins was about the same size as Greeley. There had

2188 been considerable development in Poudre Valley between 1870 and 1876. Number of larger ditches had been constructed extending out to bench land on either side of the valley. Canal of Union Colony of Colorado at Greeley had been constructed and up near Fort Collins two or three larger ditches had been constructed on south side of valley. At Greeley two canals, known as Union Colony No. 2 and Union Colony No. 3 had been taken out, one on north side and one on south side of valley. The agricultural area had extended out from river bottoms. In 1876 area of land irrigated or susceptible of irrigation from ditches then constructed would be about 40,000 acres. Growth of towns in valley had been consistent with enlargement of irrigated area. From

1876 to present time had had occasion to follow agricultural conditions and development in Poudre Valley. Fort Collins has been my home continuously. While I have been interested in
2189 the abstract of title business, have had no active part in management. Since July, 1891, my personal attention has been given almost exclusively to irrigation and kindred matters.

Since 1876 there has been continual development in Poudre Valley. New irrigation systems have been constructed and land irrigated has grown steadily larger.

First railroad built into Fort Collins in 1877. Colorado Central Railroad. Road constructed from Golden, Colorado, up through towns of Boulder, Longmont, Loveland, Fort Collins and on to Cheyenne. That portion of road from Fort Collins to Cheyenne was abandoned in 1883. The Colorado and Southern Railroad has recently constructed a line from Fort Collins and to Cheyenne.
2190 In the 80's there was railroad constructed running up and down Poudre Valley from Fort Collins to Greeley. Towns of Timnath and Windsor and other smaller stations are located on this line. The railroad now running from Greeley to Fort Collins, from Fort Collins to Cheyenne, and from Fort Collins to Denver, all belong to and constitute a part of the Colorado and Southern Railroad System. This is a railroad system extending northerly and southerly from the Gulf of Mexico with contemplated connection with Seattle.

Lands of Poudre Valley are now in high state of cultivation where irrigated. There are from 275,000 to 300,000 acres of land under cultivation and watered from different irrigation systems in valley. My work has given me wide experience in matters pertaining to agriculture. Present development of Poudre Valley compares favorably with that of every other section of irrigated country in west. I think it excels anything that I have seen, with perhaps the exception of Salt River Valley in Arizona. The country around Billings, Montana, I think was very similar and perhaps equally productive with section in northern Colorado. Factors which have gone to make Poudre Valley successful agri-
2191 culturally are soil, water supply and climate. Development would have been impossible without irrigation. Without irrigation these lands would be fit only for grazing.

Towns and cities in Poudre Valley are modern towns with modern homes, water systems and electric lighting systems and every convenience of modern towns. These municipalities are dependent almost altogether on the farming communities surrounding them. The larger towns and cities of the valley are: Fort Collins, Greeley, Windsor, Eaton, Ault, Severance, Lucerne, Timnath, and a number of smaller places. I have not attempted to give complete list of smaller places. In 1910 census Fort Collins had population of 8,210. Greeley had population of 8,179. Eaton had population of about 2,000 and Windsor about same. Ault had population of about 1200 and Severance about 300. Greeley and Fort Collins are modern,
2192 up-to-date towns. They have street car systems in each town. Agricultural College of Colorado is located at Fort Collins

and State Teachers' College of Colorado at Greeley, with very large attendance at both institutions. There is large beet sugar factory at each of cities of Fort Collins, Greeley, Eaton and Windsor. These factories are for manufacture of sugar from beets grown in valley. Cities of Fort Collins and Greeley obtain their domestic water supply from Cache la Poudre River. Water is diverted from river at base of mountains west of Fort Collins and carried to each city through pine lines by gravity system. Each city owns its own municipal water plant. Diversion point of Fort Collins water-works is about 15 miles from city. Foothills of mountains are about 5 miles from Fort Collins. Fort Collins water system cost about $300,000.00. Diversion point of city of Greeley municipal water system is about 10 miles northwest of Fort Collins. Pipe line from diversion point to city of Greeley is about 35 miles. Town of Windsor also receives water from the Greeley system.

2193 Principal crops raised in Poudre Valley are: alfalfa, wheat, oats, barley, potatoes and sugar beets. The land lying north of river and in Weld County is particularly adapted to raising potatoes. Section lies from Greeley to beyond Ault.

Am acquainted with lands that form Greeley-Poudre Irrigation District. The area of the Poudre Valley now devoted to the cultivation of potatoes lies immediately south and adjacent to the Greeley-Poudre Irrigation District. The potato industry is developed to a very large extent in this community. A large acreage is devoted to the industry and a large yield of first class potatoes obtained. The product is famous throughout the country as the Greeley Potato. Owing to a blight, the potato crop in this section of the country has not been a success during the past two seasons. During the year 1913 crop was practically back to about former standard. This blight which affected this area was wide spread. It was so serious in all potato districts that the experiment stations

2194 throughout the country and the government itself made extensive investigations.

Normal yield of potatoes in Greeley District is from 125 to 300 sacks per acre. I would say average yield was about 200 sacks per acre. Sack holds about 2 bushels, 118 to 120 pounds to a sack.

Alfalfa crop yields from 3 to 5 tons per acre. Three cuttings are obtained. Alfalfa is basic crop of community in my opinion. Wheat is pretty extensive crop, yielding from 30 to 50 bushels per acre.

Oats produce from 50 to 90 bushels per acre, would say average about 65 bushels.

Sugar beets produce from 17 to 20 tons per acre. Would say about 35,000 to 40,000 acres are devoted to this crop in valley. These beets are sold to sugar factories of the Great Western Sugar Company. Price obtained for sugar beets was $5.50 per ton for all running as much as 15 per cent sugar. Additional 50 cents per ton was paid for every one per cent sugar above 15 per cent.

2195 Rate is obtained on sliding scale, based on percentage of sugar content. Average price I think is about $6.00 per ton. In order to give idea of magnitude of enterprise, will state that Fort Collins factory was originally constructed for 1200 tons

of beets every 24 hours, but they slice and work up about 2200 tons every 24 hours now.

There are great many vegetables of all kinds cultivated in valley. There have been crops of cabbage this year with large returns. These cabbages are raised generally for shipment to markets in Texas, Oklahoma, and other southern countries. Would not be able to give average yield. Know of one yield of 20 tons per acre. Mr. Hice had 30 tons per acre. Am unable to give market price obtained.

2196 Onions are extensively raised. It is valuable crop and raised for export to southern points. Delta country from Greeley down as far as junction of Poudre with Platte is perhaps largest onion raising section. Then again in neighborhood of Laporte, a great many onions and cabbages are raised. Laporte is close to foothills west of Fort Collins.

Fruit is extensively grown. More in upper end of valley near foothills than near Greeley further east. Apples and cherries are principal fruits. In southern end of valley canteloupe and melons are quite extensive with large yields. Fruit culture is quite successful in Poudre Valley. Largest apple orchard we have is the McClalland Orchard near Fort Collins. He realized some $7,000.00 out of his crop this year already. Largest cherry orchard is the Mogg Orchard, 2 miles north of Fort Collins. He has sold $8,000.00 worth of cherries and apples. He has apple orchard in connection with cherry orchard. The McClelland orchard is 5 miles

2197 south of Fort Collins and contains about 250 acres. Mogg's cherry orchard occupies only small area of about 40 acres. These orchards are typical of general yield of apples and cherries in that vicinity. I remember them because they are two of the largest.

Wheat raised in Poudre Valley is practically all ground and used at mills at Fort Collins, Greeley, Windsor, Eaton and Severance. A number of other towns have elevators. Poudre Valley exports cereals and cereal products.

Practically all of products raised in Poudre Valley are exported. Sugar beets are exported in form of sugar. Alfalfa industry affords large amount of hay and every winter season large numbers of lambs are fed and fattened for eastern markets. About 300,000 lambs are fed and fattened each winter *de*sides a large number of beef cattle. The lambs are raised in southern Colorado and northern New Mexico, and a great many in Wyoming; southern Wyoming along the line of the Union Pacific Railroad up to the western border. Lambs are obtained from Laramie Plains. These lambs are brought in for feeding purposes during fall of each year. They are

2198 shipped from Poudre Valley to Omaha, St. Joseph and Kansas City more than at any other points. Also to Chicago and quite a number of them are marketable in Denver. They go directly from feed lots to packing companies.

Lambs are fed on beet pulp and alfalfa hay and finished on corn and ground barley. Corn used in fattening is imported into state

from other sections. Beet pulp is the pulp left after sugar beets have been sliced and sugar extracted.

Cattle fattened in Poudre Valley are largely raised in neighborhood. A good many are raised in mountain districts and many on farms in valley and large numbers are shipped in from outside parts. Those produced in Poudre Valley are either raised in mountains or on plains or such as farmer is able to raise in connection with agricultural work.

The farming section is not a live stock country in the sense of production. The farms are too valuable to afford any part of them to be used for pasture.

In early days when I first came here, practically all of that land now devoted to farming was devoted to the raising of live stock. Live stock production has given way to farming because farming is a better paying business. It pays better to raise alfalfa for feeders than it does to grow stock on the land.

2199 Beet tops furnish a great deal of food for lambs and cattle during fall and winter season. The tops are left on the ground at harvest. After the beets are taken from the field, stock is turned in on tops and they are very beneficial. The top is cut off just as soon as the beet is taken from the ground.

Sugar beets produced within one or two miles of factories are delivered directly to factories. Most of beets are hauled to beet dumps on railroad and there loaded on cars and from there shipped to factory. Facilities for transportation of beets are very good. The Colorado & Southern Railroad, the Union Pacific Railroad, what we call the Sugar Road, with many beet dumps along the lines, where the roads gather the beets. The Sugar Road runs from southern part of Larimer County northeasterly through town of Windsor and through Severance over to Eaton. As matter of fact, valley is completely threaded with railroad lines or spurs which are placed there for transportation of farm products. The price paid for sugar beets which I just gave is that paid for beets in the condition of delivery over the beet dumps by farmer. Beets are

2200 transported from loading stations to factory at expense of company. The beet dumps are merely chutes permitting unloading of wagon by mechanical means.

Beet tops sell from $3 per acre up. I know of farmers who prefer to feed the beet tops to their own stock rather than to take $7 or $8 per acre for them. Mr. Cuthbertson and Mr. Bransom, two of our farmers, told me they could make $15 per acre off of tops by feeding them to their own cattle. It is practice in Poudre Valley to feed forage crops upons premises insofar as possible. Advantage is obtaining fertilizer in form of manure.

Alfalfa is basic crop of Poudre Valley because of fertilizing properties. It is usually sown with some other crop, oats or some like grain, though quite often they sow the seed by itself. After 5 to 7 years the alfalfa is plowed under and followed with a crop of wheat or sugar beets. Also potatoes. Alfalfa is a great fertilizing crop.

It keeps the land up. They adopt a system of rotation of
2201 crops with alfalfa as the basis. It is a nitrogenous crop. It adds to the lands substances which other crops take away. It is a perennial. In some countries it is known as lucern.

There is uniformity of value of agricultural lands where water conditions are similar, in Poudre Valley. Farm lands under reasonably good irrigation ditches and systems will have an average value of from $100 up to $250 or $300 per acre. Some of smaller, more highly cultivated and improved tracts bring as high as $300 per acre. Orchard land brings a much higher price. The values which I have given apply to agricultural rather than to horticultural lands.

Am familiar with lands lying under and irrigated by Larimer County Canal belonging to the Water Supply & Storage Company of which I was president. Values range from $100 up to $300 per acre under that canal. Head of canal is about 9 miles northwest of Fort Collins. The terminus of canal proper is at Union Pacific Railroad in Weld County, 2 miles from Ault. Water is car-
2202 ried 15 miles further, by extensions of the canal. Following meanders of canal it is about 85 miles long. The Larimer County ditch is about 71 miles long and extensions are probably 15 miles. Lower end of canal and extensions lie just south of Greeley-Poudre Irrigation District lands. The extension known as Owl Creek Lateral enters southern boundary of the Greeley-Poudre District. The Pierce Lateral from the Larimer County Ditch is a part of the Greeley-Poudre system, but the Larimer County Ditch and its water rights does not form a part of the district system.

Larimer County Ditch was built in 1881. Lower end was con-
2203 structed as late as 1885 or '6. It was built by Larimer County Ditch Company. In 1891 the Water Supply and Storage Company succeeded to property and franchises of the Larimer County Ditch Company. Water rights under original Larimer County Ditch Company were represented by contracts. They sold 600 water rights with one right for each 80 acre tract. Canal system was designed to furnish 600 eighty acre tracts with water. When The Water Supply & Storage Company was organized the water rights of the Larimer County Ditch Company were exchanged for shares of the new company, one 80 acre water right being exchanged for one share of the new stock, the par value of which was figured $100. The new company is a mutual company of farmers and they manage affairs of company by electing board of directors each year and making assessments on the stock.

Mutual irrigation companies, incorporated under laws of State
2204 of Colorado, have their capital stock so arranged that the stock represents the title to the water rights of the farmer. Practically all the companies or associations owning the various ditch and reservoir systems in Poudre Valley are such mutual companies.

Larimer County Canal has carrying capacity of about 600 cubic feet of water per second of time. Source of supply is Cache la

Poudre River and from ditches that divert water from Laramie, Grand and Michigan Rivers.

Diversion of water from Laramie, Grand and Michigan Rivers of Larimer County Canal are diversions from streams from other watersheds. The first diversion from another water shed was from small tributary of Grand River. Next a diversion occurred from a tributary of Michigan River. Last the Sky Line or Laramie River Ditch was constructed. Later the main Grand River ditch was constructed. The later or main Grand River Ditch absorbed the first or smaller one from that source. In other words this canal system has three interwatershed ditches. Grand River Ditch diverts water from watershed of Pacific Ocean drainage. Grand River is tributary of Colorado River which discharges into Gulf of California.

2205 Michigan River is tributary of North Platte, rises in North Park, Jackson County, Colo. Laramie River is tributary of North Platte river also.

These three inter-watershed diversion ditches were constructed because of fact that main decree of The Water Supply & Storage Company was one of last decrees granted on Cache la Poudre River. Water derived from Cache la Poudre River was insufficient to supply stockholders with water for crops and company went into higher altitudes and diverted this water from other watersheds to supplement supply that was obtained from Cache la Poudre. The three inter-watershed ditches discharge their water into tributaries of Cache la Poudre River some 60 or 70 miles upstream. It is then conducted down the stream to headgate of Larimer County Ditch. The Poudre River is utilized as a carrier of water from place of discharge in the mountains to the head of main canal. In effect, the stream is made a part of the irrigation system for carriage of this foreign water.

Sky Line Ditch from Laramie River was commenced in 1891 and finished in fall of 1893. Was secretary of company at that time and member of board of directors. Ditch is about 5 miles long.

2206 Took about three years to construct it. That length of time was required to construct this 5 mile ditch for reason ditch is located at elevation of 9,300 and 9,500 feet above sea level and along steep mountain side through very rough country. Large part of country through which it flows, is timbered and very rocky, loose and solid rock and mountain side is very steep so that it was very difficult to keep material in place to form lower bank. Materials excavated tended to roll down hill instead of forming bank of ditch and had to be retained by log cribs below the ditch for large part of distance. One tunnel was constructed. The country was very hard to get into and very inaccessible because of steep mountains and lack of good roads. Another reason for time and expense of completing was that work had to be done between July 1, and November 1 of each year. Season is so short there. Snow and ice in spring prevents getting in there before July 1 and storms start early in fall and we could not keep men and teams in there after that very well. Our engineer, John Nelson, attempted to get into that region early in spring with force of men and in so doing

overdid himself and died. Cause of death was over-exertion and effort to get in there through deep snow.

Compelled to haul supplies from Fort Collins by teams. Distance 80 miles, nearly all the way through mountains.

Sky Line Ditch taps tributaries of Laramie River, principally West Fork. Headgate of ditch is about 3 miles below head-
2207 waters of that branch. Stream bed of West Fork of Laramie at point of diversion is about 10 or 12 feet wide on bottom. I refer to natural channel. When flow is normal in this branch of the river, a man could jump across the stream.

During flood time when stream is swollen it might be difficult to get across in that way. The Sky Line Ditch also intercepts a number of small tributaries of Laramie River between point of diversion and Chambers Lake. One-half Creek, Three-Quarter Creek, and Two and one-half Creek are the tributaries thus inter-
2208 cepted. These streams flow during early part of season but by August 1 there is very little water running in them. Most of them quit running at that time. In language familiarly used in east these streams would be called brooks or runs. They are small streams coming down from snow banks above. They are intercepted by line of canal.

We had trouble with slides on line of Sky Line Canal. Banks would slide both above and below canal. In one place the slide was of dry material and in another place of wet earth and vegetable matter. In order to hold these slides we built log cribs along upper side of ditch as retainers.

$70,000 were expended in first three years in construction of Sky Line Ditch. This included engineering, construction and every expense connected with it.

2209 Cost of maintenance has been very heavy.

Carrying capacity Sky Line Ditch at lower end, the large end of ditch where it empties into Chambers Lake, is 130 cubic feet per second. That is what rating table shows capacity to be at high water mark. Former ratings were different. Earlier ratings showed larger flow than present or subsequent ratings. State engineer had ditch rated along with other ditches up there by a deputy and last rating gave amount of flow different than that formerly obtained. It seems that early ratings had been incorrect. I was always satisfied with early records. I was satisfied with them because we were allowed to take the same amount of water shown by the ratings down at the headgate on the main Poudre River, being satisfied with it I never called for a rating until State Engineer called for it. It is rather deceiving up there, anyone not acquainted with conditions could not tell what amount of water there was in the canal, not so well as he could in plains ditch. State Engineer who fixed rating lower than former amount was Prof. L. G. Carpenter. First
2210 rating was taken on new ditch just finished and of course after use for several years conditions changed. Ditch really should be rated each year and sometimes more than once a year in order to be exact, as conditions change. The velocity must have been slower than when we first measured it. This rating is at lower

end of ditch. It shows the net amount of water received into Chambers Lake. Of course all that was lost by seepage from canal was lost to us and went back down Laramie River. Character of country through which ditch is constructed tends towards heavy seepage. It seeps quite a good deal all along the line.

We kept ditch open during the winter through two seasons or attempted to keep it open by keeping a couple of men there to watch it and keep it open. We tried to keep it open by placing checks in places in canal so that ice would freeze over and water would run underneath but we found it impossible with small amount of water there to keep it from filling with solid ice. It would fill with ice and run over banks. We gave up trying to run water through the canal in winter season.

Sky Line Ditch usually open for running of water between May 10 and July 1, and runs then to about Thanksgiving time or the middle of November. Sometimes until December 1, depend-
2211 ing upon season. Every spring it is full of snow and ice and men are sent in, usually 12 or 15, and they trench through, cutting narrow trench through ditch from one stream to next. They start water through trench and it makes its way pretty quickly cutting ice and snow out. Work of clearing is commenced at lower end. Trench does not have to be constructed all the way. Lower end of ditch is more easily kept clean because Two and a Half Mile Creek flows warm water from springs and it is easier to keep the ditch from there down open. This flow of warm water is not over 1 cubic foot per second. Just small stream of water there. Usually makes its way through, keeps running along through ice and snow. These creeks take their name from distance from lower end of ditch. Three-quarter Creek is ¾ of mile of lower end of canal. At head of diversion works there is all earth diversion dam, wooden headgate and waste gate where water can be turned back into stream, or be carried down the ditch as owners may desire. Headgate leading to ditch is closed during winter.

2212 During some winters we allowed water to run in ditch to sand gate below it. Sand gate intended to pull out sand. Later it was found impracticable to allow water to enter ditch at all during winter time. During time water was turned into ditch to sand gate it returned to Laramie River after passing through the sand gate. During winter water runs down natural course into Laramie River and thence into Wyoming. During time ditch is open are not able to divert all water from west branch of Laramie River. In month of July there is excess. Am not able to give maximum carrying capacity of ditch at upper end, but with 130 cubic feet maximum capacity at lower end, I should say there would be somewhere about 30 cubic feet at times coming in from lower tributaries, and that capacity of upper end would not be far from 100 cubic feet per second.

Sky Line Ditch discharges water into Chambers Lake. It was originally a natural lake and upper end of Cache la Poudre River. There has been dam constructed at lower end of this lake or outlet and water impounded there in excess of its natural storage capacity.

It is now used as a reservoir by the Water Supply & Storage Company. It was constructed as reservoir in 1882. Used to
2213 supplement supply for Larimer County Ditch. Waters from river for Larimer County Ditch were not sufficient without storage. The decree from Poudre River was very late and river did not afford water supply to the extent of the decree each season, and there was water shortage so that in order to supply consumers, more water was necessary and the reservoir and these mountain ditches were constructed to afford adequate supply of water for these 48,000 acres on the plains under the system.

Chambers Lake is about 70 miles from Fort Collins by wagon road. Larimer County Ditch was awarded decree for 463 cubic feet of water per second of time from the Cache la Poudre as of date April 25, 1881, and also appropriation from Chambers Lake Reservoir as of date July 12, 1882. My recollection is that construction was going on at lake about the same time *there* were constructing ditch on plains, during 1881-3. 463 cubic feet per second does not represent capacity of ditch. It represented capacity at
2214 that time but ditch was later enlarged. The Poudre River decree has nothing to do with water returned by system from Grand, Michigan and Laramie Rivers. Larimer County Ditch Company also constructed reservoirs numbered 1, 2, 3, 4 and 5, located just north of Fort Collins. They also constructed two reservoirs in mountains near Chambers Lake known as Lost Lake and Laramie Lake. They are small reservoirs. Lost Lake it about ¼ mile east of Chambers Lake and Laramie Lake is northeast of Lost Lake about ½ mile. They were lakes originally caused by beavers but which were later utilized by the company as reservoirs.

These three inter-watershed ditches and these mountain reservoirs were constructed to obtain supply of water sufficient to afford irrigation to lands lying under Larimer County Ditch. Necessity for water for irrigation caused construction of these ditches and reservoirs.

Direct examination cont'd.

By Mr. Fred Farrar:

2216 Water diverted by the three inter-watershed ditches from the Grand, Michigan and Laramie Rivers has a special economical advantage. It is diverted from Poudre River above nearly all land under cultivation, and exchanges of water can be made on that fund of water with other systems, so that more land can be served and more crops irrigated. This exchange system is practiced to quite an extent in Poudre Valley. Mountain water can be delivered by water commissioner into ditches on south side of Poudre and served by North Poudre Irrigation System and system of Water Supply & Storage Company in exchange for mountain water, receives water from reservoirs belonging to The North Poudre Company Ditch, below line of North Poudre Ditch. Irrigation system of North Poudre Company lies on north side of river and generally

to north of Fort Collins. Its chief supply of water is taken
2217 from North Poudre. They have some stockholders who are not directly under their ditches but on south side of river.

Plan is to give stockholders of North Poudre Company located on south side of the river, water from inter-mountain ditches belonging to Water Supply & Storage Company, and then in turn North Poudre Company gives Water Supply & Storage Company reciprocal amount of water into their ditches from some of its reservoirs lying down in country some 20 miles below intake of Larimer County Ditch It is general practice. Larimer and Weld System takes water from reservoirs of Water Supply & Storage Company and in turn reservoirs under Weld System furnish water to Greeley No. 2 system and there is a general exchange of water among all the large systems in the valley. Practice of exchange permits these later ditches to take water directly from the river, which otherwise would be used by prior appropriators lower down the river and to compensate the prior appropriators by turning into the river or ditches an equivalent amount of water from the reservoirs. This system of ex-
2218 change tends to increase area of irrigated lands in valley. It tends to economical use of water from stream. If it were not for this practice, upper ditches and reservoirs would not be as effective as at present for irrigation of lands. Some of them would not have been constructed if this had not been possible. This exchange is recognized and approved by law of Colorado.

From January 1895 to January1910, while president of The Water Supply & Storage Company, was also manager of system, had charge of distribution through main canal and from reservoirs and also had charge of maintenance and operation of the ditches in mountains from Grand, Michigan and Laramie Rivers and had general supervision over all affairs of company.

45,000 to 50,000 acres of land are irrigated by Larimer County Canal of Water Supply & Storage County. Lands under this canal are typical of general development and condition of lands in Poudre Valley. There are 600 shares, going to make up what is
2219 commonly known as 600 rights, each right being designed to serve 80 acres of land. These rights or shares are worth $3500 per share. That is their value subject to bonded indebtedness of about $300,000 on whole system. It also has floating indebtedness of about $100,000, making a total indebtedness of $400,000. The bonded indebtedness of company itself is distributed over entire acreage and would amount to about $9 per acre. Each share of company would, accordingly, be worth approximately $4220.00. About $52.75 per acre.

While president I found it necessary to be thoroughly advised on rights of our company and also rights of all other companies in valley. The dates of appropriations and amounts of water decreed to each system and found it necessary to be vigilant and watchful as to rights of our company in obtaining all water to which company was entitled on its decrees. It was question of eternal watchfulness. I found it necessary to be watchful at all times in interests of com-

pany. Necessities for water in Cache la Poudre Valley are so great that each appropriator is constantly on the lookout for advantage to be gained or for additional supply. Irrigated area in valley consumes all available water from Poudre watershed and also what is brought over from other watersheds. Lying to east of and beyond present irrigated area is vast body of as good land as is now under cultivation in valley, still demanding water for irrigation.

2220 With economical use, I think there is sufficient water now obtained from Poudre River and foreign watersheds to irrigate all lands now served. I include in that the proposed diversion from Laramie River. Mountain Supply Ditch System and North Poudre System have been recently consolidated and are now under one management. I believe there is sufficient water owned by the consolidated company to irrigate the land under the system. The two systems served in general, lands which are located in the same area. The lands lie together, and are intermingled. Before consolidation lands supplied by Mountain Supply Company were

2221 only fairly irrigated. They did not always have sufficient water for early irrigation of alfalfa. Consolidation affords a supply of water at all seasons when needed from main system of North Poudre Company. It facilitates more economical use and distribution. It is an advantage to both systems. Lands formerly irrigated by the Mountain Supply System get a better, early supply and North Poudre lands get better late supply than they formerly did.

Throughout Poudre Valley greatest economic benefit is obtained from available water supply. Methods are improving every year and experience of irrigators teaches them. Economy is increasing in use of water in valley and water serves an increased area from year to year as compared with what it formerly did. The duty of water in the valley is increasing. There is less waste of water and

2222 more intelligent application to crops. By duty of water I mean the amount of land which a given quantity of water irrigates. When I say duty is increasing I mean that given quantity of water is irrigating an increased amount of land. General experience of irrigators in Poudre Valley is that duty of water does increas and has increased from earlier days. That is true of land irrigated from system of Water Supply & Storage Company.

Duty of water under Larimer County Ditch of Water Supply & Storage Company is about one acre foot per acre during season on diversified crops that are commonly raised under that ditch. My figuring is from amount which is delivered at lateral headgate to consumers.

Main distributing canal of Water Supply & Storage Company is 71 miles long and has capacity of 600 cubic feet per second at upper end. This water is diverted from river and carried through main canal and delivered at headgates of small canals all along the line throughout the ditch. These lateral headgates discharge water into small laterals or ditches that carry the water down to each farm unit. The water is measured over weir and delivered

2223 into lateral by management of company. After water is measured and delivered into laterals, water users take care

of it from then on to farms. In event more than one farmer takes water through lateral, the company does not assume to divide water in the lateral among consumers. The farmers divide the water among themselves.

Main canal is divided into four divisions. Four ditch riders attend to the distribution. Each ditch rider has from 17 to 20 miles of canal to superintend. Ditch rider is furnished with list of stockholders entitled to water and advised every morning of number of inches per share to be delivered. He regulates headgates to discharge water into laterals in accordance with this information and keeps record of deliveries. Information and permission to take water from stream is obtained from water commissioner of district, who supervises distribution of water of river to several ditches in order of priority. As superintendent of ditch I had to be governed by action of water commissioner as to amount of water obtained under decrees and franchises owned by company.

Cache la Poudre Valley constitutes one water district. Over
2224 this district there is one water commissioner. He is allowed as many deputies as may be necessary, depending upon circumstances. Duties of water commissioner of that district are performed thoroughly and actually. He is in direct charge. His whole time is employed in looking after distribution of water, especially through the irrigating season. Water commissioner of our district is on duty from four o'clock in morning until ten and eleven o'clock at night a large part of irrigation season. This complete supervision and control of water of river has been practiced for many years and ever since I had to do with distribution. I know at least since 1890 that has been the case. Water commissioner of Water District No. 3, which comprises the Poudre Valley, does not employ over three deputies. One is stationed up in mountains, where ditches from Laramie, Grand and Michigan are in operation. One other deputy looks after discharge from reservoirs in valley and other on patrolling
the stream regulating main headgates of canals. Deputies
2225 supervising discharge of reservoirs regulate exchange of water from river. Deputies have telephone connection with commissioner and of course each deputy is supplied with automobile or horse and cart for travelling about.

In early history we had telephone lines connecting with water commissioners and with headgates of larger headgates on river. Shortly after I took management of our company, we installed telephone line of our own. We built about 40 miles of line, connecting up along line of main canal so we could keep in touch with ditch riders and employees of company. That was followed by other systems using telephone lines, but after number of years The Bell Telephone Company took over all lines and now they are part of the Mountain States Telephone Company's system and all connections are over the lines of that company. Almost every farmer and water user through the valley has a phone in his house and in connection with all water officials and managers of different systems throughout valley.

State Engineer's office takes measurements and keeps record of

flow of Cache la Poudre River. In 1885 through cooperation
2226 of a number of ditch companies, a measuring weir was constructed on main river at point w-ere river emerges from mountains. Weir was rated and record kept of discharge there. Automatic register was put in so the record day and night and flow of the stream was preserved. This was put in to facilitate greater and better distribution of water to various ditches.

Amount of water which canal may take from river is determined by water commissioner. Headgates are regulated, as a rule, by headgate man of company under orders received from water commissioner. As conditions demand, we receive orders from water commissioner or one of his deputies as to regulation of headgates leading from river. Changes are made every day. Sometimes when river is fluctuating, adjustment of headgates are made several times a day. As changes of headgates are made fact is communicated to superintendent of ditch and by him to various ditch riders
2227 I have mentioned. Ditch riders in turn regulate lateral headgates leading to consumers. There is complete system running from water officials down to individual consumers.

Water commissioner is under orders from division engineer. There are 5 division engineers in state. Each division comprises all water districts lying in one general water shed. Division engineers are under State Engineer of Colorado. There are a number of water districts in each water division. It is duty of division engineer to regulate distribution of water between districts. This is done in manner similar to distribution between various ditches by water commissioner in his district. State Engineer, division engineers, and water commissioners and deputies have jurisdiction over questions of economic use of water and preventing waste. Statute prohibits waste and it is duty of officers to enforce the statute.

2228 Water commissioner and deputies make practice of preventing waste in Water District No. 3, constituting Poudre Valley. Necessity for water in that valley demands most economic distribution and use.

2228 Am familiar with headgates and diversion systems of various ditches taking water from Poudre River. They all have headgates. Each has diversion dam leading into main headgate of canal. These structures were formerly of wood, but of late years nearly all of them are of concrete. Headgates are substantial structures built of concrete and steel with sufficient capacity of intake to fill ditch to maximum depth when required. This is general rule but does not apply to all ditches. Water is measured below headgates some distance. Rating weir is used. Weir is not really part of headgate. All ditches are equipped with measuring weirs. This is absolutely required.

Have been on Laramie Plains. First time in 1877. Was there six weeks or two months. Was at Laramie City and over on Little Laramie River for a time. From there went over on Big
2229 Laramie near Sheep Mountain. That is at upper end of Laramie Plains. Had occasion to observe development of

region at that time. Passed through south end of plains in 1887, on trip to North Park. At later time made more extensive trip. Have been through on Union Pacific Road a number of times and have driven to Laramie City in automobile and from there followed river into Colorado to tunnel site of Greeley-Poudre District. Went from Laramie City right up to the river. Made that trip in May, 1910, and again in August, 1912.

(Mr. N. E. Corthell, counsel for Wyoming, states into record that Union Pacific Railroad was completed into Laramie City May, 1869, and reached Cheyenne sometime in 1868.)

2230 Know in general way of Pioneer canal heading on Laramie Plains near Sheep Mountain and running in general direction parallel to river down past Laramie. In traveling up river from Laramie City was traveling in general course along line of this canal. Am not familiar with ditch below or northward of Laramie. Only know that portion of it above Laramie. I made no definite investigation of this ditch. I did see country which lies in immediate vicinity.

Mr. F. C. Avery of Fort Collins, Colorado, made location survey of Pioneer Ditch. Am not informed as to date of construction. Assuming date of construction of ditch to be 1879, it was not constructed when I first visited Laramie Plains.

2231 In 1877, Laramie Plains was purely and exclusively stock country. There were great many cattle, sheep and horses there, especially sheep. First bottom lands were meadows used for hay. Don't remember any grain raised at all at that time. On my trip during 1910 and 1912 observed country has some of it been fenced and noticed construction of inlet-ditch into what they call Lake Hattie. Looked like some steam shovel work there from distance. Just after leaving Laramie and crossing river we passed demonstration farm of State University. Saw some crops in some of inclosures, demonstration crops I took it. Traveled up foothills to Woods Landing. Passed along road or lane with buck fences on either side. Buck fences are constructed of poles and posts. Posts are not set in ground. It is something like old fashioned saw horse, somewhat of a truss at each length and poles extending from one of these to the next. Country is more settled than in early date when I was there, more building and ranches along and more hay raised. By hay I mean native hay. I think I saw some alfalfa, that is, it had been sown to alfalfa. I did not notice particularly as to crops. We were traveling in automobile and could not see quite so well as though traveling in wagon. Saw evidences of agriculture.

2232 Development of Laramie Plains region along Pioneer Canal, which is older canal than Larimer County Ditch, has not kept pace with development under Larimer County Canal in Poudre Valley. There is no comparison between two. In 1912 saw several men and teams working on lateral on plains.

Will give my recollection of the impressions I had from general appearance and development of country along Larimer County Canal in Colorado to country along Pioneer Canal in Wyoming.

Country along Laramie River appeared to me to be very little developed there from the time I first saw it in 1877, except that it was fenced up more and more settlement, more ranches, and people living along and a good deal of stock. I saw in the fields quite a considerable amount of hay in stacks. Don't remember seeing any straw stacks, any threshings, or anything of that kind. No vegetable cellars or anything that indicated that they were raising potatoes or anything of that kind, and I don't remember seeing any grain raised. In Poudre Valley nearly every one has granaries and orchards and in the potato districts have potato cellars, corrals, barns and houses. Improvements on Laramie Plains look good as to houses and corrals for caring for stock. They seem to be
2233 pretty well supplied in that way there. I would not think there is any comparison agriculturally between the two sections. Settlements and ranches above Laramie were mostly along road travelled. Over near Pioneer Canal line that seemed like new country still unsettled. Do not know country below Laramie City. It may be possible there is more development below Laramie than above. Am only testifying to those things I observed. Ranches along Laramie River seemed to be of considerable acreage and it appeared as though they depended largely upon stock raising. Ranch houses or habitations were not as numerous as they were along Larimer County Canal in Poudre Valley. Land seemed to be in larger tracts with each plant of buildings. Under Larimer County Canal in Colorado I would say the average farm was about 160 acres. Farms vary in Poudre Valley. Some near La
2234 Porte and near towns of Greeley and Fort Collins are small tracts of from 10 acres up to 20, 30 and 40 acres. Out on benches farms run from 80 to 160 acres, some large. 160 acres would be above average, take ownership all the way through. Average in Poudre Valley would not be over 10 acres taking in all gardens and fruit tracts.

In Poudre Valley where crops such as potatoes, beets, cabbages and onions are raised and areas are devoted to fruit, 40 acres in either beets or potatoes would be sufficient for one family, and where cabbages and garden products are raised, from 10 to 20 acres will support a family. Beets require a good deal of hand labor.
2235 Farmers contract with Mexicans and Russians for hand labor at so much per acre. To care for the crop, plant it, prepare the seed bed, irrigate, cultivate and harvest, beets require about $40 per acre. A farmer owning 80 acre tract, who devotes portion of it to beets, also employs family of Mexicans or Russians who take contract for hand labor and who live on place in addition to inhabitants of farm.

Where cultivation of land is intensive in Poudre Valley, 80 acres will support two families. These beet laborers have large families of healthful children and get through the season without much protection from buildings. One Russian family takes care of not to exceed 40 acres of beets during the season. These families consist of husband, wife and children. They all work in the beet fields. Even the babies are taken into the fields. The climate is mild and outdoor life is preferable all the way through the season. These

Russians are a German speaking people. They are German-Russians, as I understand it. They came from German provinces of Russia. They are very thrifty, saving people who are
2236 accumulating wealth and are buying small farms in the community. They came to the country with the sugar factories. First sugar factory in northern Colorado was constructed in 1901. In passing through district along Laramie County Canal would find very few high tracts of lands not under cultivation. Some ridges or knolls would not be under plow. As matter of fact, all land susceptible of irrigation is under cultivation.

This is not the rule on Laramie Plains. The country there was pretty level and it could all have been cultivated. Cultivation was the exception rather than the rule. As I previously stated, there is very little evidence of crop raising, except native hay.

I became manager of the Laramie-Poudre Reservoirs and Irrigation Company in July, 1910. Succeeded Mr. Wellington Hibbard. He lost his life in automobile accident about 50 miles west of
2237 Fort Collins. Was on his way to Greeley-Poudre Tunnel. It was then in process of construction. East Side Collection Ditch and West Side Collection Ditch were also in process of construction at the time I became manager. They were all located and surveyed and some construction work was going on at that time. At that time they were drilling tunnel from both ends. Was manager of company until September, 1911. During that time construction work on these ditches and tunnel continued. Bore of tunnel was completed in July, 1911. Contract which McIlwee had was completed at that time. Work of lining tunnel was not completed then. It was completed after I had resigned. The District did that afterwards.

2238 Charles R. Hedke was chief engineer of all work on the system up until a month or two before I resigned, and after that Mr. Stimson of Greeley succeeded him. Burgess Coy was engineer in construction of tunnel and collection ditches and of all work on the Laramie River.

All supplies for carrying on construction work on Laramie River and tunnel were shipped from Fort Collins to tunnel. They were hauled in by teams, freighted in. As I remember wagon freight rate for this hauling was $1 per 100 at east portal of tunnel and $1.25 per hundred at west portal, except heavy machinery. That was considerably higher. Some of supplies taken to west portal of tunnel came from Laramie but principally from Fort Collins. Some were shipped up from Denver to Tie Siding, Wyoming, and taken in from there.

Distance from Fort Collins to east portal of tunnel is about 65 miles and to west portal is about 110 miles around by Tie Siding through the Laramie Plains. It is about 50 miles from Tie
2239 Siding to west portal of Greeley-Poudre Tunnel.

We were unable to prosecute work of construction of collection ditches during all season of year on account of high altitude and heavy snow fall. Construction work on tunnel continued during winter season. Obstacles in way of construction work met in con-

struction of Sky Line Ditch compared somewhat with those encountered in construction of Laramie-Poudre System. On latter system east portal was more accessible and at lower altitude than Chambers Lake county and Sky Line Ditch. Upper end of tunnel on headwaters of Laramie is quite similar to conditions on Sky Line Ditch. Ditches such as these cannot be constructed with the same ease and facility as ditches on plains. It is a radically different proposition. It is different in all ways. On plains construction can be largely done by machinery and men are more available and will work for less money. Teams cost less. Feed costs less. And expense of transportation of powder and all sorts of tools, implements and supplies is in every way more advantageous and economical on plains construction than in mountains. By economical I mean less expensive.

2240 Time for working at altitude of Laramie River Ditches extends from about July 1 to October 15, or November 1. On plains work can be prosecuted year around with very little interruption from storms. It is not difficult to get men to go on upper ditches but more expensive. Our forces had to be disbanded at end of each working season when you stopped work. Forces have to be reorganized at resumption of work next summer. We had to transport men in, and transport them out. They would not go in there to work and at the same time be at expense of paying their way. The roads over which transportation occurs are over rough mountains. There is a stage line running between Home Post Office at Zimmerman's on Poudre, some distance below tunnel, and Fort Collins. There is no regular means of transportation to west portal of tunnel. Within last year Zimmerman has put on automobile stage line from Fort Collins to Home Post Office.

2241 It was along line of this stage route that Mr. Hibbard was killed.

Under Laramer County Ditch in Poudre Valley and throughout that valley habitations are permanent homes. Of course, Russians and Mexicans laboring in fields on beet crops do not have permanent habitations on farms. They move to town in winter time where they have permanent houses. All farm owners or tenants have permanent homes.

2242 There are a great many trees throughout the Poudre Valley. Early custom was to plant trees along irrigation laterals and there are trees throughout the whole district, mostly cottonwood species. These trees grew naturally only along streams. They originally grew along Poudre River. The entire Poudre Valley has taken on more the appearance of the prairie countries in Iowa and Illinois as far as trees are concerned.

In Laramie Plains I did not see trees except along streams. I saw no trees around ranch houses or along ditches as will be observed in Poudre Valley.

I mentioned State Agricultural College at Fort Collins and State Teachers College at Greeley. In the larger towns of the Poudre Valley they have public school systems with high schools in each, and every rural school district has good school house-. School

houses are located through rural districts every few miles. I think there are upwards of 100 school districts in Larimer County.
2243 The whole section is well supplied with permanent structures, brick and frame school houses. In La Porte 4½ miles from Fort Collins they have lately constructed a three-story school house. They have combined five or six school districts into one and have a combined school there. Students are all hauled from their homes and back in evening. Districts are small enough to permit students to attend combined school. All districts contribute support to this one school.

State Board of Agriculture has established School of Agriculture at the State Agricultural College four years ago, and we took in pupils from all over state that have passed eighth grade. Took them into this school of agriculture and gave them course of three years of six months each. This is separate from Agricultural College course. College course is four years. Students who attend college are largely from State of Colorado and adjoining states. Some foreign countries are represented. We have one from Phillipine Islands and two or three Japanese and some from old Mexico.
Enrollment of Agricultural College is about 600 and School
2244 of Agriculture about 400. The latter school has been very popular. We have had to turn away students. Do not have capacity to care for all applicants. I am president of State Board of Agriculture.

A. A. EDWARDS.

Cross-examination by Mr. N. E. Corthell:

2244 The railroad I have mentioned as being abandoned in the eighties was the Colorado Central Railroad from Fort Collins to Cheyenne, the track of which was taken up. Within the last two years another railroad has been constructed along the same general line.
2245 The country on the north side of the Poudre and above the irrigation systems is partly a grazing country, and some is used for dry farming. There is also some dry farming on the high ground between the Poudre and Big Thompson Rivers. I have heard of some pretty good crops on these dry farms some years and of failures in other years. The so-called Oklahoma district
2246 south of Windsor is in part a dry farming district, and I have heard of yields of from 20 to 30 bushels of wheat to the acre there. I never heard of a 50 bushel yield, but I have heard of entire failures. I do not know the market value of these lands. I do not know the assessed value of irrigated lands in the Poudre Valley. The system of assessment is undergoing a change.
Lands were formerly supposed to be assessed at one-third
2247 of their value, and now at the full value. My understanding is that farm land in Larimer County is assessed at about $100 per acre, but taking all of the farm lands, I would not be surprised if they were assessed at $67 an acre. Neither do I know the average assessed valuation of natural hay land and of dry farm

land in Larimer County. In the change in the system of assessment I doubt whether the full value was reached, as they were frequently treb-ing the old valuation, which was not really one-third of the real value.

2248 From July 1910 to September 1911, while I was acting as superintendent of the Greeley-Poudre system, work was being performed continuously. They were working upon the large tunnel, upon the reservoir dike called the Tunnel Reservoir, and upon the Collection ditches. I am not sure whether any work was

2249 done there during the winter of 1910-11, except upon the short tunnels, and the rock work upon the Collection ditches, I believe. I was not up there during the winter. About the first of July, 1911, I went through the tunnel into the Laramie Valley, and at that time work had been stopped on the Collection ditches and I can not say when it had stopped. The natural trees

2250 in the Poudre Valley are Box Elder and Cottonwood, and the native grasses are Buffalo and Gramma. I believe these grasses are quite a little different from the native grass grown in the Laramie Valley, but they may belong to the same family, I have never examined the native grasses down toward Laramie City, and they may have the same appearance as the grasses in the

2251 Poudre Valley. When riding through the Laramie Valley in 1910 and 1912, passing from Laramie City to Woods Landing, I made no effort to investigate the agricultural conditions, but I observed them as closely as I could from an automobile. Excepting at the demonstration farm, I saw no cultivation, although I saw a field or two of alfalfa. The acreage given to the cultivation of potatoes in the Poudre Valley is materially less than it was eight or ten years ago, but has increased within the past two years. I believe that about one-fourth as much land was given to this in 1913 as in 1905 and 1906.

I believe the amount of water diverted from the Laramie River by the Skyline Ditch is about 600,000,000 cubic feet per annum, but I do not have the records, which are in Fort Collins. It might possible be 18,000 acre feet.

2252 The water available in the Poudre River has been distributed over a larger area of land from year to year as new economies are introduced in the method of use and the demand becomes greater. This extension of the use of water has been continuous ever since they began irrigating. It is also true that for at least 23 years the water commissioner has been diligent in enforcing the priority of rights in the Poudre Valley. I would say as an estimate that since 1890 the area of additional land irri-

2253 gated in the Poudre Valley is from 35 to 40 thousand acres, an increase in 24 years of about 15 per cent. Although the Larimer County Ditch of the Water Supply and Storage Company was constructed for its entire length prior to 1890, the acreage irrigated has been constantly increased and is still being increased from year to year, the Company acquiring additional water by building reservoirs and securing water from other watersheds, and better methods in the use of the water being adopted. I believe that the

history of this ditch is typical of that of the irrigation in the Poudre Valley, although more has been done in the way of securing water from other watersheds. The duty of water under the other
2254 systems in the Poudre Valley is generally about the same as that in the Larimer County Ditch.

Redirect examination by Mr. Fred Farrar:

Wheat is about the only crop raised by dry farming methods. My information is that dry farming is very uncertain as to its returns. There have been two years when they have had pretty good crops, two years in succession, and previous to that I never heard
2254 of anything that amounted to very much of a yield. I am speaking of sections south of Fort Collins, those high ridges between there and Longmont. 1908 and 1909 were only two good years for dry farming so far as I know. Oklahoma District in Poudre Valley is high prairie country, between Poudre and Big Thompson Rivers. It lies southeast of Fort Collins.

2255 About 20 per cent of Laramer County is prairie country outside of foothills. Quite an area of this plains country lies between highest ditch and northern boundary of county. This upper portion is not under irrigation.

There are lands in Poudre Valley lying to the north aside from the Greeley-Poudre District, that are still raw prairie lands for reason that there is no water for irrigation of them. Also some land lying close to foothills.

The hay meadows of the district are distinct thing- from the raw prairie lands. The hay meadows usually grow Blue Stem Grass; the prairies, Gramma and Buffalo grasses.

2256 The Cache la Poudre River has been required to furnish some water to other appropriators with senior priorities on South Platte below mouth of Poudre.

In stating that increase of land under irrigation since 1890 was 15 per cent I was mistaken. The percentage is higher than that. Reservoir development in Poudre Valley since 1890 and water from foreign sheds had been brought in. I meant the main feeders in Poudre Valley were projected and land that could be reached by them in 1890 was not essentially different from that which we reach now, but more of it was then raw undeveloped land. Development of reservoir system and inter-mountain diversions has increased irrigated area in Poudre Valley about 100,000 acres since 1890. All the large ditch systems, especially on north side of river have extended their lines by extensions of their canals. Larimer
2257 County Ditch has extended 15 miles. Larimer and Weld Canal has extended 10 to 20 miles and also the same with Greeley No. 2. They have all extended further into Weld County, covering large bodies of new land. The North Poudre Irrigation Company and The Mountain Supply Ditch Company have extended their area since 1890 so as to cover new area.

Area previously devoted to potatoes in Greeley District is now

devoted to increased area in sugar beets and alfalfa. More wheat has been raised than in previous years.

Alfalfa hay ranges in price from $5 to $12 per ton in stack in Cache la Poudre Valley. It is now selling at $12 per ton in stack. This hay is usually fed on the place near the stacks.

Recross-examination by Mr. N. E. Corthell:

2257 The present winter (1913-14) is unusual on account of the amount of snow which has fallen, and this has had some effect upon the price of hay. Previous to the heavy snows, 2258 however, the price was high, partly on account of the demand in Kansas and Nebraska, where there had been a dry summer. The usual price of hay from year to year is about $5 or $6 a ton in the stack. The return flow of water from irrigated areas is a large element in the extension of irrigation, but the return flow in the Poudre Valley reaches the stream too low to be used excepting in the Platte Valley.

Redirect examination by Mr. Fred Farrar:

2258 The return flow of water supplies in some measure older appropriators on Cache la Poudre Valley. The ditches lower down the river obtain it and thus leave Poudre River available at the upper part of the stream that would otherwise have to be sent down to supply the older appropriators.

[End of Volume I.]

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1916.

No. 7, Original.

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY.

IN EQUITY.

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VOLUME II.

THE STATE OF WYOMING, Complainant,
vs.
THE STATE OF COLORADO et al.

LOUIS G. CARPENTER, recalled.

Direct examination by Mr. Delph E. Carpenter:

2259 Development of country from state of aridity to state of high cultivation is better illustrated in the west and especially in Colorado, than in almost any other place in the world. The Cache la Poudre Valley is most typical of this evolution, because it has passed through all of these stages within the memory of existing inhabitants. It is valuable that this evolution should have taken place in the memory of man because the different stages are visible and have been evident within the memory of living people, while in almost all cases of older civilization at least, original conditions of things are utterly unknown; that is, development from original condition was long before present generation and very frequently before historical record, and historical record does not go back to that condition of things, so that in this case, there has been no opportunity to compare effects brought in by irrigation. We do have that information in many of our western valleys, and of them all, we have the Poudre Valley, which typifies not only what has been the stage in most of these valleys, but in most of them it shows what will be the situation in some of valleys not as yet developed as far as Poudre Valley has. In order to describe development of

2260 Poudre Valley as an irrigated area it is best to summarize its history briefly in a few sentences. There was no settlement in Poudre Valley prior to 1859. In that year there must have been some California immigrants or gold seekers that got stranded by losing cattle or something to that effect. They raised hay for gold miners at Central City, at Gregory's diggings at Black Hawk and Central City, so that settlement for next few years was largely of this character. These settlers were not people who intended to be settlers in sense of making home there, but began by merely making temporary living. Most of them stayed as they found it was a good valley and lived there until their death. This was character of first development during those first few years. Then came development about 1870, starting from impetus of Greeley Colony, bringing in then a number of people who came with expectation of making this their permanent home.

Prior to 1870 the stage of development might be considered that

of the individual, or at least that of the cooperative ditch of a few individuals as distinct from the subsequent development. It could perhaps be termed the period of individual development; that is, there were then a few individuals who came before and took a tract of land here and there, very frequently isolated, and then developed it without capital and simply by their own individual means. The

instance might be mentioned of Mr. John G. Coy in outskirts
2261 of Fort Collins, who was stranded there in 1860 or 1861 by
death of one of his oxen. This is simply case illustrating condition that often arose. A person coming in that way, without capital but taking up or squatting upon a tract of land and with limited supply of tools, instances the economic development of land by labor alone. This meant selection of tract of land that could be irrigated at relatively small cost. A tract where fall was quite considerable, where ditch could be taken out in a short distance and ditch from small stream or tributary as distinguished from large streams with relatively large fall, so that ditch would be manageable, and so that short ditch would be sufficient to get water out on ground to be irrigated. That was case with Mr. Coy and many other owners at that date.

From these individuals as instances, movement of next 10 years was simply accretion or increasing coresponding settlements. In some cases, two or three or half a dozen people came about same time and took up land close together. They might join in construction of ditch and these ditches were partnership ditches, not corporations, but built in same way, by two people having joined instead of by one person, and this really is first stage of development here, and is typical of almost all other streams.

2262 This development was confined to lands easiest irrigated by shortest ditches on main river bottoms or flats adjacent to river and below mesas. This would be the alluvial land immediately along channel of river, a strip a quarter of a mile to a mile wide, according to width of bottom. Only a small part of this land had been irrigated by overflow from time immemorial. They cover this land which had been so irrigated by overflow with their ditches. Construction of these ditches had practically no influence on overflow of stream. Their aggregate capacity was not large, nor was the acreage they supplied very large during the first 10 or 12 years. Aggregate capacity of those ditches was very much less than that of later ditches constructed when agriculture was practiced. They were small, the appropriations were often quite large principally from fact that they made large claims, especially at beginning, and water was not as economically used and they used more water, rel-

atively speaking, for various reasons, some of which I will
2263 describe later. These appropriations made by these ditches
are now known as very excessive. This is also true of their meadow ditches along river bottoms on meadow lands. Excessive appropriations were also due to lack of knowledge at time original decrees were given. They were dealing in cubic feet per second, of which none of the people at that time had very distinct idea, and

so were given decrees in language with which they were unfamiliar and some very absurd results were consequence.

In later testimony under title of "duty of water" I will take up reasons for size of these appropriations, but will pass that for the time being.

In 1870 another form of development was initiated. That was the beginning of an epoch of development on a large scale, calling for larger ditches and thus marking passage of individual ditch with some exceptions. This initiated development of upland or mesa lands, or lands outside of stream bottoms. In first stage which I mentioned, there was only small acreage under each individual ditch as a whole. Starting of Union (Greeley) County in 1870 initiated an attempt to irrigate quite a good many thousand acres in one body. This was on upland, which with many of the old settlers, was thought to be of no value. In this case, as in development of more recent years, it required larger body of land to justify construction
2264 of larger ditches and the construction of larger ditches made necessary larger aggregation or community affair of some kind, with capital and cooperation. This led to formation of colony. The colony was known as the Union Colony of Colorado and sometimes called the Greeley Colony. They planned several ditches including that canal now commonly called Greeley No. 2 and the Greeley No. 3 canal. They constructed both these canals. They also early indicated intention of building Greeley No. 1 canal which was not constructed by them, but was built at a subsequent date under leadership of Governor B. H. Eaton. He was active in its construction and was its contractor and had a great deal to do with its operation. This canal is now known as the Larimer and Weld Canal. It is also called the Eaton Ditch on account of the local connection of Governor Eaton with the enterprise. When speaking of the Larimer and Weld Canal or of the Eaton Ditch, reference is had to the same canal.

2265 These larger canals were different in degree rather than in character of work, except perhaps as regards the taking of water from the streams. When taking water in small amounts from a stream having a relatively large supply, it was only necessary to construct a headgate and some obstruction which would turn out some water. It did not have to be effective nor water tight nor need more than to divert some water which was very easily done. With later and larger ditches, taking larger proportion of stream, diversion dams had to be more effective, more expensive and more than simply a wing dam. Many of earlier ditches were so constructed as to take water at high seasons only. This was possible owing to — we do not find except in early stages, that is, the river is very large and water comes in such quantities as to subject dam to being torn out. A dam of this character has been re-
2267 tained at the head of this large Cavour canal. They have a great deal of water to waste and they don't need to hold it up tight and use it to divert all water that is available.

Dams of the Indian Canal of the character of which I have spoken, are situate at points on stream where rock has been piled in and

washed down time and again for long period of years, forming sort of a ripple or rapid in the stream. Anicuts or river dams are made with very broad base as compared with their heights, something like twenty times broad as they are high. But at the same time that that condition prevails, they don't attempt to bring up more than a fraction of the water of a large stream. When they attempt to take out a large percentage of the water, then they have to put in a new type of dam. Even in India dams of this character are for most part indicative of large water supply.

Rubbish dams prevailing in some portions of arid west are indicative of large water supply. When it becomes necessary to utilize the water in its fullest extent, they are forced to put in dams of different type. As the development increases, the two-story ditches have to be altered so that they may be able to take water at any stage of the stream. This alteration is generally made by
2268 running the ditch further up stream, or it may be made by building a dam that lifts the water. Very frequently the ditch itself is carried up stream to a new head so that it may tap the river at its bottom at low water stage or else a permanent dam is put in. This same change took place in the Indian canals, so that their flood water ditches are often times turned into perennial ditches by making them deeper or taking them out higher up stream.

Construction of larger canals involved engineering problems, differing in degree and to some extent in kind. These larger canals crossed arroyas or gulches or watercourses of considerable size. They might be troubled at times by flood waters coming down from land above and thus protection of ditch from storms was required and also carrying of ditch across arroyas and water courses by flumes or other means. Sidehill construction became necessary. A large variety of flumes were required varying with character of country. In some places the large canals might be taken out without sidehill construction. In other places such construction or even canon construction might be involved with long expensive flumes in order to bring the water out by gravity to lands which might be cultivated.

Period of development beginning in 1870 on Poudre River meant large and more expensive construction, building of larger ditches, long ditches and of course larger capacity because they were intended to supply larger tracts of land. The Greeley No. 2
2269 was designed to supply in the neighborhood of 25,000 to 30,000 acres of land as compared with 1000 to 1500 acres or perhaps less than that supplied by most other ditches. They were short of capital and at that time there was no means of bringing in capital. The credit of such enterprises was small and they had to depend largely upon themselves. In the case of the Greeley Colony I am advised that each colonist subscribed $100 as his fee to colony, which went for land and ditches. In many cases they constructed the ditch by actual labor instead of paying cash. Each one put in a certain amount of the labor. The problem was to do the construction with as little capital as possible. The headworks in such cases were simply what might now be considered

temporary. They were of lumber and could not have been constructed and the settlers could not have gotten a foothold if they had not been cheap. At that time the Forest Service had not got possession of all the forests. They simply could not have developed the country unless they could have developed it at a very small outlay.

The people who were the pioneers and were willing to expend their efforts, were people without money and without credit to any great extent, at least. Those who were required to borrow money had to pay a very high rate of interest. These headgates and structures were all built of timber or lumber and usually of very simple character but were such as met the needs. In many of these cases the actual outlay was only a few dollars per acre, and this was the case for even quite a good many years after that.

This led then to the forming of an organization which was rather that of a cooperative company or body. Sometimes such organizations were in form or company simply because of convenience in administration or division of burdens. The corporate
2270 form was simply for convenience. They were purely mutual companies, they were not organized for profit, but were simply the most convenient machine for performing services required. The capital stock in such cases merely stood for the respective interests of the farmers who were interested in canal. In most cases stock had a par value, but in some cases even that was not the case. They represented shares in the ditch and in the water that the ditch supplied. The stock was taken as a mere convenient evidence of title, and under some statutes in some states, some value had to be given to such shares of capital stock, so in some of these cases a par value was given because it was necessary by law when they organized as a corporation.

The lands under these ditches were in most cases taken up prior to the construction of the ditch. That is, the ditches were constructed by the people who had taken up land like in the case of Greeley Colony, the Longmont Colony and the Fort Collins Colony. The settlers were on the ground or they sent their subscription and assessment, whatever it might be termed, and some of the officers of the colony built these ditches and then these people came as soon as the land was ready for them. They used all the water they could get. In some cases perhaps the appropriation was large and the appropriations were made in terms they were not famailiar with, and they were feeling their way to know what should be proper and best.
2271 They were moulding the future laws and rules of administration pertaining to irrigation. This was decidedly the fact in the Poudre Valley. At that time there were no laws in the United States relating to irrigation. There had been no law relating to mining prior to 1866, and the same condition prevailed concerning irrigation. These early communities, especially this Greeley community, met a condition of affairs that was not anticipated by the laws then existing. They developed beyond the existing laws, and hence they felt the need of further statutes, and the statutes of Colorado have largely been developed as the need grew. This par-

ticular community is responsible for the development of irrigation legislation in Colorado and that legislation, in turn, has been the pioneer of most of the legislation in most of the other arid states. This legislation grew out of the needs of the irrigators, and not out of anticipation. It has always been true in Colorado that legislation has generally been behind the needs of the Poudre Valley. This valley has been in advance of the needs of other parts of the state. That is true even to the present time, because this valley has been about ten years ahead in its activities of most other portions of the state. I am generally familiar with these large canals con-
2272 structed in Poudre Valley and which began in about 1870.

In the entire valley there is not a single case in which there is a large body of land situated beneath a canal whose water supply has been ample where the lands have remained in a great measure arid, uncultivated, and in their raw, unbroken state, or where, when settlement has been commenced, it has been eventually abandoned and the lands allowed to return to their formerly uncultivated condition. Such cases are not found in my experience anywhere in the arid west where conditions are fit for agriculture, and where reasonable time has been given for development. By reasonable time for development I don't mean that the land will be taken up and occupied immediately the year following construction, but, in case of the Poudre Valley for instance, under the Larimer and Weld or the Larimer County Canals, it took perhaps a period of ten years to put all of the land under cultivation. I think all of the land had been taken up before that, but after that time there would be practically none that would not be under actual cultivation. In the case of the two canals mentioned the period was even less than I have stated. In the arid region where the rainfall is scarcely sufficient for independent agriculture, settlement follows construction and does not precede it to any great extent. It preceded construction in the earlier days to the extent in most cases that the settlers took part in construction of canals. They did not have independent means, as a rule, and they were settlers during time of construction of canal.

This was frequently the case in the west during these periods
2273 in the sense that they were building canals and had to build them without money. Frequently where canals are surveyed by other parties to irrigate lands fit for agriculture, settlement precedes actual construction. Perhaps as a whole this is generally frequent. Quite a large number of cases where prospective settlers are people who propose to take up the land and who do come immediately and wait for the canals to be completed and water to become available. This is quite generally true in case of reclamation projects by the United States Government. It is universal so far as the fact is concerned that there are instances on ever- canal, but it is not the case that it is true in every track of land under such canal, or by any means a majority.

Beginning 1870 there were a number of other canals constructed in the Poudre Valley on practically the same basis as those constructed by the Union Colony. For instance, there is the canal commonly known as the Larimer County No. 2 heading at Fort Collins,

the New Mercer Canal came in this period and was of the same general character, and the Lake Canal was essentially of this general character. I refer to the fact that they did not have to depend upon outside capital. Several other canals were constructed or enlarged during that time but were of generally a smaller size. This stage was not so much a condition or stage of development as it might be termed a stage of social development. The financial con-
2274 dition of the country was such that it meant not only their own financial resources, but confidence that people with money had in them and in the community, and which made them willing to put up funds for development, doing it as a commercial enterprise possibly. It is along that line that I distinguish between this stage and the third stage.

The third stage, the construction of canals by aid of outside capital is exampled by the construction of the Eaton Ditch or Larimer and Weld Canal. Construction of canals by capital from other sources began about 1880, although the Highline Canal near Denver and the Eaton Canal in the Cache la Poudre Valley, and one or two others were started about 1879. 1880 would practically mean the beginning of construction by capital from outside. This was the beginning of the third period. Of course, the two stages more or less overlap, but that was the time when outside people began to see that the development of civilization and development of the country was permanent. That it was not simply a mining country with a temporary life. It also indicated to people at large the results of irrigation were sufficiently remunerative to warrant expenditure of money. It meant that they were willing to invest their money and that they did so expecting to get a return from it.

Following these cases came the period in which people were willing to build even larger canals and expected to get their money by sale of water rights and possible sale of land and water rights and generally took up the project on a scale which it would be very difficult to do as a co-operative enterprise. In the cooperative enterprise it meant the land was in private hands, at least
2275 to a large extent, and that this large number of individuals must get together and agree upon a course. This was always surrounded with more or less difficulty. Conditions were such that longer canals were necessary and corporations of this kind had to be formed to meet the conditions. These corporations constructed the canals on contract for sale of water rights, and in many cases they obtained the land and sold the land and water together. They were able to do this, owing to the fact (in some cases) that lands had been granted to the railroads and they could secure these. Not very many of these companies made money out of these enterprises in the end, at least not those which sold water rights. Some of those that sold water rights and land together did, but many of these enterprises were not brilliant successes in a financial way. As to being successful in way of developing country, they have all been successful and the communities have benefited almost immeasurably.

The value of lands that has come in consequence of construction

of these canals has been a great many times the cost of the canals and there is no case in which the enterprise has not been a complete success. The original investors, when they attempted to sell water as a water right, did not do well, for the public as a whole was not inclined to pay for a water right anything nearly what it had cost the canal company. The land developed notwithstanding
2276 these financial obstacles. Developed constantly and very successfully. None of them showed evidence of abandonment either in settlement or cultivation. During this period of investment by corporations, the following canals were constructed in the Poudre Valley:

The Larimer and Weld, the Larimer County, and the North Poudre Canals.

These were the especial three along in that stage of development. Following the construction of these canals, settlement occurred with greater or lesser rapidity, depending upon success of bringing in settlers. In some of these cases they had vacant land and had to find purchasers for this land and their water rights, so that some few years were consumed in taking up the lands. Less than ten years were required by the Larimer and Weld for placing the lands under cultivation.

There was a lack of water under each of these canals in beginning. There was an acute situation under these canals. The pres-
2277 sure for water was felt at that time. When I first came to Colorado to reside permanently in 1888, the situation was more acute than it has been since.

This general period of construction of canals through corporate enterprise in the Poudre Valley practically ceased in the 80's, although it should be modified by this statement, that the same general conditions still prevail and the reason it ceased was because the larger supplies of water immediately available were exhausted insofar as expensive construction was justified and there were some water districts which would continue to rely on the development or consequence of the same general conditions.

The stage of construction of reservoirs followed the construction of canals by corporate enterprise.

This reservoir stage was due to other than finances of the community, at least very largely so. In the first stage we found individual activity. In the second stage we found cooperative activity. In the third stage the bringing in of outside capital and the construction of practically all large canals that were then available and now comes a stage due as a consequence of settlement and the pressure for more water, and need of water for late crops, and hence the saving of water which they had and which was going to waste more or less. This led to the development of reservoirs as a practical means of conserving the water supply and the using of it to the best advantage. In this case, the change of the value of lands led to the discovery of more valuable crops, especially potatoes, which
2278 call for water late in the season. They found that the water supply was short for that period. If they were required to

rely upon the natural supply from the streams they had to confine themselves to cereals and alfalfa.

In the 80's they had not begun to sow alfalfa to any great extent. It was also a period in which they were developing to a great extent the jurisprudence relating to water. Then came the potato growing period, the period when wheat was found not — be as profitable, and then came recognition that a great deal of water had been going to waste earlier in the season, during the natural flow of the stream that could be saved if they would build reservoirs.

Reservoir construction began in these different communities in the same manner it had with construction of ditches, that is, cooperative enterprises in the form of a corporation. They utilized the basins that were cheapest and most available and built storage reservoirs at some cost. They made assessments and proceeded to use their surplus of water that had been going to waste earlier in the year, in the winter and at other times.

The fourth period would be that of reservoir construction and would be a separate stage as distinguished from the others. It started about 1890 although two or three reservoirs were constructed prior to that time and it might be said to have begun in 1888 or in 1889. It has continued up to the present time. Simply economy and pressure for more water continues and in this case as in others, the same question, forcing the people at all times to be as economical as possible with the water supply. Just so soon as the people become more economical and they use the water with greater effectiveness, the water increases in value and they can afford to take other steps to be economical, and can get greater results. This has been the condition all the time in the Cache la Poudre Valley and will continue to be the condition almost indefinitely.

2278 With this development of reservoirs in Poudre Valley came another related development of identically the same general cause, that is the need of more water in the existing canals. Where they had reservoir sites that were convenient, they then have, of course, constructed reservoirs, but they were searching for water and reservoir sites when most satisfactory were constructed. But the same search for water caused them to look into the mountains and to investigate the bringing of water over the divides. This caused the more far-sighted and those of most constructive imagination, to bring water across divides where they saw streams on the other side flowing in other directions and more or less unused. Hence, from identically the same cause, they began to consider means of bringing water across the divide and as early as 1879, 1880, and 1881, there were some attempts made at the head of the Poudre River to bring water from Lost Lake of the Laramie drainage, to bring water from Michigan Creek which flows into North Platte, to bring water from Grand River, or one tributary of that stream into the tributaries of the Poudre. These inter-watershed diversions are identical or of the same character of development as reservoir construction. They needed more water and these were means to get it, and the extent to which the irrigator could go depended upon their need for water and their financial ability. A

few years later came the construction of the Skyline Ditch. This was the most elaborate of any construction of that character at that time and the owners worked the inter-mountain diversion along with reservoir storage and we now have The Water Supply and Storage Company, which was originally the Larimer County Canal as the most typical case.

2280 The effect of the construction which took place during these four epoc-s of which I have spoken was to use the water supply of the Cache la Poudre more effectively than previously had been the case. Each succeeding period diminished available — of the stream. And yet the water obtained from the stream constantly increased. The call upon the river increased but the scarcity was felt less with the increase of acreage than one would expect, owing to the economies that came into operation and that came with more successful management, with the preparation of the land and the changes that took place as the communities were irrigated. There has not been as much quarreling over water, or as much anxiety over water supply, I think, in the immediate past as there was 20 or 25 years tgo when the acreage was not half so large as at present. There has, of course been some new water coming across the divide, but that is relatively small when compared with the total supply of the stream.

During all these times the irrigated acreage has been constantly increasing and is continuing so to do, and yet the water supply has not been increased, except for this amount from across the divide, which does not account for all the development. The same quantity of water has been increasing in its efficiency to serve

2281 lands for reclamation. The area has increased two and one half to three times within the last 25 years. The valuations have increased many more times. I would not be surprised if the valuations have increased 10 times.

The Poudre Valley has now reached a period where the larger enterprises are almost impossible, because the supplies that come from the river are now those which come from the economies, and hence, especially with the development of this last enterprise, the Greeley-Poudre enterprise, the period of large development has probably been reached.

The Greeley-Poudre is in one sense a combination of the corporate and public enterprise. The incentive and initiation has been due to some people of large vision who needed the corporate form to get started. Then development was made by the irrigation district form in which the people who own lands become responsible for the development. In the latter case it is a public form organized under public law and is of a quasi-municipal character.

This sixth and last stage is practically the final stage of development in the Cache la Poudre Valley. The same pressure exists and there is another stage which has been developing during the last 15 years that simply illustrates the same tendency, and inasmuch as it will continue in the future as at present, it will result in a class of development that might be put somewhat in a different

2282 stage. I refer to and will speak of this stage as the cooperative stage. It is not the construction but something similar in

principal of development as reservoirs. It is the utilization of the existing water supply. Pressure or need for water caused construction of reservoirs. Pressure and need for water brought about this cooperation stage of development. Reservoirs served to store up and utilize a certain part of the water, and this cooperative combination has helped them to combine together and use the water to better advantage. The development primarily consists in this:—some of the reservoirs were, of course, either below or above the ditch that needed water. If the ditch was to fill the reservoir it had to fill one below it and when they turned the water out they could not use it. If they could use water from a given reservoir they had to fill it from a ditch above, or build an independent channel to fill it. That then developed a situation where one ditch could fill a reservoir below, but they could not use the water and it had to be turned out to another ditch which could use it. For instance, the North Poudre Ditch could fill certain reservoirs and their water would be available possible for the Larimer County Ditch, then again, the Larimer County Ditch could fill some reservoirs that would be available for the Larimer and Weld or the Greeley No. 2 Canal, and the Larimer and Weld could fill a reservoir which they could not use. This would be available for Greeley No. 2 or Greeley No. 3 Canals.

2283 Taking again the case of the North Poudre Canal, they had water in their reservoirs and they had to let water go by their headgates in order to supply the Greeley No. 2 Canal for instance. The water in their reservoir would be unavailable for themselves, and of course, it would be the most natural thing for them to wish they could take that water which was going past their headgate and replace it by water from their reservoir. This would seem like a fair exchange and same conditions obtained as to other ditches that had reservoirs.

That originated the system of exchange so that, for instance, in the specific case mentioned, instead of letting the water go by their headgate down the river to supply Greeley No. 2 Canal, the North Poudre Canal would take that out into their headgates and turn out a corresponding amount of water from the reservoir put into the stream between the headgates of the two canals. A diversion again by the Larimer and Weld Canal and the Larimer County Canal caused another and more complicated exchange. The North Poudre Branch would turn out water from their reservoir and the Larimer County Canal would take it into its ditch. In exchange for that water the latter canal would turn water out of their reservoir which would go down to the Larimer and Weld Canal. The Larimer and Weld Canal would take this water into their ditch and in exchange for that would turn water out of their reservoir which would go down the stream to Greeley No. 2 Ditch and consequently there would be a series of exchanges so that all of these ditches would work somewhat together and during this period of a month or two in each season, they use a special man to supervise the exchanges, to measures out from one to another and to cast up at the end of the year the water accounts, so that they can see how the water exchange has finally resulted. More than that, one system, like the North Poudre,

has constructed a ditch and reservoir on Fossil Creek. They could not fill this reservoir from this canal or utilize it in their
2284 ditch They however filled this reservoir and used the water thus stored to supply the Greeley No. 2 Canal and then take out a corresponding amount at the headgate of the North Poudre Canal. All this has not only brought about this system of exchange, but more than that has put in operation a general cooperative system. While there is a series of ditches with a series of companies, and independent corporations to some extent, with opposing interests in the call for water, yet the joint condition of development has pressed them into a common union in the way of working together and they then cooperate in this and various other ways, so that the result is a better and more economical use of water in the stream. It makes a great deal more economical use, less waste, much less water going by and hence means a greater efficiency in the application and use of water supply. I speak of the present stage as the cooperative period; as the pressure continues it will undoubtedly develop this system to a greater extent than it has to the present time. Just how far it will develop at any time will depend of course upon the extent which the land will justify it. The final development of the exchange system will not result in a gigantic combination or water trust. There are definite units and they are not united financially nor are they united in disposition of water. It is simply a form of operation so that the water is used much more effectively and with less loss. At the beginning some of the ditches opposed such exchange, and it required some law suits to settle the matter.

2285 The exchange system of water in the Cache la Poudre Valley has brought about a constantly increasing acreage. Crop yield is also increased.

The exchange system on the Poudre River has reached a complicated state. It meets the present state of developement very well. It is developing and changing every year. I think the general principle to be that the system will continue to be developed just as conditions justify. To illustrate, the Fossil Creek Reservoir of the North Poudre system is one used purely for exchange and they are able to use this water for delivery to any canal in the valley notwithstanding the fact that the reservoir is below most of the canals. The system of this company is largely one of exchange. The whole system of exchange is largely under supervision of the Water Commissioner who is a state official exercising police supervision of the distribution of water of the district. He distributes in accordance with the decrees.

The initiation of this system of exchange in the Cache la Poudre Valley resulted not only in a decision of the courts supporting it, but also led to the introduction and enactment of statutes legalizing it. The first case arose where one ditch took out water from the stream and replaced its equivalent for rediversion by a ditch lower down the stream. The lower ditch objected to the substitution. On trial of the case the court recognized the justice of the substitution and afterwards the legislature enacted a statute legalizing the
2286 exchange, as in so many cases in water litigation in this state. The customs have been started in Poudre Valley and after-

wards put in form of legislation affecting other parts of state. Briefly summarizing the stages I have given and which I think might be clear or important enough to distinguish as I have mentioned are:

First, the individual ditch practically limited to bottom lands;

Second, the cooperative or community ditch carried out onto the uplands, but done by combinations of individual practically without capital;

Third, corporate or company development on larger scale with outside capital;

Fourth, development that came with pressure for water and necessity for storing. In this stage occurs reservoir development and also development across intervening divides. The latter is parallel to the former and due to the impelling cause;

Fifth, general cooperation of ditch companies in their joint action in economizing water and developing it more effectively. The companies and not the individuals forming the units.

Sixth, an extension of the corporate form into irrigation districts. this is again a way of raising funds and being able to carry
2287 out an enterprise on a large scale.

These stages on the Poudre Valley are, as I stated, typical as a whole of the stages of development of almost every irrigated valley in the west. Some of these localities which began in more recent years have been practically able to omit one or two of these stages. The stages have either been short or development has gone without that particular stage. The Poudre Valley has not only been the pioneer valley in many ways, but has been typical of these stages of development as a whole. It has been earlier than almost any other valley as a whole. The people who came into the Poudre Valley became familiar with the idea of developing the country by use of water and later scattered all over the western portion of the United States so that the consequence or fruit of the skill of this valley has been shown in enterprises in all our adjacent states.

Referring to the Greeley-Poudre System, an example of the last or sixth stage, only the flood water of the Poudre River was left for the development of the land included in the district. It was that portion of the flood waters not already taken by existing reservoirs.

In the Poudre Valley, reservoir development consisted in construction on sites of the main river, that is, they have had to build inlet canals and naturally the capacity of these inlet canals is limited. They are constructed so they do not take all of the supply of the river. They could not afford to build them large enough to take all the water of the stream and as a consequence there is a considerable supply of water left remaining at times. Under the Greeley-Poudre System, there would then be a utilization of the surplus of flood waters that other reservoir inlets could not take or which
2288 is in excess of capacities of reservoirs. They will also be able to obtain water that is available at time of rains when ditches do not need it, or when, from other causes and breaks they could not take it. In this case it came to the utilization of water remaining in this stream and also to going across the range and obtaining water that might be available there.

The principal available supply of water from Poudre River consisas largely of the peaks of the floods. At times of the year during storms there is water available when other ditches are not prepared to take it.

The construction of reservoirs in the bed of the stream was the most effective means of serving and utilizing these remnants of the water flow of the stream. These reservoirs are very expensive and that is one reason why they have not been attempted previously. Naturally the farmers would construct the less expensive ones.

The available remnants of water supply remaining in Cache la Poudre alone would probably not warrant the construction of these reservoirs. Hence, in the Greeley-Poudre System, the general conditions caused them to search for water supply for large body of available land and this general idea is the inception to a great measure of our enterprises. The storage of the peaks and surplus water was one source of supply. The other was the possibility of bringing water from Laramie River by construction of a long tunnel.

2289 The Eaton Canal or Laramie and Weld Canal, construction of which commenced in 1879, experienced a feeling of shortage of water for its consumers. That shortage continued throughout its history and up to the time of the construction of its reservoir. The shortage became acute. It was the cause of considerable litigation between this and other ditches, regarding water rights, and between users in that canal, who have different forms of water rights. In one way or another it has been the cause of quite a number of suits that I recall. For a number of years there was a constant contest for a sufficient water supply. This contest ceased about 15 years ago, during the period of reservoir construction. Relief came largely with building of those reservoirs and increase of capacity. Also by the inauguration of a system of exchange. It is true that that canal was short of water for long periods of time during each irrigation season for all of the years previous to the reservoir construction. It was shut down for considerable periods each season. Notwithstanding this, the development has constantly proceeded and the part 15 years has been more active than before. The people under the canal have been quite contented and their disputes, I think, are practically

2290 all settled, and the supply of water is now such that the crops are in splendid condition. It irrigates a very rich section of agricultural country.

It is the rule with canals in the Poudre Valley not to permit water to waste out of the lower end. It is used by lower ditches and there is practically no waste at present time. That did not use to be the case. The individual irrigator arranges his irrigation so there is practically no waste. If he does waste his water it is caught up in a lower ditch, and if he habitually wastes it the ditch rider cuts him down and cuts off the excess.

Waste of water is prohibited by law within Colorado. There was more waste of water in earlier days. There is a provision of law requiring the returning of water to the streams. None of the canals in the Poudre Valley turn their water into waste lakes where it is

absolutely lost. Development has been such that individuals waste practically none. The small waste means very close supervision. This means expense, with night irrigation and night supervision.

2291 These all come with the development of the country and that has been a development of this valley.

Very close supervision is given the use of water in irrigating potatoes, beets, cabbage, onions and other late crops. The water is used very economically. It is followed day and night. This is also true of irrigation of other earlier crops. The custom is constantly growing and in some cases people avoid attention during night by turning it on tracts where irrigation can proceed with advantage without much supervision. In other cases they go out several times during the night. This varies according to immediate situation.

Irrigation practices in Poudre Valley have developed class of laborers whose business it is to apply water. Many of them are very skillful, having become acquainted with different tracts of land and know better how the water will run and how it can be made to reach special places. The whole result is one of increased efficiency.

Nearly all the larger enterprises in Colorado have come from Greeley in first place. That is, you will find, in tracing history of almost any of the larger enterprises, that the people active in them came from Poudre Valley after having been there for some time. For instance, the Highline Ditch near Denver, sometimes known as the English Ditch, both the chief engineer and the constructor, Governor Eaton, were from the Poudre Valley. In the Arkansas Valley you find the Fort Lyon Canal laid out by Mr. LaGrange from Greeley. The Amity and the Colorado and Arkansas, on the south side of the river, were developed by Mr. Nettleton who was at Greeley an original colonist, and his locating engineer, Mr. Duvall, who has testified as a witness in this case. In the Montezuma Valley each of the canals built through the divide from the Dolores River into the Montezuma Valley were projected by Greeley people. Go up into Wyoming and several from the Cache la Poudre Valley are found under the Wheatland Canal. In the region of Sheridan, Wyo., you will find the Fort Collins Canals. In Utah along the Utah Lake a gentleman from Greeley was active in the development. This is generally true throughout almost all of these western states. Likewise in New Mexico, Texas and Montana, a little investigation of history of various enterprises will reveal the fact that Greeley or Poudre Valley people had a great deal to do with suggesting development or perhaps furnishing one man or men

2293 who were active in it. The same is true of Australia. Australia sent their commissioner here in 1884 and obtained several men for a system there. The State Engineer of Wyoming, who was very active in their development, Mr. Mead, was in Colorado for several years, and Wyoming took the Colorado laws with some modifications. The list is very extensive and undoubtedly is much more extensive if one knew the history of each enterprise. We find it in Western Oregon, Idaho, and I have had to do

with some cases. Also in Nebraska, Kansas and Northwestern Texas.

In the Laramie Valley in Wyoming, in part of it at least, some people who had been in Colorado made some attempts at development. I think the idea of the Wheatland Reservoir originated with a Colorado man, Mr. H. E. Johnston, who was taken to the Wheatland enterprise from Colorado.

The Cache la Poudre Valley is typical of other valleys throughout the country.

Direct examination continued.

2294 By Mr. Delph E. Carpenter.

The development of the reclamation of lands of the Poudre Valley under the canals I have already described, having been within the present memory, has made some physical changes very evident. One of these is the filling up of the subsoil. In 1870, when the Greeley Colony was started, there were probably not more than 10,000 acres of land irrigated in the valley. That was estimate made by one of colonists. This land was all contined to bottom lands. During next 10 years area became approximately 70,000 to 80,000 acres. In 1890 there were 135,000 acres irrigated. That was estimated based on the best information I could obtain, and which I made for United States Progress Report on Irrigation published in 1891. That is Senate Executive Document 53. At the present time there is approximately double that acreage irrigated.

At beginning of irrigation, as in all this western country, water was difficult to obtain by means of wells. It was practically
2295 at bed rock and then only in small quantities. In building the Greeley No. 2 Canal they did not have enough water about a mile below the headgate to water their stock. They had to drive their stock to the river. All through that tract of land the depth to water was practically the depth to bed rock. They could not obtain water enough from wells for their animals.

Bedrock seemed to run from 30 to 75 feet. More commonly 50 feet and over. After irrigation it was found that the water was nearer to the surface, so that all through that section of country instead of 30 to 60 feet it has come to 5 to 15 feet from the surface and in some cases to the surface. Where the town *or* Eaton now is, it was originally 54 feet to water. In 1890 it had become 16 feet to water. I do not know present depth, but presume it is about the same. Where Greeley now is I believe it was originally even more than that. At the point I previously mentioned a short distance below the headgate of the No. 2 canal it was originally 40 feet to water. At the Baker homestead it was originally 20 feet to water, that is, they dug a well 20 feet deep and got no water at all. In 1894 at this point the water was at the surface. This place is located a few miles north of Greeley. South and east of Lucerne, one Hopkins went still deeper for water. In another place he went 35 feet and in the course of a few years the ground water was within ten feet of the surface. There are number of instances of this kind. Wherever facts are ascertained it is demonstrated that practically

whole country is filling in to depth of less than 30 feet, as an
2296 average. In some places underground water has risen 50
and *and* in some places not more than 10 or 15 feet. I think
30 feet on an average is rather a low estimate. The ground water has appeared at some places on the surface. This appears in depressions and draws. These traverse Greeley country. They run in same direction as tributaries, nearly at right angles to stream. They cross the ditches at right angles.

The effect of irrigation has been to convert this arid country into a country somewhat analogous to the east. In the east the rainfall is more than is lost by evaporation, there is a surplus which goes into the ground and the ground is more or less filled and it contributes to draws or water courses and the streams are increasing constantly as you go down the stream.

In this country, with relatively low rain fall, the reverse is the case. The draws are very dry except in times of floods, but as the country was filled in with this excess water from irrigation, it raised the ground water or water table and this would be higher than on ground under the ridges than in ground under the draws and so it would be near the surface of the draws. It might be absolutely at the surface.

A great many of these draws which were dry have now be-
2297 come running streams from seepage water. That is the
visible contribution from the underground lake that has come from irrigation. That change due to irrigation is found throughout all these irrigated sections. It means that the water in the river itself has tended to increase. That is, the Cache la Poudre River has tended to increase rather than decrease throughout its length. The same is true of the Platte.

The rising of the underground water plane has not decreased the necessity of irrigation. It has decreased necessity of so much water for irrigation. This applies to the portions in draws or bottom lands that were near water table beneath. In some cases they became so wet that drainage became necessary instead of irrigation, and the conditions varied all the way from that to the place where the full amount of water is still required and consequently on the average the need of this ground was very much reduced.

A very small proportion of the land of Poudre Valley is seeped. It occurs mostly on the original bottom lands and some of the draws. This seepage is the natural consequence of irrigation and is found wherever irrigation is practiced. It has occurred in San Luis Valley where it has been termed sub-irrigation. The phenomena is the same but the plain is so uniform it does not appear in draws or ravines but comes uniformly. It had the effect of destroying the land or crops in some places. Water in Poudre Valley did not have that effect to any great extent, because ravines served as drain-
age channels, and served to drain it before it seeped a very
2298 large area. Such land, while frequently spoken of as be-
ing destroyed, is simply temporarily injured by excess of water and can be and is frequently reclaimed by drainage. A great deal of the land in the lower depressions or irrigated land in the Cache la Poudre Valley has been drained. The area that remains

is relatively small. In the older countries, India, Italy, etc., where irrigation has been practiced longer, they have not known what the original condition was and so the effect could not be observed. Again, the Cache la Poudre Valley becomes typical of this feature of development. It shows the changes that might have been missed by lack of records. It is evident that the water required to make this underground lake, has had to come from water supplied to the surface.

There have been other changes which might have come partly as a consequence, not so marked as that. These perhaps are not such as might be classed so much as physical changes due to natlral conditions, but simply to development. For instance, the lateral system or method of irrigation. Application of water has been with skill, and with knowledge of the lay of the ground so as to lessen the loss of water and increase its effectiveness. The skill of the ir-
2299 rigators has been increased. Management of canals and a great many other things of like character have been changed, so that the human element becomes quite a large factor.

The Cache la Poudre Valley has become almost a solid cultivated area. It is a country of homes, of rich farm lands. It has now become a country where the houses have all the appearance of prosperity. They are of brick, two stories, electric lights, telephones, etc., with the adjuncts that go with prosperous country places. The farms have largely been broken up into relatively small tracts to 40 to 80 acres, and it is practically one solid mass of cultivation.

Originally the country was barren and without trees. The colonists set out trees as one of their first steps, especially along roads, borders, and ditches. The country now is a wooded country. In many cases the first crop of trees has matured and been cut down, this is the case with cottonwoods. They became old and began to decay but the country generally has the appearance of a wooded country. The cottonwood is a native tree. There have been quite a variety of trees planted but the cottonwood is prevailing. It is a tree of quick growth, hardy, resists the attacks of insects, and is very certain to grow with little attention. While it is objected to, to some extent, it has been a very popular tree. The box-elder is a native tree of the valley. They also have growing, ash,
2300 elm, locusts, and in fact almost all the trees of different varities that will grow at this latitude.

Orchards of fruit trees have been planted to some extent, more as you reach the neighborhood of the foothills.

I have never seen any part of the United States that gives as favorable impression as does this country in its present state of development. There might be some parts of Illinois and some parts of New York and New England that compare with it in some respects, but the portions I have been through in detail with teams or automobiles have been so rough that they have not had an area that would compare with this. There might be some tracts. The area of this valley is more uniform and comparatively smooth and even without irregularities. Practically all of it is under cultivation. The area gives that appearance of crops and richness. I have not

been through Western New York. I have heard of it, but have not been through that way.

During time I have been engaged in practice of my profession in Colorado and elsewhere, have had occasion to make study of subject of duty of water. In work in connection with Experiment Station, that is the Agricultural Experiment Station maintained by funds from Congress and called either the United States Experiment Station or the Colorado Experiment Station, I took up the
2301 duty of water as one of the subjects of investigation and made some investigations quite a number of years ago and published a report. I think it was one of the first reports printed on that subject. It was the first so far as I know. That was Bulletin 22 of the Experiment Station and must have been issued about 1893. Incidentally I carried on experiments and investigations and made examination of all different tests and experiments that I knew of anywhere in this country or abroad. I have always kept up, or attempted to ascertain what might be called the duty of water.

The term, "duty of water" has several different significations as commonly used and one prevailing one has been given, especially at the beginning of irrigation of any section, and is found almost everywhere at beginning of development of country. With other developments that come with economy of use, with reservoirs, etc., it has rather a different meaning than as originally used. In the one case duty is commonly expressed as the relation between the number of acres irrigated and the flow in cubic feet per second. The other way of expressing it is as the depth of water that has been applied, and very frequently the use of the word duty in the latter case is avoided because of confusion and ambiguity. Thus in the Poudre River Valley, originally they made comparisons on the basis of 1.44 cubic feet per second to 80 acres and that form was very common as the duty at that time. That was really equivalent to enough water to cover 80 acres 6 inches in depth every two weeks.

2302 It is a convenient form of expression to use cubic feet per second for a given area because it is an item of information that is wanted by the constructor of the ditch, by the farmer, and by the ditch user or superintendent. It gives them a means of knowing how much water should be turned out. As used in this way, is rather an expression of the maximum amount of water to be turned out. That might again be expressed as the average flow, which again would be different from that result.

If the other expression of depth during the seaosn, be taken, then the element of time has to be taken into account. In the first case, of for instance 1.44 cubic feet per second is equivalent to 6 inches in depth in two weeks over eighty acres. As a matter of fact, users of water would not use that water continuously at any such rate. They would use it at such a rate perhaps for two or three weeks and then the demand would drop off to a much less amount. I refer to agricultural methods on agricultural crops. The individual farmer would not use that flow as an average quantity. Thus in May he might use very little, June might run to the maximum, July might

drop down very much. The time that the water had been used would be a very essential element. If it were to run for 98 days for instance, it would be equivalent to 3½ feet depth of water. If used for less time, the depth would be correspondingly less. While it has been a convenient method of expressing it, it has not been a very exact method. It has given a means of knowing how large a ditch would be required to furnish water for a given tract because the ditch would have to furnish enough water at the time that the growing crops needed it most, and not simply to supply the average quantity.

With development of reservoirs and pressure requiring use of every bit of water that there is in the unit, it has become con-
2303 venient to express water in depth, and especially since reservoirs have been constructed. For instance, there would be 10,000 acres feet in a reservoir and that would then supply 10,000 acres one foot deep, or 20,000 acres six inches deep. The size of the stream that would be taken to supply this quantity would vary according to the rate at which it was demanded. But even in those cases they are required to figure out the size of the stream called for.

It might be well to mention here that the relation is fairly simple between the size of the stream. A stream running one cubic foot per second would supply in twenty-four hours almost exactly two acre feet. The discrepancy is less than one per cent, so that for common purposes it is a convenient ratio.

It has been customary in Colorado to fix the capacity of reservoirs and the water stored in millions and fractions of millions of cubic feet. The law requires that capacity be expressed in cubic feet. In large reservoirs, millions of cubic feet are convenient to engineers. They also express the capacity in acre feet, which is more convenient.

There are 43,560 cubic feet in an acre' foot, because there are 43,560 square feet in an acre.

An acre foot of water is enough water to cover a superficial acre one foot in depth. As an acre has 43,560 square feet, an acre foot would be 43,560 cubic feet.

The cubic foot is used as a unit of measurement of stored water. The cubic foot per second is used as a unit of measurement for flow-
ing water. The cubic foot per second is a rate of flow while
2304 a cubic foot is a quantity and has no connection with time whatever.

A cubic foot per second would produce 60 cubic feet in one minute, 3600 cubic feet in one hour, and 86,400 cubic feet in one day. The quantity would increase with time. It is a measure of rate of flow while the cubic foot as a quantity is independent of time.

The acre foot likewise is a measure of quantity and it does not have any connection with time so far as the unit is concerned. It is not a measure of rate.

A stream flowing a cubic foot per second would give a cubic foot in one second. The relation between a cubic foot of water and a cubic foot of water flowing in a second of time is corresponding between that say miles and velocities, or miles per hour, for

instance in speed. That is, a mile is a distance while a mile per hour is velocity or rate.

There are 23 acre feet in 1,000,000 cubic feet. It is of course as many as 43,560 contained in 1,000,000 or in round numbers about 23.

Speaking of unit of figures, 1.44 cubic feet of water per second of time as used as a standard of contracts in certain irrigation systems in early days, there is a similar unit used in Wyoming by statute. It is expressed in the reversed way, that is all. In the case of this unit, it appeared in the early days. 1.44 cubic feet per second of time for 80 acres, which was made the basis of contracts in the Highline Canal near Denver, Laramie and Weld Canal and other canals. That, then, is equivalent to 55.6 acres per cubic foot per second. That unit was used for their in-
2305 formation. They then had it fixed at a sum they thought would be sufficient.

In Wyoming the statute has fixed 70 acres per cubic foot per second as a basis for their decrees. In their contracts this ratio is then used. This unit of 70 acres per cubic foot in Wyoming and 1.44 cubic feet for 80 acres in Colorado, is a maximum measurement rather than a constant flow. It is often stated as a constant flow but as a matter of fact it is not. The idea of many users is that it is a constant flow, but every one of these contracts is limited by beneficial use, that is, they are entitled to a stream of water not to exceed that amount and the proviso is read into the condition, so much as they can beneficially use or need. As a matter of fact, they cannot use that quantity ordinarily, so it is really the measurement of a maximum amount they can draw at any one time.

In practically all cases, whether so provided in the contract or not, users were all on same basis and if there was a shortage the water was divided among them. Many contracts did provide that in case of shortage they were entitled to their proportionate part. The contracts in the Colorado practice were simply preliminary contracts that came in the third stage of development concerning which I have just testified, where they were organized as companies and contracts made with users. Later nearly all these canals were put in form of mutual companies and in that case the stockholder was entitled to his proportionate share of the total amount of water in the canal.

2306 Wyoming statutory maximum of one cubic foot per second of time for 70 acres of land does not carry with it any limit of time. The only limit is that caused by conditions of irrigation season. In long season or long demand, the absolute quantity is increased and in short season it is decreased. That unit of meaurement simply applies to present diversion at any one particular time. It is practically the maximum quantity. I suppose it would be in legal effect the same as it is in this state. We may have ditch here, for instance, with decree of 100 cubic feet per second, or 500 cubic feet per second. That means the ditch may draw that amount but if it does not need that amount it cannot

draw it. It must remain in stream and is available for others later in right and time. Need of stream is fluctuating amount. By need I mean the amount they can beneficially use for current application.

Most reservoirs of Poudre Valley followed in point of time the construction of ditches in that valley. These reservoirs fill to some extent in winter. They fill in spring before ditches call for water or call for all the water. Or they fill in fall to some extent and at flood seasons during the summer. In fact, they fill whenever there is amount of water that is not being needed for immediate application to lands. They take water that otherwise would go to waste.

2307 The decrees for reservoirs in Colorado are generally expressed in either million cubic feet capacity, or in depth in reservoirs. The depth in the reservoir is measured from a definite point and gives quantity in reservoir, which is measured by physical conditions, whether it is so stated in decree or not. For illustration, I think the Terry Lake has decree for something like 29 feet. In expressing the quantity in that way it simply gave a figure that would be more easily observed or checked.

The term "duty of water" may be used in either of two senses. Commonly used as one expressing relation between the acreage served and amount of water, as so many acres per cubic foot per second. Same meaning is contained in statement of so much quantity per unit of land, as 1.44 feet for 80 acres. These are both expressed in same unit or in same way, except that one of them is using a unit of cubic feet per second and other is using a unit for 80 acres, but they are exactly the same in character. That is rather an expression of maximum quantity of water—maximum rate. Average duty under such conditions would be average flow for season which is practically not a very satisfactory unit. The other expression of depth is one that is increasing in use and will continue to increase in use with development of country, that is of stating how many inches or feet in depth the water is applied or needs to be applied to any tract of land.

As commonly used, "duty of water" means the size of stream that a unit of land can legally call for. With ditch men it is being to some extent superseded by other ways of expression.

2308 "Ultimate duty of water," would mean the amount of water that the plant itself may use in its own growth. I so used the expression in Bulletin 22 as the measure of that duty. When we speak of duty of water in ordinary ditch management it includes all waste incident to loss in canal, loss in measurement, failure to use, evaporation from soil, amount disappearing in soil by absorption, etc., seepage in canal and is very different than ultimate duty. One who attempts to compile results of duty of water as measured in this way, either by units that canals use in their contracts, or even in their depths, finds results that are very inconsistent and such that he can scarcely reconcile them, largely because of way of looking at them, and in the ultimate duty, that comes back to pretty nearly the constant term.

Various plants require different quantities of water within certain limits. Stating it in a general way, it may be said that a pound of produce of any kind requires in round numbers 300 pounds of water in the plant economy. That varies under experimentation both between different crops and under different conditions, different methods of treatment, and ordinarily whether they have been accustomed to such treatment. Other experimentors find dif-
2309 ferent figures and that figure has been accepted a good deal and seems to be a fair measure of the amount required. Thus a ton of hay has used in round numbers 300 tons of water and everything in excess of 300 tons of water has either been unnecessary or has been ineffective in the sense that it is not applied to the direct needs of the plant. Some may be necessary in distribution, some may be lost in carriage, some lost in evaporation from soil, and all the other elements of waste will add to the amount of water that may have to be applied or taken in by the ditch or consumed by the farmer. The farmer can economize in all other sources of loss but when it comes to the plant itself he cannot cut down the amount to any extent. This amount of 300 tons of water for one ton of hay, for example, if applied to an acre of ground, would mean that a ton of hay per acre would require 300 tons of water per acre as used by the plant and that measured in depth would be about 3 inches; 3 acre inches. That gives rise there to what might be considered the ultimate duty of water.

You can economize on the other waste of water as used, but you cannot eco-mize on what the plant itself uses. The ratio is approximately the same in most plants, wheat, etc. Individual tests run below and above. So that, a yield for instance of 3 tons of hay per acre would have used approximately a depth of 9 inches of water; 9 acre inches. Not 9 miner's inches but 9 inches in depth. If the yield be one-half ton per acre that would correspond approximately to depth of water used of 1½ inches. This is all dry matter, so that in the case of sugar beets, for example, when they speak of a tonnage of 10, 15, or 20 tons, that tonnage is not a dry matter but the wet weight, the weight with the water still in it, and this ratio would need to be based on the dry product and not on the gross weight before the water is evaporated from it.

2310 Alfalfa probably produces as much weight as most of the crops we have, and that could be considered as between 3 and 5 tons or probably the average is not more than 4 tons per acre. That is for air-dried alfalfa hay. We would not take into consideration weighed grain. We have straw and the grain itself, but in that case the weight is almost always in the grain, and the weight of the straw is not often known. For that reason I mention alfalfa owing to the fact that from the character of the crop we do know gross product. In case of wheat yield of 50 bushels per acre wou'd be 3,000 pounds or 1½ tons and to that would be added the weight of the straw.

Native hay would be the weight of hay produced, ½ ton to ¾ ton per acre is commonly found. In round numbers that would be equal to 1½ inches for each ½ ton per acre, to 2½ inches for

¾ of a ton, or 3 inches for 1 ton per acre. I am still referring to acre inches, owing to fact am using acre for unit of land upon which crop is raised.

2311 While speaking of "duty of water" I have not given the term the same as if I should start out and give what might be a definition but have given what is commonly understood as meaning of term. The term has different meanings in the different locations, and in same locality as well. I prefer the definition as it is used in expressing a measure of depth of water. I have mentioned the fact that that is the tendency that is coming among engineers in all parts where reservoirs are in use, that is, the depth of water on the land rather than the size of the stream, but that may be measured like the size of stream either at headgate, the end of ditch, or in river. Hence the place where it is measured needs to be specified in order to make comparison. This finally gives means of estimating or determining the economy in the unit as a whole by comparison with water resources in acre feet; for instance, it shows the extent of loss or waste and ineffectiveness, and hence suggests the economies that may come.

All the definitions that I have given employ the term "duty of water" as used to imply service water will perform in irrigation of land; but the term is expressed in so many different ways that they are scarcely comparable.

2312 By "increase of duty of water" is meant that in time in most communities larger acreage is served by same quantity of water. Hence acreage is increased and that means that stream serves larger acreage during time it is running. It is also true that depth of water required during season is less than formerly. That is phenomenon that is noticed in nearly all these valleys.

I previously described the rise of water plane in Poudre Valley and creation of additional supply on proably 300,000 acres of land and likened that increase to underground lakes. The spaces in the soil amount to practically ¼ of its volume. The volume of these interstices range from 30 to 40 per cent and on the average may be counted as at least ⅓. Hence, if water has filled up subsoil to depth of 30 feet, which it has done in Poudre Valley, that would be equivalent to at least ¼ of that depth of solid water, that is if soil were removed that 30 feet of saturation would give in the neighborhood of 10 feet of solid water. It would make a lake of that depth. The soil that is filled does not require re-filling. That body of water has gradually accumulated from water that has been applied to surface. It is the surplus. That amount of water has been applied over and above the quantity required by plants or needed for other losses or wastes, and hence, in course of practically 30 years there has been approximately 3,000,000 acre feet of water gone into subsoil. That would make lake 10 feet deep over 300,000 acres. This water now forms fairly stagnant body. It is in slow movement down hill whichever way the slope is. The movement is very slow compared with the surface flow. The law of

2313 its flow is different except that it flows down hill and runs in around number from 1 to 2 miles per annum, in places

it is considerable more. That does appear in these depressions, draws, arroyas and in the main stream. Where it appears in arroyas as well as in the main stream it is very frequently used again. There are many seepage ditches in Poudre Valley that depend entirely upon seepage water. Their appropriation is from these draws that were formerly dry and there is a claim for seepage water. The larger ditches crossing these arroyas pick up seepage streams that come down the arroyas. It forms quite a considerable contribution to main supply.

Practically all of surface waste water as well as seepage water is conserved and reused in Poudre Valley. All of surface waste that comes from ditches is used. In early days there was considerable waste from that source. There is practically no waste from that source, either individually or by communities. That has come with greater skill in handling water. I may state that there is a condition that at first somewhat puzzled me. I found individuals were wasteful while community was very economical. Reasons for that, however, was that the loss of the individual was captured and used again by other ditches, so that we have the fact that the community may be relatively economical and the individual might be
2314 wasteful. At the present time individual has more skill as a rule and much more familiarity with his land and individual application has decreased.

Water flowing in Cache la Poudre River as it passes out of mountains and begins to enter canals now serves much larger area than formerly. In 1870 it served 10,000 acres. In 1880 probably not more than three or four times that quantity. In 1890 about 130,000 acres. It now serves 260,000 acres: the same stream flow serves the latter acreage that served the first acreage given. The water stored in reservoirs is merely part of the stream flow so that the peak part of the flow has since decreased, is stored in reservoirs as has also the waste at other times. The acreage served has been very much increased. For all purposes it is substantially the same water now as it was 20 or 30 years ago, with these changes in methods of use, matters of economy and conserving water. The struggle over water and pinching caused by shortage is much less than it was 25 years ago. The increase in acreage has occurred almost entirely on north side of valley. This has occurred because lands were available there. On south side of valley, a few miles east of Fort Collins a ridge extends out that confines irrigation from south of Poudre almost entirely to mesa near Fort Collins. This mesa is north and west of Fossil Creek. North side of river lies so that water can be brought out to it, and in that time there
2315 has been further utilization of Laramie and Weld and Laramie County Ditches, North Poudre Ditch and extensions of these ditches and also extension of Greeley No. 2 Canal. In case of each of these ditches the land, especially near headgate, became more or less saturated. The ground water came near enough to surface so that it needed very little irrigation and perhaps needed drainage instead of irrigation. That land, if not abandoned, was in situation where it would not need irrigation. They then transferred right to use

that water to other lands lower down and so ditch did not run any more water but it brought under cultivation more lands towards lower end of ditch.

Did not increase its demand on stream in making extended reclamation. This extension was by means of extension of main ditch or by formation of lateral companies and laterals which might run our 5, 8, or 10 miles and were in effect an extension of main ditch. By this means this land has been brought under cultivation and has had the effect of largely increasing the total acreage. These were mutual ditches, so that owners living near head who owned ditch stock have nearly all divested themselves of that stock.

I will distinguish between Colorado plan of water rights and its relation to land and Wyoming plan. Under the system that has grown up in Colorado, the mutual ditches, the ownership of a share in a ditch meant the control of a certain fraction of the water. Water was delivered to possessor of share of stock without distinguishing where lands of its owner were situate, whether it be at lower end of ditch or somewhere else. This permitted
2316 to a greater or less extent, natural development that follows natural economy, so that person who had more shares of stock in ditch than he needed to supply him with requisite amount of water, could dispose of portion of his stock ownership; for reason already given and other reasons, his demands for water decreased to a greater or less extent. Less water would be needed by his tract of land. Where perhaps 10 shares were needed to supply him originally in many cases 5 shares or some other number might suffice after a series of years, and in that event, he would or could often sell his extra shares of stock. This would naturally go to lower end of ditch and really increase the total acreage, but would not increase the amount of water that the ditch was using. That has been one of the practical workings of this system in Colorado. The mutual ditch system operating in that manner has tended to facilitate the reclamation of land.

In this Colorado system then, water was not confined to a particular tract of land. It was assigned to the ditch and the land under it, but it has lent itself to this expansion and this economy that is a natural consequence of irrigation development we see in any irrigated country.

Under the Wyoming system, I understand, the water is limited to a particular tract of land and the particular section or particular eighty of that land in the permit is described so that water is decreed to that particular tract of land and no other. The owner of that land then, has no particular inducement to economy because he does not get the advantage of the expansion. If he uses less water, the condition is that the quantity in the ditch or in the stream is possibly increasing, but as he does not get the benefit he is not constantly pushed by the incentive that prompts economy and that is of getting more benefit himself. This system, therefore, does not lend itself so well to a growth of this kind of develop-
2317 ment and to a greater economy. Activity in that regard is very largely increased by selfish benefit. That is, greater

economy or greater use of water or extension of use of water has come from various causes, but practically the recognition of the benefit of economy has come only under necessity. I mean this:—that on the ditch where there is plenty of water or on a farm where a man has all the water he thinks he needs, he is not going to economize. He uses water in place of cultivation and uses it a great many times when it is not necessary. My observation has been, and I have had quite a good deal of opportunity to see it in going over this Poudre Valley and other parts of the state in detail with horse and buggy and a great many times, and in discussing the matter with these men, that nearly always they have first been convinced that less water could be used successfully after they had been pushed to a condition of economy. For instance, an extremely low year, or an accident to a ditch, has shut them out and they have frequently found that instead of crop failure they have had better and more crops than some neighbor who had more water. That has been the case in many instances that has convinced these people that they can get along with less water and that has been the beginning of our economy. They have had the lesson pressed upon them rather than its being one of intention. That has been true, I know of quite a number of instances under the Greeley No. 2 Canal, for instance, and other ditches, but in almost every case unless
2318 there is some constant pressure of that kind, a pressure even of canal officers, they are not going to get the best use of the water. Of course losses or even reasons why water is used in greater quantities are some of them semi-necessary, some, principally, unnecessary. There has been mentioned the great quantity of water that has gone to fill subsoil, that is not now necessary in Poudre Valley. I have seen in Poudre Valley some tracts of land which were shallow, with no irrigated land adjacent, and they would use 4, 5, or 6 feet in depth in that case. Lots of water was being applied and going out to fill up sub-soil in adjacent land. If lands near were irrigated, amount of water would not be so great, because it would practically only have to fill the subsoil beneath. Loss in ditches themselves, that is, after the water is measured into canal at headgate, or as far as whole community is concerned, loss from headgate and lateral is considerable. Loss in lateral, loss due to measurement in water owing to inaccuracy, requires that ditch rider gives enough so that user will think he has what he is entitled to.

There is less waste individually after a man becomes acquainted with his field. At first his knowledge of field is new. He turns water out in an amount and after a time that probably will cause water to fill up at lower end, run through the rows and across the field and waste. He learns after a while what size stream is required, how many hours it will take to cross his field and of course with
2319 an experienced irrigator or careful man, his object is to prevent any such waste, and as he gets more skillful, and acquainted with his field, that decreases more and more, so in some of these communities there is practically no waste from this source. One of the greatest differences is in the change of character of sur-

face. It requires a depth of 3 inches to irrigate a tract of land. When compared with good rain fall that amount seems extravagant, and, in a sense, it is. The need is not that of the plant alone. They cannot distribute a less quantity and that is the physical problem of spreading it. If ground is more or less uneven, rough, with little hommocks, ridges and prairie dog mounds, and ant hills, etc., other like irregularities, they practically need to get nearly as much water as the amount given on the summits of these little mounds and the effect is that they get a great deal more water than that in the depressions and hence, when the field is rough, the problem of uniform distribution is that the common or average amount is much in excess, 8, 10 or 12 inches is taken often for single irrigation. As irrigators become accustomed to their fields and know how to run their laterals and distributing ditches, as they smooth their places from year to year so that it might be compared to an inclined *plain*, which is case in many instances, they lessen the amount that is required for purpose of distribution, they bring it down to depth of possible 3 inches, sometimes a little less. This then, results in great source of increase of efficiency of water. These sources come in as country gets better accustomed to water, as subsoil is filled, as management of ditches becomes more efficient, as users
2320 operate day and night, as they will do when water is more valuable. Irrigators do now operate day and night. As land gets smooth it can very readily be seen that same amount of water will go very much further. A great many irrigators have a man to distribute water by night as well as by day. Where they do not keep a man active all the time, they generally have means of setting it so that it will continue its irrigation during the night without waste.

Failure to distinguish between these conditions explained great discrepancy in depth. Limits of measurements from different places can be obtained that vary all the way from a few inches of a foot in depth up to even 2,000 feet in depth. That amount has been used on a tract of land. 2,200 were used on a tract of land in French Alps under management of Herve-Mangon. Of course that land was pretty nearly a sieve and was used for hay. But with cultivated crops, they are within much more moderate limits, but still frequently run up to 10 feet in depth. This may be measured either at headgate at ditch or outlet headgate at stream. I do not believe distinction for most purposes is accurate enough to make any great degree of refinement necessary there. Final comparison would really be made final with what plant requires and that in excess of plant requirement might be lessened or reduced to a moderate limit, so that when it runs up to any such amount as several feet, it means that there is a great deal of waste going on somewhere.

Expense for smoothing is justified or not according to value of land and general economic conditions. The crops to be raised give
2321 the land its value. If it is land worth $20 an acre, it will or will not justify a certain expenditure. If it is worth $100 per acre, the expenditure which could be made would be absolutely

unreasonable if made on $20 per acre land. In such a community, land is liable to increase in value, which means that more labor and expense can be put upon it. Aside from much expenditure for such purposes, the land is plowed and cultivated from year to year. They frequently go over it with this in mind, so that they tend to fill up hollows and smooth out the hummocks and this brings the land constantly into smoother condition. Many farmers go out at spare time and scrape off hummocks, filling in the depressions. That is constantly continuing process from year to year. In some places they start in systematically and spend considerable money smoothing the land. In Northern Italy they go to an expense of several hundred dollars an acre in preparing land.

The crops the land will yield and the people it will support gives it its value and warrants an expenditure of money in the manner I have stated. This process has been going on constantly in Poudre Valley and land has been increasing in value. The population has been increasing. Building has been increasing and the income from the land as a whole has been on the increase. Of course, all these conditions have made conomic conditions more favorable for improvement.

Poor land producing small returns is liable to mean a low duty of water and waste of water. The crop return is small and is generally true that the water is used with relatively poor economy, at least so far as *though* conditions are concerned. They cannot afford to go to much expense to save water. It is the general consequence that such communities are usually extravagant and wasteful in their use of water.

2322 Changing of character of crop raised and method of irrigation in Poudre Valley has not made so much change in quantity of water used in depth as have other conditions. It has made a great deal better use of supplies of water that are available in valley. Instead of running water to waste unused down stream, a greater quantity is utilized now than formerly. For illustration, in the first stage, wheats and oats were principal crops. They mature in June and likewise alfalfa, when it was started, called for water in June but could use water to benefit later on. That meant the demand of the valley was pretty nearly parallel to flood stream in June, but in July of course there was little water and crops then did not use all of that. By changing to potatoes and sugar beets for part of their lands, there is a demand in July and August for more water than the stream will supply and that requires storage reservoirs for storage of the peak of flood and they use that water in July and August for these crops. It also means another economy for use, that is, a psychological principle, that a person who depends upon natural streams for water applies the maximum quantity

2323 in irrigation because of waste, and thinks that the time to use water, as they say, is when the water is there. This means that their tendency is to apply water when they can get it from the stream whether the land really needs it or not, for fear that later on when they need it, ordinarily, the water is not within reach. Hence they use the water practically on the supposition that the weather is

going to turn dry, and if the weather is, on the contrary, wet, they then have used an unnecessary amount. Under reservoir use, having water available, they are not under that pressure and they can then wait for a greater or less extent until they actually need it. When they use this method they find that a great deal of their prospective irrigation is unnecessary. This is really quite a source of saving and a means of extension of use.

With reservoirs owned by mutual companies the stockholders divide the quantity of water in the reservoir by the number of shares of stock. The stockholder draws on the supply available and draws with the modifications that are necessary in order to make a practical order of distribution. With the modification that one man could not call for his water to be delivered through a long ditch and be the only person demanding or receiving water, the farmer receives his water just as he needs it. They have to make some limitations and restrictions as to the number of farmers who must call for water at the same time in order to make delivery.

With all crops cultivated in rows, such as potatoes, beets, cabbage, onions, truck and garden produce, water can be applied somewhat more economically because the loss by evaporation is lessened.

2324 The net return from the crop produced gives the land its value. The net return on agricultural lands in the Poudre Valley has been very much increased with increase of acreage of rowed crops. This, of course, has been parallel with other causes which it is difficult to distinguish at times. Historically it is a decided fact. It is also historically true that the duty of water has been increased with the increase of crop returns. This process of increase of duty under the old canals with consequent increase of irrigated acreage is still going on. The same conditions forcing the greater use of water exist now as then. The value of water is constantly tending to increase and hence it appears to me that what has taken place *is* past years *in* bound to continue and to increase for future almost indefinitely. Our lands, for instance, are worth $100 to $200 per acre. In southern France, for instance, even unirrigated lands are worth twice that much with less rainfall than we have and irrigated lands are worth a great many times what our lands are worth. Just so long as all these causes tend to increase the economy of water there will be a resultant progressive effect.

The Larimer County Canal of the Water Supply & Storage Company is about the only canal on which I have available data for illustration of ability to produce agricultural crops in Poudre Valley under economical management. For some years I kept a record of Cache la Poudre Canal but I have not those available. I

2325 also kept a record on Larimer County No. 2 and New Mercer Canal. I cannot give those figures exactly. This was 15 years ago. In case of Water Supply & Storage Company's Ditch, Laramie County Canal, we have a record of water uesd there kept systematically by that company for a series of years. That is best instance we have in valley. It is one of few instances where record has been kept, so that it is available. It has been kept with care.

Conditions on that ditch have been such as to exercsie constant

pressure towards economy. It used to be so especially. I have mentioned that people using water are apt not to have that economy unless they are constantly pressed in that direction. In 80's and 90's that ditch was somewhat pressed for water and this forced them to construct reservoir systems and forced them to bring water across the range. Exactly the same conditions forced them to be careful in their distribution of water and in carrying water and therefore constantly pushed towards economy. I think it is absolutely necessary towards getting economical use.

I have here the record of Larimer County Canal since 1895, up to and including 1911. That is inflow at headgate. The amount taken from river. That is measured or taken daily by gauge heights in rating flume. That flume has been rated at different times
2326 so that it is fairly accurate, and transfer of those depths into quantities is therefore pretty reliable. It might be said that this then includes the amount also that went into reservoirs, and while from any individual year totals might be affected by the fact that water is exchanged to some extent from some of their reservoirs, turned down into other ditches, and they might not have been paid back exactly, that is, the amounts might not have exactly balanced at end of year, if it increased one year it would decrease in the next, so that the aggregate for a series of years would do away with that. They might carry over a small balance at the end of the year and might receive a little more but it is practically eliminated in the course of a few years.

The Water Commissioner keeps a book account of all ditches and reservoirs and credits and debits the accounts against each throughout the season. He does of all those that use the stream in any way by their exchange. That is what I refer to in the matter of balances. When they exchange without going through the main ditch, where one trades with another, he at any rate doesn't usually keep track of that. It is out of his jurisdiction. He may do so in last few years, am not positive. They generally have separate man to keep accounts who is independent of commissioner and is paid by ditches. He does keep account of all that goes through river.

I have here amounts in acre feet for each of years under Larimer County Ditch and I may say those acre feet values I have obtained by simply multiplying cubic feet per second for one day by two, which is within less than one per cent of what it would be if we made careful comparison, and that inaccuracy would not be of any great note. In 1895 there were 6,520 acre feet, that included, I
2327 may say, December of that year, which of course went into the next year's storage. We have in 1896, 51,879 acre feet; 1897, 63,115; 1898, 29,843; 1899, 83,035; 1900, 65,110; 1901, 66,763; 1902, 46,191; 1903, 69,356; 1904, 63,665; 1905, 54,650; 1906, 79,955; 1907, 79,210; 1908, 63,664; 1909, 64,028; 1910, 42,986; 1911, 52,232. This means an average for this period of 60,928.

The acreage under that ditch has been throughout this time probably not less than 45,000 acres. I think it was stated in testimony in this case that it is figured about 50,000 acres. At any rate, it has been considerably in excess of 40,000 and would average some-

where between 45,000 and 50,000 acres. If we call it 50,000 acres for ease of division of the amount, that would then be an average of 1.2 acre feet at headgate. If it was 45,000 acres it would be .1 greater, that is, about 1.33 feet as the average depth. This system uses reservoirs and thus has that condition for using water to best advantage and economy. It is long ditch, something like 70 miles long. It has late water in season to considerable extent and it is also a system that has been practically on outside of irrigated region, that is, it is on boundary of irrigated region of Poudre Valley. Between irrigated section and unirrigated plains.

Larimer County has received during this time no benefit from return or seepage water from other canals. There is only one other canal above it and that is confined to upper end for a few miles. That is, north-Poudre System. There has been practically no seepage from that canal unless it has been within the past few years.

1.2 acre feet at headgate includes all water that has entered
2328 the headgate. So far as service to the land under canal is concerned, that figure includes all losses in transmission through the canal, all losses in distribution, all amount that has gone into subsoil and all wastes incident to distribution and transmission. It also includes evaporation from canal and reservoirs. The figures represent gross amount which could be charged to each acre of system at headgate before any of these losses have been deducted.

These figures represent duty of water under canal and measured at headgate under conditions as they existed. I do not have here any record as to losses occurring during carriage and distribution. I will obtain such records and furnish them later. I think they are at experiment station, but possibly I have a copy or index from which I could determine amount.

Larimer County Canal of the Water Supply & Storage Company in situate just beneath the Greeley-Poudre Irrigation District and forms for a great portion of its length the lower boundary of
2329 the district. Lines of district works are contiguous and similar in character to lines and works of Larimer County system. In fact these lands form a strip parallel and along the Larimer County Ditch for a great many miles. The strip is only a few miles wide. There are no essential changes in soil conditions or otherwise. The region is practically the same.

History of Larimer County Canal is in large measure a forecast of Greeley-Poudre System in matters of water service. It is a very good basis for judging what will take place in irrigation of the land. Lands under Larimer County Ditch are much the same as those under Larimer and Weld or under Greeley No. 2 Canals. I think they are fully as good as under the latter canals and certainly not inferior. Possibly taking drainage into account, I think they are as good and in many cases better, that is, some of the lands near river have become water-logged to some extent and lands further from river are less subject to that. That is only temporary damage, however, along that line drainage has been done in several cases by persons having land below who have made drain ditches for sake of getting water, or, in one case, it was done by public spirited Greeley

man who ran drain ditch at his own expense and sold the water. He derived some revenues from it but his idea was to demonstrate that it was a desirable thing to do and would justify expense.
2330 That was Governor B. H. Eaton. The water in that case was sold to other users for more than enough to pay for cost of ditch. He sold it for $5,000. Speaking again of Larimer County Canal will say that there is only a slight difference in drainage of lands under that canal and other canals mentioned. These general changes that took place in the raising of ground water which I have already described, affect the lands near the stream more than those at some distance, as water gets nearer the surface and that means there may be some per cent of the lower lands where water comes too close to the surface and needs to be drained.

The Central Lateral of the Greeley-Poudre Irrigation District's distribution system, testified to by Engineer Wortham and others, constructed for re-capture and re-use of water within the district itself in connection with Camfield and March Reservoirs located below and fed by that lateral, will tend to greater use of water in district undoubtedly. The Central Lateral is about 3 or 4
2331 miles from main ditch and thus there is strip 3 or 4 miles above it. Below that lateral is a strip of land 6 or 7 miles wide close to Larimer County Canal. Use of that lateral will be to capture drainage water above it and also waste water. Will also be available to use as distributing lateral, so I think there is no question it will aid in economy and the use of water, but I would hesitate to say it would increase over Larimer County Canal in so far as that one fact is concerned. It would tend to increase duty of water over what it would be without it. It is a very excellent part of the plan.

Judging from experience of other canals in Poudre Valley, it is safe to say that in course of time there will be more or less seepage ditches constructed in the large body of lands going to make up the Greeley-Poudre Irrigation District. As district develops and subsoil fills up with water, which will be the natural outcome, a large part of the water or most of it will undoubtedly be re-used within the confines of the district. Under Larimer County Ditch seepage and return waters appearing are used almost exclusively on lands
2332 below that irrigated by the canal. They are used under Laramie and Weld and Greeley No. 2 Canals. Laramie County Ditch in fact loses almost altogether the benefits of its own seepage.

Natural presumption of future use of water under Greeley-Poudre System as compared with Larimer County resulting from facts I have just described is that there would be a saving in water by the Greeley-Poudre System and utilization of water that is not utilized similarily under Larimer County Canal. The water thus saved would then be an additional use and a reduction of the average supply required and used, as compared with Laramie County Canal. The tests I have made in Poudre Valley show that about one-third of water that was taken out of ditches reappeared as seepage. This deduction was arrived at at time I published report on seepage and result of subsequent measurements, in course of publication, indicate

rather a larger percentage. I am inclined to opinion that the proportion of water which would return and reappear as seepage water within the large body of lands going to make up the Greeley-Poudre Irrigation District, may be judged by experience on other ditches.

As I mentioned in 1896 I concluded at that time this was about one-third of original water. I see no reason why there should not be as much as that returned from the waters of the Greeley-Poudre System

2333 because the conditions are very much alike. The upper portion of the district is so situate that a great deal of the water from that will reappear below the district, but on larger body of land will probably appear within borders of district. That is not a matter of conjecture entirely, because we know the conditions that are existing as a whole and we know the tendencies, so that I think the matter is only partly conjecture; that is, the extent of return and time could not be stated exactly, but we know pretty nearly from the similarity of other conditions. In answering your question a few moments ago about the Central Lateral I did not take into account the seepage. My latter answer was more nearly correct.

Crop production under the Larimer County Ditch compares very well with crop production under Larimer and Weld and Greeley No. 2 Canals. I could not give specific statements but in going over country under those ditches they show up approximately as well. The other two ditches mentioned are somewhat older in their development. The houses and farms are somewhat better developed and the farm owners have gotten a little further along financially, this shows to some extent. Under the Larimer County Canal they are as well if not better off than farmers under Larimer and Weld Canal were at same period of development. Latter Canal is a

2334 number of years ahead of the Larimer County Canal. There has been great increase under these three canals since I have known them by extension of canals and covering of additional acreage as I have previously mentioned. This has been accomplished by building laterals, by separate co-ordinate companies not part of the company managing main canal, but consisting of corporations of users who have combined together for distribution. Some of these laterals run 10 or 12 miles. Referring to the map, Exhibit 1, attached to the answer of corporate defendants, there appears the Pierce Lateral which is a lateral from the Larimer County Canal That does not extend much further east than the original ditch but is built parallel to the original canal and at a lower grade. It starts up ditch some miles and covers considerable territory eastward and parallel to Collins lateral. Collins Lateral begins at crossing of Union Pacific Railroad, between Greeley and Cheyenne, main ditch terminating at that point. On map it appears without designation as a continuation of Laramie County Canal. Physically it is continuation. The Larimer and Weld Canal was carried as corporate enterprise few miles east of railroad. That has been continued by lateral known as Owl Creek Lateral. It is 12 or 15 miles long and covers lands beyond Owl Creek. This has been brought under cultivation and when I was first over there, 20 years ago, that was undeveloped. This lateral appears on map as continuation of

Larimer and Weld Canal without distinction as to continuation, and forms part of boundary of Greeley-Poudre Irrigation District
Greeley No. 2 Canal, or Union Colony No. 2 Canal as it
2335 appears on Exhibit 1, has likewise been extended beyond original point of termination. This canal extends beyond two miles east of Union Pacific Railroad near Lucerne. Map shows continuation beyond that by two laterals which are not distinct from main canal. One runs to Crow Creek, a distance of about 15 miles. These have been built within last few years. They are not part of original construction and have been possible simply by the fact that same amount of water was capable of serving larger tracts as time went on. There is nothing to prevent reclamation of still larger tract- of lands under this canal. Just as far as the economies which have been mentioned prevail and as fast as land is filled up so that existing land does not take so much water and under the pressure of conditions such as have prevailed in past and prevail today, this extension undoubtedly will prevail. The same is true of the other canals I have mentioned. We find such conditions in history of Indian Canals. For instance, in construction of some of large canals that were built, in one case, the Chenab Canal was designed to cover 1,100,000 acres, and the engineers had recommended 1,200,000 acres. The administration thought they had better confine it to 1,100,000 acres. They thought that was all the land
the water would supply and it was only a few years after
2336 that same canal was extended after the filling in of the subsoil. They found that they could irrigate about 2,500,000 acres instead of 1,200,000 acres. They applied that idea in the planning of construction of more recent canals, wherein Colonel Jacob, Chief Engineer of these provinces, recommended that while they did not at the present time expect to supply more than 2,-000,000 or 2,500,000 acres, it would be planned to cover 5,000,000 acres, expecting it would not be many years before they could irrigate that much. These canals illustrate the same consequence and conditions that prevail in Poudre Valley.

There is no obstacle to prevent serving of large additional acreage east of Greeley-Poudre District in after years the same as under other canals. So far as canal is concerned there is very large body of land lying east of Crow Creek that can be supplied and would be equally as good if brought under irrigation. Consequently conditions there are favorable for extension and utilization for any water that may be spared with growth and economy in future.

Testimony as to crop productions generally, values of lands already irrigated, etc., in Poudre Valley might be some index of possible development of land east of Greeley-Poudre District at some future time. It takes it almost out of the realm of prophecy so far as this case is concerned and puts it on a basis of reality. Judging from history of other irrigation systems, irrigation of this increased area will occur without increased demand upon the water supply
from either the Laramie or Poudre Rivers. Experience of
2337 other canals indicate- that the area served can constantly increase after a few years. This will occur with same amount

of water. This subsoil at first takes up a great deal of water and after a few years there is no longer necessity for so much. These and other matters tend to increase effectiveness of water and therefore increases duty and increases acreage with decrease of amount of water used. There is no physical obstacle to increasing the acreage of the Greeley-Poudre District as future experience may prove provident. There is no legal obstacle to the natural extension and growth of the area after they get their supply of water and obstacles of that kind have been overcome and have disappeared.

Wyoming water rights are limited to a certain acreage. This probable increase of irrigated acreage would not be as rapid under the Wyoming system as under the Colorado system. There is no inducement under the conditions for a man to exercise economy and that has a great deal to do with the ultimate economy. While the doctrine making water pertinent to the land was quite popular among engineers a few years ago and looked pretty good, I will say myself, yet in seeing the effect on development in later years I am very doubtful of its wisdom, because it appears to me to serve as a brake on development of community in this respect.

2338 I have also had occasion to make measurements or collect data in several cases on Arkansas and South Platte Rivers. I had self-registering instruments on individual areas and have very often attempted to get data of canals where they were keeping records. These records were generally disappointing and some of records I kept of measurements are not available at the present time. I have here results of Fort Lyon Canal, a very long canal, in Arkansas Valley. I have 4 years' record of that canal. One is 1899 and the others are the last 3 years. They show in 1899 the total depth in irrigated area was 4.4 feet over an area of 40,000 acres, which was pretty close to the amount then irrigated. In 1911 depth over area was 2.95 feet; in 1912, 2.86; and in present year, 1913, 1.7 feet. These last three results are taken from official reports based on daily intake readings. They show quite a decrease in amount of water used which I think is a real decrease. Country has been filling up. We have that effect as well as the other effect of which I have spoken, that the lands have become more valuable and they are farming more carefully. Crops are worth more and so there is presence of these things which give economy. That is a mutual canal. It is a large one both in size and length. It is about 116 miles long. I think this record is indicative of the changes that are taking place.

2339 Amity Canal in 1899 I have a record of and also for several years previous but I do not have the recent years. Amity Canal is also in Arkansas Valley. Quantity used in those years is very much like that of Fort Lyon Canal. Headgate of canal proper is near Old Fort Lyon, just above Lamar. They used in 1897 4.8 feet; in 1898 they used 6 feet and also in 1899. Now they were then filling up the country. Many of the tracts that were then being irrigated were not contiguous. They were isolated. Hence conditions were such that the amounts would be excessive. From what

I know of situation, I know amount now required is less, but I do not have figures.

If amount of water heretofore used in Poudre Valley for filling up subsoil remained in subsoil instead of gradually running away, so that it finally came up to surface, it would tend to lessen room for more water and lessen amount that would need to be supplied. It would finally tend to destroy some of the land.

Reservoirs have been constructed for supplemental supply to Greeley No. 2 canal and other canals. The increase from this source is not so great as the increase of acreage brought about by greater and more economical use of water.

2341 HIRAM TIMOTHY, a witness for defendants.

Direct examination by Mr. Charles F. Tew:

Have resided at Greeley for 12 years past. Am agricultural superintendent for The Great Western Sugar Factory at present. Was agricultural superintendent at Sugar Factory at Windsor and Eaton and also at Fort Collins. The company I mentioned is corporate owner of all beet sugar factories in Cache la Poudre Valley. Prior to coming to Greeley was engaged in sugar beet business in Rocky Ford, Colorado, for 2 years, in service of The American Beet Sugar Company in Arkansas Valley. Prior to business in Arkansas Valley was in sugar business at Lehi, Utah, about 9 or 10 years prior to that.

2342 23 years ago last November, I started with beet sugar companies. During last 2 or 3 years that has been my principal business. I am in charge of field work.

My business is to hire field men. We have crew of field men for each factory. I have 4 at Greeley, 5 at Eaton, 4 at Windsor and I think 6 at Fort Collins now. My business is to look after these men, shape up business for them and help them instruct farmers how to prepare land and raise sugar beets. During time I was engaged in sugar beet business outside of Colorado was engaged in same branch of work. While engaged in this work we pass over the area devoted to beet culture every week. For illustration, it takes 830 miles riding just for the Greeley factory alone to see every field of beets. I have 4 men riding that route continuously and I aim to take a trip over it once a month with the field men. We travel by automobile entirely.

Also have superintendence of harvesting, gathering, weighing and transporting beets to factory. Have charge of delivery of raw material.

2343 Superintendents held responsible in every mill for raw material. I keep in touch with different dumps and receiving stations. I hire all the men. I also have superintendence of the department which has charge of disposal and utilization of by-products. Pulp and molasses are fed to cattle. Some of it is carried away. Scope is getting wider every year, with both molasses and pulp. We have men hauling pulp now 12 miles from our factory. In former years they would only haul it 2 or 3 miles.

Pulp is solid matter of the beet. It is a valuable stock food for

cattle and sheep. Many thousand cattle and sheep are fed each winter at these factories.

The molasses used for feeding is a refuse from juice of beets. It is that part which will not granulate. It has about 52 to 54 per cent purity but it is a class of molasses that will not granulate. We use this molasses for cattle feeding. Feed it directly on the pulp. Some cut their hay and spray it on the hay as the hay is
2344 cut. We feed most of molasses on pulp at time of feeding.

I am continually observing crop returns under different methods of agriculture. That has been my duty and practice through 23 years I have been engaged in sugar business. The factories in northern Colorado controlled and operated by Great Western Sugar Company are high class factories. They are more efficient than any factories I know. They keep them up better and spend more money on them annually. They carry on constant experiments to determine cost of production and ways and means of economy in culture of beets, in harvesting, in saving of sugar and in methods employed. At Greeley factory we have not been trying to experiment, but have an experiment station at Longmont and one at Sterling, where a great many thousands of dollars are expended annually in experiments. All of us go down and visit these places once or twice a year. The object of these experiments is to save cost to farmer, so that he can produce beets cheaper and avoid thinning them. We tried 200 acres this year. We plant beets and
2345 go across them with cultivator, simply taking pulverizing harrow and not thinning them at all. We tried this and after harvest ran them through factory to ascertain cost and value of crop. If thinning were eliminated it would save $6 per acre. That would be quite an object on 150,000 acres of land. We make experiments to assist farmer to obtain highest results both in crops and returns. We have men hired for that purpose to visit every field. I think I can advise a man how and on what land to raise beets to make a success of the business. From my experience I am able to make a comparison of the worth of lands for raising sugar beets. Am acquainted with season required and character of climatic conditions necessary for successful beet culture. Have also taken statistics from other factories. Have tried experiments in high countries and low countries, hot countries and cold countries.

2346 Fort Collins, Windsor, Eaton and Greeley factories are all situate within irrigated territory known as Cache la Poudre Valley. Major portion of beets for Greeley factory comes from Platte valley.

I can give you exact tonnage for years 1912 and 1913 received at different factories. Can also give number of acres of sugar beets tributary and delivering their product to the four factories in Poudre Valley. They are as follows:

1912, Fort Collins, 12,348 acres;
Eaton, 10,480 acres;
Greeley, 10,088 acres;
Windsor, 10,348 acres.

This makes total of 43,242 acres supplying beets to these four factories for 1912.

For 1913 acreage was as follows:

Fort Collins, 14,392 acres;

Eaton, 16,597 acres;

Greeley, 11,489 acres.

Windsor, 13,401 acres, making total of 55,879 acres.

Average sugar content in those beets in 1912 obtained from different areas described tributary to several factories *are* as follows:

Fort Collins, 16.61 per cent saccharine matter;

Eaton, 16.84 per cent;

Greeley, 17.009 per cent;

Windsor, 16.30 per cent saccharine matter.

Average saccharine content for 1912 for four factories was 16.71 per cent.

Sugar content in beets received in four factories for 1913 was as follows:

Fort Collins, 15.38 per cent;

Eaton, 15.72 per cent;

Greeley, 15.27 per sent.

Windsor, 15.53; thus making average for all four factories of 15.47 per cent.

Average price per ton paid in these years from the different factories was as follows for 1912:

Fort Collins, $5.92 per ton;

Eaton, $6.05 per ton;

Greeley, $6.10 per ton;

Windsor, $5.87 per ton.

For 1913 Fort Collins paid $5.53 per ton;

Eaton paid $5.56 per ton;

Greeley paid $5.51 per ton;

Windsor paid $5.51 per ton.

The average price for 1912 for four factories was $5.98; for 1913 was $5.53 per ton. In 1912 our silo beets were included in the figures of $5.98 per ton, and in 1913 that has not as yet been figured, but we have the figures $5.53 without the silo. The contract with each farmer provides that they shall silo 25 per cent of the gross tonnage. In 1912 it brought that up a little higher. This
2348 year it is not yet figured in average price. The variation in price described between 1912 and 1913 is in part due to fact that silo portion of crop is not included in estimate for 1913. We agree to pay $.75 per ton in addition for siloing sugar beets. We find that in Northern Colorado it is necessary, owing to our heavy tonnage, to have farmers take care of 25 per cent of crop because we only have about 65 to 75 harvests days' time and if we pile them all up at the stations they will heat and spoil. We contract with farmer to silo 25 per cent of beets so there will be that per cent retained on farm until we need them. We pay 75 cents per ton extra for that work.

We expect to start our factories by October 1 each year. Length of season in grinding beets depends upon quantity of crop. It gen-

erally terminates about January 1. During that time the
2349 factories operate day and night. They never stop until we are through. Do not know how many men we employ at Fort Collins. Greeley factory has 338 men on payroll to operate the mill. This includes dump men. Greeley factory has 10 dumps. Windsor has about 15 dumps. Other factories I have mentioned employ more labor than Greeley factory.

Average yield of beets per acre in 1912 for Fort Collins factory was 12.08 tons; for Eaton was 15.40; for Greeley was 12.07; and for Windsor was 13.45 tons. The average for 1912 was 13.25 tons; in 1913 average yield was as follows: Fort Collins was 11 tons; Eaton 13 tons; Greeley 12 tons; and Windsor 12.98 tons. The average for 1913 was about 12.78 tons per acre.

The total number of tons of beets harvested for these factories for 1912 and 1913 is as follows:

1912 Fort Collins 149,232 tons;

Eaton 160,965 tons;

Greeley 121,727 tons;

Windsor 138,931 tons. Total 570,865 tons, that is the four factories in 1912.

In 1913 the four factories harvested as follows:

Fort Collins, 158,165;

Eaton, 217,899 tons;

Greeley, 137,484 tons;

Windsor, 173,911 tons; making total of 687,459 tons.

The average yield per acre for the years 1912 and 1913 includes all acres both good and bad. On high class land the tonnage runs quite a bit higher than that I have mentioned. Am familiar with the quantities and location of the land which gives higher crop returns. The Greeley average of 1912, 12.07 tons per acre, includes the Platte Valley area as well as the area tributary to the Greeley factory in the Poudre Valley.

The Pleasant Valley territory north of Greeley is the most productive land farmed in connection with any
2351 of the factories I have in my charge. That is in the territory of the Eaton factory. As field superintendent I have become acquainted with the lands in general which are within the confines of the Greeley-Poudre Irrigation District. I have been over them. The soil in the lands of this district is a lighter than the Pleasant Valley soil. In my opinion, the soil in the district would be more productive. I believe there is a little more sand in
2325 it. It is a sandy, clay loam, while the other down here is more of a clay loam. The Greeley-Poudre District lies adjacent to the territory of the Eaton factory. Generally speaking the two are similar. The difference in elevation would not be observable.

The Cache la Poudre Valley is superior to the Arkansas Valley for the culture of sugar beets. It produces 2 to 3 tons more per acre. The San Luis Valley only produces 6 or 7 tons per acre. This is at a higher elevation than the Poudre Valley. I attribute the short return to the high altitude. The season is too short. The

Cache la Poudre Valley is superior to any of the land along the Platte Valley.

2353 Made investigation of land on Laramie Plains to determine adaptability of such lands for successful culture of sugar beets in company with other officers of the Great Western Sugar Company. Parties there wished to raise sugar beets and we made an investigation of the territory. I cannot remember the names of the parties, but we were invited up there by a little farmers' club, at Bosler, Wyoming. We were invited to stop at Laramie. Bosler is station on Union Pacific on Laramie Plains. I went to Laramie on train and took automobile from Laramie to Bosler in company with Mr. S. M. Edgell of Greeley factory, and Mr. C. H. Turner, superintendent at the Eaton factory. I

2354 cannot find any records of the date. It was about February 1, 1911. Went to Bosler, Wyoming, by invitation of farmers. They wanted us to give them district to raise beets and furnish them man to help raise them as we had in other districts. We went up and held meeting and next day went out to inspect land, with understanding if we thought land and climate suitable, would send seed up to those farmers and send man up there to help them prepare land and sow beets. In going over territory next day we found that land in my judgment was of nature that we could not recommend it to our company. It was also far away from the factory and we did not ship any seed up there. It is an adobe clay land on the low lands and has heavy gravelly clay on the upper lands. It was unbroken and uncultivated at that time, the greater portion of it. We did not think the land was fit for sugar beets, besides we found that the season was too short to mature sugar beets. The altitude of 7,000 feet would not have made any difference if the season had not been too short. The season however, was too short, whether due to altitude or other conditions.

Stopped at Laramie on account of invitation to stop there

2355 and see real estate men and also in order to arrange hotel accommodations. In journey from Laramie to Bosler noticed character of territory. Noticed land. That was our business up there. The Laramie Plains are not fitted for successful culture of sugar beets. I would not plant them. It would be pretty hard to compare the Laramie Plains with the Cache la Poudre Valley. There was very little humus in the soil. The germination of the seed would be almost impossible. We did not wish to open up a territory and induce farmers to raise beets when, in our opinion, the proposition would prove a failure. I reached this conclusion on more than 20 years experience in raising beets in several states.

2356 The number of cattle and sheep on feed at present time consuming by-products at Eaton and Greeley sugar factories are: At Eaton there are feeding today 4,394 head of cattle and 63,850 head of sheep; at Greeley, 5,504 head of cattle and 35,456 head of sheep. There are more than twice as many sheep and cattle on feed at Fort Collins than at Greeley. They are feeding about as many sheep and cattle at Windsor factory as at Greeley factory.

All of these sheep and cattle are fattened for market. As soon as they leave the factory they will go in for slaughter. Num-
2357 bers that I have given are those of the stock that first came in. They are refilling their corrals to finish the season. Those feeders who come in early are able to feed more than one consignment during the winter. These cattle and sheep are fed in corrals and feeding pens established near the factory. In addition to that a number of other cattle and sheep are fed at places remote from the factory.

Sugar factory by-products are very valuable for stock feeding. Considering the price, they are superior to corn. For this reason, they are largely fed. They do not feed corn so long as they
2358 can get pulp and molasses.

Tonnage of beets was less in 1912 than in 1913. This was on account of the shortage of water and a very hot August. August is month when beets grow the best. Lack of sunshine in ripening season of beets effects sugar content. We do not have sufficient lack of sunshine in Colorado to affect the crop.

I will describe process of production of sugar beets from planting to reduction for sugar. I have assistants called field men.
2359 We go out and contract beets. We contract our acreage in February. We purchase and furnish the farmers the seed to plant. We ship that to them in March. We obtain the seed from Germany. The seed costs the farmers 10 cents a pound. We wait on them for our pay until the harvest of the crop. At the time of plowing land, we send men out to show them how to plow and to select best land on farm. Every year we have new farmers. Field men show farmers how to level and roll land. We furnish drills for every man who does not have one or who does not have opportunity to get one from his neighbor. We instruct how to plant. Planting generally begins about April 10. At that time our field men have to be on duty day and night. They use automobiles. We expect beets to come up in 10 to 15 days after planting. We then cultivate beets as soon as possible, preparatory to thinning. It takes both heat and moisture to germinate the seed. If the climate is cold and windy the seed will lie in the ground. If it lies too long it will rot. If it is continuously cold the seed will fail to germinate. Continuous wind would dry the ground and blow the soil away. When the beet sprouts it is a very tender plant.
2360 The wind would probably kill such plants. It would cut them off.

Our next step is to find the hand labor for thinning the beets for the farmer. The farmer pays $20 per acre for all hand labor on the crop. The hand labor consists of blocking and thinning, second and third hoeing, and in the fall the pulling, piling and topping of the beets.

Beets are planted in one continuous row. 20 pounds of seed are planted per acre and as result we have seed to every inch in each row, and every pod has anywhere from one to six germs and they come up thick in the row and have to be thinned and hoed
2361 so that there is one plant from every 7 to 10 inches. The plants are thinned out so that the beets will grow to large

size. Beets are first blocked with a hoe and left in little bunches and then thinned by hand. One beet is left in each place. We leave them 7 inches apart in the row on good land and 10 or 12 inches on poor land. By good land I mean such land as lies north of the Poudre River. It requires about six weeks to finish the blocking and thinning. The beets are not irrigated during this time except in rare instances where the subsoil has dried out.

2362 After thinning, cultivation comes next. Irrigation begins about first week in June. The beets are hoed and the weeds kept out. There are three hoeings. Contract provides that all weeds that grow must be hoed out or taken out by hand. Weeds are kept out to harvest time. Cultivation of beets is with machine cultivator, generally taking four rows. There are about four cultivations during season. After cultivation the beets are furrowed out and

2363 irrigated, then recultivated and re-furrowed again. Beets are irrigated about four times during the season. This varies some with the land.

Beets are laid by, as a rule, by August 1st. Then growing season starts. Sometimes they are laid by July 15th. In forepart of September we take samples diagonally across field to ascertain whether beets are ripe and whether or not they will go 15 per cent sugar. We hardly ever order beets to the factory that do not go 13 per cent sugar. If we need beets badly we order in 13 per cent beets. We send out written instructions to farmers to harvest their beets when we find them testing up to a certain per cent. These orders simply give the farmer the right under his contract to proceed to harvest. He is not bound to do so. It is optional with him

2364 and he may wait if he desires. This depends upon his convenience.

When I used the term "laid by," I referred to the time when work was completed on the crop. The foliage has grown to such an extent that it would be a detriment to put a team into the field because it would break off the foliage. The foliage will fill the rows. These rows are about 18 to 20 inches apart. Water passes down between the rows in irrigation. Beets are not flooded during irrigation. Flooding of beets is injurious. Dirt must be kept away from crown. After leaves once reach the sunlight covering them up rots them. Flooding would tend to seal the crowns over.

Majority of work of pulling and topping beets is done with two-horse plow, what they call a digger. They have different kinds of such plows or elevators. The plow leaves the beets standing

2365 in the row all loosened. The hand labor piles the beets up in piles from 12 to 18 feet apart. They throw them on a place cleaned for that purpose. The hand labor then removes the tops with a large knife. These knives are made for this purpose. They pick up a beat and chop off the top, throw the beets in the pile there and tops in a pile here. Topping has to be done in a certain way, cutting off top below base of bottom leaf. Beets must be taken by hand and topped with a knife. Most of this labor is done by contract. It is a part of the labor included in the $20 per

acre contract. Hand labor begins with thinning and ends
2366 with topping of beets. It includes the labor included in pulling out the beets and piling them. This hand labor averages $2.62 per day for time actually employed in their work. These figures include men and women and children 12 years old and over. These children do the thinning after the hoeing. A great many make $4 or $5 per day.

After the topping and throwing into the piles the beets are then loaded onto large wagons provided with large beds made for the purpose and are hauled to the dumping stations. At each
2367 dump station there is a weighman or weigh officer for the factory. We have several employes there to receive beets, to weigh them, tare them, and then dump them. A man to move cars and a dirt man to wheel away the dirt that falls from the dumping.

Tare is obtained by putting beets into baskets and weighing them. They are then cleaned and weighed back and what is lost in weight is the tare.

The wagons are built about 15 feet long, 6½ feet wide. They come out over the wheels but have a flat bottom and for that reason the beets fall out as we dump the wagon with the dump. This character of beet bed is manufactureed in Greeley. It is especially prepared for the purpose.

Our dumps are constructed 18½ feet high and the approach is 220 feet long. Some approaches are 250 feet long by reason of going up a little grade There is a landing on top of the dump of 40 feet. It is a flat surface with a dump there. We have two kinds of dumps; one works with a lever entirely by weights, while the other dumps automatically. You drive on and there is nothing to push it over or push it back. It has a rocker rollway. It rocks over and dumps the load, and when it has dumped it tips right back. The wagon goes with it. The labor of hauling
2368 and dumping the beets as well as of loading the wagons is done by the farmers. It is invariably the case that we do not have enough cars to carry away the beets from the dumps.

At the various beet dumps we had piles of beets of about the following tonnage during this last fall:

Eaton factory, 55,000 tons at dumps;
Greeley, 37,000 tons;
Windsor, 40,000 tons;
Fort Collins, 60,000 tons.

These piles are about 9 feet high and they cover from 400 to 500 feet in length and from 150 to 200 feet wide. We had one
2369 pile 9½ feet high and covering a city block. We had 5,000 tons there. This piling is in excess of that portion siloed by the farmers. Siloing beets means that a man will take 25 per cent of his crop and pile it in piles in his fields or along some road close to his field and cover the pile with dirt to protect it from frost and sun and will deliver them as we call for them not later than January 31. After October 10th, the farmer may dig the beets as fast as he chooses. Prior to that time we expect to grind the

beets as fast as harvested. After October 15th the farmers harvest their beets faster than we can take them.

2370 Beet tops are a valuable feed for stock. They commonly sell for $2.50 to $6 per acre. They are fed to cattle, sheep and horses. They are used for fattening purposes. I have known sheep and cattle to be fattened upon beet tops alone.

After beets reach factory they are stored in large bins before being sliced and reduced to sugar. At Greeley the wagon sheds

2371 have a capacity of 9,000 tons. We have three railroad tracks, high lines, with capacity of about 12,000 tons. They are about 440 feet long.

In bottom of each bin we have what we call a flume or sluiceway covered over with boards. Beets are loose and lying on top of flume. Two men take boards up with steel hooks and the beets roll down into flume. Water is running in flume and beets float into factory. Flumes are made of cement. They are 22 inches wide by 32 inches deep. From the time the factory starts these flumes are kept in continuous operation in carrying beets. Just one flume delivers beets to the mill at a time.

In the mill the beets go into the washers first, and then into the cutters. This department of work is one with which I have not been directly connected.

My specialty for 23 years has been growing of beets and supervision of harvest. My attention has been devoted to that branch of the industry, concerning planting, tillage, irrigation, harvest and delivery of beets to mill. This includes selection of soil and judging of character of soil fitted for beet culture. The conclusions I

2372 have given are based upon experience in practical operation of beet culture. I do not pretend to give technical knowledge.

Cross-examination by Mr. N. E. Corthell:

2372 The one visit I made to the Laramie Plains in connection with agricultural questions was the visit to Bosler in February, 1911. I was there for a part of two days and took soil samples at different points in that neighborhood. The price paid by the Sugar Company for beets in 1913 was the same as paid in 1912. The contracts made for 1914 are upon a lower basis, the farmer receiving 30 cents a ton less, the laborers 17 cents a ton less, and the Company losing 40 cents per ton, that is, about 87 cents net difference per ton, compared with 1913. I can give no definite answer to the

2373 question as to whether it is generally conceded by the sugar companies that the industry will cease to exist in about three years.

2374 L. G. CARPENTER, recalled.

Direct examination, continued.

By Mr. Delph E. Carpenter:

I have with me results of some tests of duty of water in Cache la Poudre River in last decade or in early 90's. I have some of

records that I then took in Poudre Valley in case of Greeley No. 2 Canal for three successive seasons.

Depths of water used measured at the headgate were as follows: In 1890, 1.86 in depth; in 1891, 1.59 in depth; and in 1892, 2.09 feet in depth. Greeley No. 2 Canal is the one that is least likely to be economical in use of water. These figures are for water taken in at headgate. I had self-recording instruments and checked with depth and tested it every week during season.

Have record of Larimer and Weld Canal for 1892. This canal lies between Greeley No. 2 Canal and Lorimer County Canal. In case of Larimer and Weld Canal for that whole season, depth of water used was 1.49 feet measured at headgate.

For many years I kept records at Cache la Poudre Cañon. Depth use for whole valley for year 1892 was 1.25 feet from May to September. If we include all of September it made 1.30 feet in depth over whole valley. This does not allow for the water that went out of the valley at the mouth of the Poudre, so if that were taken into account it would be reduced somewhat. We don't have records at that point of the amount. In some years discharge from mouth of Poudre was considerable and in every year there was some discharge and in times of floods the discharge would be considerable. I could not answer as to any specific year. It is almost universal for the Poudre River to discharge water from its mouth from June floods. It is common for large amount to be discharged at times, and even in low water there is considerable water flowing from seepage. In the last figures that I gave, am not taking into account the water that went out of the mouth of the stream. I am taking the river as it came out of the cañon and not deducting the amount that escapes from the river. There is a constant discharge from the mouth of the Poudre River the year around. These measurements were made in the 90's. Since that time there has been a tendency to constant gain in the duty of water in the Poudre Valley because of greater economy, filling the subsoil, and greater skill in the use of water. The same quantity of water serves more acres in subsequent years than it did prior to the 90's.

Cross-examination by Mr. N. E. Corthell:

2376 The existing ditches and reservoirs in the Laramie Valley might perform the same functions in an exchange system as the ditches and reservoirs in the Poudre Valley, this being more a matter of personal enterprise and cooperation than of physical situation. All of the principal ditches from the Poudre River were commenced before 1880 excepting the Larimer County Ditch which was started about that time, and the North Poudre Ditch and the Poudre Valley Ditch, started still later. These last two ditches represent from about 12 to 15 per cent of the capacity of the Poudre Valley ditches. Some of the other ditches, constructed prior to 1880 have been increased in capacity since that time. I presume
2377 that the ditches constructed since 1880, together with the enlargements of other ditches, have added 25 per cent to the

carrying capacity of all the ditches in the Poudre Valley, but I am unable to give any definite figures as to the extent of increase. In addition to these new structures and enlargements there are several new diversions going to the various reservoirs.

2378 The larger part of the extension of the area brought under irrigation since 1880 is due very largely, but not entirely, to the extension of previous ditches or building of laterals therefrom. That does not include the area under the North Poudre canal, which is all new since that time, and some under both the Larimer County and the Larimer and Weld canals.

Since 1880 the area has increased from about 35,000 acres to 270,000 acres, an increase of about 800 per cent. The 1880 data I took from statement of Captain Boyd, which I presume to be

2379 correct. The first part of the decade of which I have spoken, from 1880 to 1890, was largely new land under new canals, including that under the Larimer County and the Pleasant Valley & Lake Canals. Am more familiar with the extension after 1888 than from 1880 to 1888. From 1880 to 1890 there was an expansion of about 135,000 acres. The increase due to expansion of existing systems has come largely since 1890.

In 1890 there were existing ditches in Colorado which had made contracts for duty of one cubic foot per second to 55 acres. The Wyoming statute limiting one cubic foot to 70 acres of land was adopted a little later. I heard some of the discussions leading

2380 to its adoption. I came to Colorado to succeed Professor Mead, who went to Wyoming, and this was one of the early questions I heard discussed, and they are speaking of fixing the duty of the newer ditches at one cubic foot per second to every 80 or 100 acres. The standard of one cubic foot per second to every 55 acres was used in a group of ditches constructed by the English company, i. e. the Highline and the Larimer & Weld, which started ten years before. That was not the starting of new contracts. It was not the prevailing standard for existing ditches in 1890, as most of the ditches were mutual and there was no quantity specified in any of those cases. In cases of ditches which were then being, or had then been built in the Arkansas Valley, the unit was one cubic foot to 80 acres, representing more economic use than one cubic foot to 55 acres. Those having the latter unit were not in the majority.

In 1890 three canals in the Laramie-Poudre Valley were selling water rights, and I could not say what their standard was. About that time, two of them became mutual ditches.

2381 The figures I have given relative to the weight of water required to produce a pound of air-dried matter in agricultural crops is not the result of actual practice, but of experiments made with a very small area, such as a pot or a tub, and all waste is eliminated.

2382 My figures showing amount of water diverted and applied by Water Supply & Storage Company in years 1895 and to 1911 or '12, cover just amount taken into canal at its headgate and not amount of water available in stream each year. I think they took practically their full need at times in most every

year, but, of course, like other ditches in that valley, they cut down as the demand decreased. They do not attempt to run constant quantity, and I don't know whether, in some years, there was shortage of water which prevented the canal from taking its full quota. I presume they would have taken more than they actually did, because that is the custom of every man who takes water. I would not say that in each year they took all they were entitled to, but I have no doubt that at times they wanted more water. I noticed in 1897 they drew as much as 468 cubic feet per second at one time, but they dropped down very rapidly after that, which was likely due to shortage in stream, but, at the same time, they evidently supplemented their direct supply from the river with water stored in their reservoirs. My figures have been taken from record kept by the company, with which I have had nothing to do.

2383 The return flow measurements taken under my direction in the Poudre Valley covered each year from 1889 to 1895, and measurements were also made one or two years prior to that time by other persons. My conclusion was that about one-third of the water used in irrigation returned to the stream, and the return flow has increased since that time possibly to two-fifths of the amount diverted.

2384 It is frequently the case that the amount of water taken by a ditch is limited by the supply and not by the necessity of the land, and the duty of water cannot therefore be ascertained solely from data as to the amounts used, it being necessary to consider whether the crops secured have been good or poor. I have known of cases where reports have been made of the irrigation of a very large acreage with a very small supply of water, but the crops were not successful so that such cases are not a proper basis for determining the duty of water.

2385 Relative to the year 1892, it would appear that the stream flow in the Poudre was below normal, being about 70 per cent of the flow of 1891, but I do not have figures with me to determine what the normal flow of the stream is nor what percentage of the normal flow occurred in 1892. My determination of the amount of water in the river that year was taken from measurements made at the head of the valley, and did not take into consideration the return flow along the course of the river.

Cross-examination by Mr. John D. Clark:

2386 Where there are leaky dams and inadequate diversion works, it would indicate that the pressure for water has not become so great as to require the diversion of all of the water available at the particular headgate. There may, of course, be some such diversion works and there are some such along the upper Poudre, but such ditches have to permit some water to pass by to supply prior appropriators. Where the earlier and larger priorities are at the lower end of the river so that the upper ditches must

necessarily permit a large amount of water to flow past their
2387 headgates, the condition of the diversion works in the upper ditches is not so much indicative of the pressure of water upon the stream. This might be true upon the Laramie River in Wyoming if the priority of the Wheatland project is among the early ones on the stream.

(End of Transcript Vol. 5—Defendants.)

2388 E. B. HOUSE, a witness in behalf of defendants.

Direct examination by Mr. Fred Farrar:

Have lived at Fort Collins since 1896. Professor of civil and irrigation engineering at the State Agricultural College. Was born at Evans, Colo. Evans is 4 miles south of Greeley, Colorado. It is 4 miles from mouth of Poudre River. It is located near Platte River. Am 42 years of age. Received public school training at Greeley, Colo. Moved there when *was* I was 6 years old. Received college education, one year at Western University of Pennsylvania and remaining three years at University of Michigan at Ann Arbor. Took engineering course leading to bachelor of science degree, and electrical engineering, taking my electives along line of civil enginering so I had only a few credits necessary for degree of civil engineer. Prior to moving to Fort Collins my home was at Greeley.

I have been acquainted with Poudre Valley throughout my
2389 lifetime. Became connected with agricultural college in 1896 as assistant professor in mathematics. After a few months was made professor of mathematics and held that position for 9 years. Was made assistant professor of engineering under Prof. L. G. Carpenter. Held that position 5 years and then was made professor of civil and irrigation engineering. This is my fourth year in that capacity. I succeeded Prof. Carpenter in that position.

My work as professor of civil and irrigation engineering takes me to experimental work. I have charge of experimental work connected with department of civil and irrigation engineering. Colorado Experiment Station is associated with the Agricultural College. That station is maintained by state with aid of government appropriations through Hatch and Adams Acts and also cooperates with government in certain other lines of work. Have been conducting experimental work along a number of lines. Investigations into problem of measuring water, concerning drainage of land, concerning growth of crops with varying water tables, and concerning amount of water consumed by growing plants of different kinds and varieties. These experiments and observations are not limited to immediate vicinity of college. Some of them are located in different portions of state. The work is state wide in its scope. We constructed special laboratory for purpose of determination of flow and measurement of water. Work has been proceeding there for last year. College constructed laboratory which has been

run in connection with Government cooperation. College and Government each pay one-half of expense. Laboratory is under my supervision. Laboratory was constructed for purpose primarily of making investigations of flow of water over weirs as they are constructed, although laboratory is rather elastic and can be used for other purposes. It is designed, among other things, to permit working out of more accurate or new formulas for measurement of water over weirs.

2391 My work takes me into other portions of the state as consulting engineer or in advisory capacity frequently. Have had observation of irrigation matters throughout the state.

In case of State of Kansas vs. State of Colorado in United States Supreme Court, was assistant under Prof. Carpenter who was then State Engineer.

Have had practical experience in irrigation. Worked on farms belonging to my father near Greeley as a boy. Grew up surrounded by practical irrigation and did a good deal of it myself. Have been in position to observe development of Poudre Valley District for last 35 years.

Have made study from governments reports of size of crops, crop return, population, temperatures and other matters that might pertain to agriculture in counties of Larimer and Weld in State of Colorado and Counties of Albany and Laramie in State of Wyoming. Sources of information are U. S. Census reports and from Meteorological Reports of U. S. Government. These are official re-

2392 ports. Have made a diagram showing size of these four counties.

(Defendants' Exhibit 86, a blue print, offered in evidence.)

Defendants' Exhibit 86 is that diagram showing relative size of these counties. Obtained area in square miles from U. S. Reports. Diagram shows area of Laramie County, Wyoming, to be 6,992 square miles. That is the county as it was prior to 1910, containing I believe, Platte, Goshen and Laramie Counties as they are now situate. Whenever I refer to other plats in my testimony and speak of Laramie County I refer to Laramie County, Wyo., as it existed prior to 1910 and before the counties of Platte and Goshen were cut off.

In Exhibit 86 I show Weld County, Colo., to contain 3,918 square miles. That is present area of Weld County. It has been area since 1889. The original Weld County is shown by finer line to right generally of diagram representing Weld County at present.

2393 Morgan, Logan, Sedgwick, Phillips, part of Yuma and part of Washington Counties and present Weld County are all included in the original Weld County. There are seven new counties in whole or in part within original Weld County.

Original county of Larimer, Colorado, was divided in 1909. Jackson County was cut off. Jackson County includes that portion of Colorado commonly known as North Park.

Albany County, Wyo., runs through the diagram without changes. Have made diagram showing population of Weld and Larimer

Counties in Colorado and Albany and Laramie Counties in Wyoming.

(Defendants' Exhibit 87, a blue print, offered in evidence.)

Defendants' Exhibit 87 is the diagram mentioned. It includes decades from 1870 to 1910. On this diagram, population of Larimer and Weld Counties is represented by solid line and that of Albany and Laramie Counties by dot and dash line. Data obtained
2394 from United States Census reports. In 1870 population of Larimer and Weld Counties in Colorado, combined, was 2,474. Combined population of Albany and Laramie Counties in Wyoming was 4,978. The diagram contemplates the undivided county of Laramie, Wyoming. In 1870, Weld County was also undivided.

From line which designates year 1880 I have upper line labeled "population of Colorado counties if original area considered." That line shows population of Larimer and Weld Counties in Colorado including the counties which were taken from them. The other line, the solid line, shows growth in population in Weld County as it existed at that time, so whenever it was divided it was, of course, cut down some in population, but there was enough growth to more than make that up.

In 1910 population of present area within Counties of Larimer and Weld in Colorado was 64,477. Combined counties of Albany and Laramie, Wyo. (with Laramie County including present counties of Platte and Goshen) is 37,701. Both Wyoming and Colorado areas show increase of population. Wyoming counties are larger in point of population of 1870. Their increase in population
2395 has kept pace with Colorado counties until last 10 years. Within last 10 years Colorado counties have gone ahead. In 1900 Wyoming counties were ahead of Colorado counties in population, that is, total population; but in 1910 reverse is true. Very rapid increase took place in Colorado counties. By population of Colorado counties I refer to smaller areas of present counties. If original areas were taken population of Colorado counties goes beyond population of Wyoming counties between 1880 and 1890.

Weld County, Colorado, is at present a little smaller than Albany County, Wyo. The difference is a little less than 500 square miles.

Have diagram showing population of the two counties in comparison.

(Defendants' Exhibit 88, a blue print, offered in evidence.)

Defendants' Exhibit 88 is the diagram showing population of two counties in comparison. Covers decades from 1870 to 1910 inclusive. Divided area of Weld County is shown. Albany County, Wyo., had larger population in 1870. Population was, 2,021.
2396 Weld County, Colo., was not divided at that time, and had population of 1,636. Line showing division of Weld County commences at point indicated in years 1880. Leaving larger area of Weld County and referring to restricted area, Weld County was

larger in population in 1910. Weld County had 39,177 and Albany County, Wyo., 11,574.

There was decrease of approximately 1500 in population in Albany County, Wyo., from 1900 census to 1910 census. There has been no decrease in population of Weld County since 1870. Population of Weld County has increased since 1870 regardless of division of county. Increase greatest between years 1900 and 1910. Each decade has produced a more accelerated increase in Weld County with exception of decade from 1890 to 1900. During that decade growth was not quite as steady, although it continued pretty well. The increase in Weld County, however, was greater in proportion to population than increase in Albany County, Wyo.

2397 Have made examination of census reports for purpose of determining rural population, taking counties of Larimer and Weld as one in Colorado and counties of Laramie and Albany in Wyo. as one.

(Defendants' Exhibit 89, a blue print, offered in evidence.)

Defendants' Exhibit — is the diagram showing the rural population. It covers decades from 1870 to 1910.

In 1870 Wyoming counties had larger rural population. Rural population in Wyoming counties was 2,700. Rural population in Colorado counties was 1,994. In this diagram have also shown original area Weld County. Eliminating that and referring to present area of Weld County and also County of Larimer in Colorado, rural population of those counties in 1910 was 43,649. That of Albany and Laramie Counties, in Wyoming, was 18,144. Colorado counties' population passed numerically population Wyoming counties between 1870 and 1880. During these four decades there has been increase in rural population in these areas. Increase in Colorado counties is more rapid than increase in Wyoming counties. Greatest increase in population in both areas in last decade, 1900 to 1910. Increase population Colorado counties runs from 21,504 in 1900 to 43,649, practically double. Increase in Wyoming
2398 counties runs from 10,971 in 1900 to 18,144 in 1910. In other words, increase in this decade in Colorado counties was 22,145 and increase in Wyoming counties was 7,273. Increase in Wyoming counties was about one-third that of Colorado counties. There has been specific increase in population during last two decades in Wheatland District. Considerable portion of increased population in County of Laramie, Wyo., shown on my diagram, comes from settlement of Wheatland area.

Have prepared data showing acres improved farm land in counties of Weld and Larimer in Colorado and Albany and Laramie in Wyoming, treating each county separately.

2399 (Defendants' Exhibit 90, a blue print, offered in evidence).

Defendants' Exhibit 90 is diagram showing last mentioned matters. Information was obtained from U. S. Census reports. Covers decades form 1870 to 1910 inclusive. According to diagram, Weld County, Colo., is represented by solid line, also shown by

another solid line area of original Weld County. Larimer County, Colo., represented by line of dashes, Albany County, Wyo., represented by dot and dash line, Laramie County, Wyo., by dash and two-dot lines. Laramie County, Wyo., on this diagram includes area now contained in three counties of Laramie, Goshen and Platte. This is not restricted area of Laramie County. It does not show restricted area as far as Weld County, Colo., is concerned. That is case in all of these.

In 1870 there were 9,715 acres improved farm land in Weld County; 5,135 in Larimer County, Colo.; 184 acres improved farm lands in Albany County, Wyo.; 125 acres improved farm lands in Laramie County, Wyo.

2400 Referring to lines representing Weld County, Colo., I showed division at year 1880. Regardless of division at that time and to divisions made after that time, number of acres of improved farm lands in Weld County increased, in each decade except between 1890 and 1900, when there was very slight decrease. That was due to panic of 1893. That was period of very little development. With exception of that decade, country shows agricultural growth all the time. Between 1900 and 1910 acres of improved farm lands in county almost doubled. It increased from 251,307 to 410,346.

Albany County, Wyo., starts with 184 improved land in 1870. Acreage increases, but not as rapidly as Weld County, and increase runs on to 1900. There is decrease between 1900 and 1910, so that total acreage of improved farm lands drops from 149,075 to 107,315. Albany County, Wyo., shows decrease of 41,760 acres improved farm land from 1900 to 1910.

Larimer County, Colo., shows increase from 1870 to 1890, not as rapid an increase from 1890 to 1900, but a substantial increase, then slight decrease from 1900 to 1910, due to division of county. If original area were taken, we would have 252,262 acres improved farm land, but on account of division of county we have 177,525 acres in 1910. County division referred to was setting aside North

2401 Park under name of Jackson County. Taking area of county as a whole, without this deduction, there is no place in its history showing decrease of improved farm lands.

History of Laramie County in Wyoming shows increase in number acres of improved farm lands from 1870 up through 1880, a more rapid increase up to 1890, remarkable decrease from 1890 to 1900, more marked than those of any of the other counties, those were years of panic and shows rapid increase from 1900 to 1910 due to opening of Wheatland area.

Total acreage improved land in those counties shown by diagram, Albany County, Wyoming, 1910, was 107,315 acres; Laramie County, Wyoming, 210,993 acres, that includes the present area of Laramie, Platte and Goshen Counties. It also includes in part reclamation projects on North Platte River. Number improved farms lands in Larimer County, Colorado, 177,525 acres, considering county as divided. Without division it would be 252,262 acres.

Weld County, Colorado, has acreage of 410,345 acres. If original

area of Weld County were taken it would have 978,261 acres improved farm lands in 1910.

2402 The counties which were taken out of original county of Weld are in eastern portion of original county. Generally speaking, they are down South Platte River below junction of Platte and Poudre.

Have diagram showing number of farms in Larimer and Weld Counties, Colorado, and Laramie and Albany Counties, Wyo.

(Defendants' Exhibit 91, a blue print, offered in evidence).

Defendants' Exhibit 91 is diagram referred to. It represents number farms in four counties in question, Weld and Larimer of Colorado, and Albany and Laramie in Wyoming. Starting in 1870, we find greatest number farms in Larimer County, Colo., next, Weld County, Colorado, 121 in Larimer County, Colo., 105 in Weld County, Colorado. We find 20 in Albany county, Wyo., and 1 in Laramie County, Wyo. Diagram shows an increase in number of farms in all counties. Weld County increased more rapidly than any of others. Increase from 1870 to 1880, is not so rapid as from 1880 to 1900. The most rapid increase is from 1900 to 1910 for Weld County, Colo. Upper line marked "number for original area" is taken and shows number farms in original area of Weld County and division is shown as taking place in 1880. Rapid in-

2404 crease noted in Laramie County, Wyo., between 1900 and 1910 is due to development of Wheatland and North Platte areas.

In Albany County, Wyo., diagram shows in 1910, 453 farms.

Laramie County, Wyo., shows 1,933 farms.

Larimer County, Colo., if original area is taken, shows 2,008 farms. If divided area is taken, shows 1,830 farms.

Weld County, Colo., shows in present area 3,981 farms in 1910 and if original area is taken it would show 8,955 farms. During that decade there was great development in Weld County. Farms were split up in number of instances, making more farms, and then great deal of new territory was opened up. There has also been more intensive farming.

(Defendants' Exhibit 92 offered in evidence).

Defendants' Exhibit 92 shows *that* valuation improved farms in Weld County and Larimer County, Colo., and in Albany and Laramie counties, Wyo. Diagram covers period from 1870 to 1910. Marginal numbers at left show valuation in dollars. In 1870 valuation improved farms in Larimer County, Colo., was $278,580. For Weld County, Colo., $22,970. For Albany County, Wyo., valuation was $8,567. For Laramie County, Wyo., in 1870, valuation was $2,000 *dollars*. Valuation of $2,000 on Laramie County, Wyo., lands in 1870 is not shown on diagram.

It places Larimer County, Colo., above other three counties in 1870. It continues ahead until 1880 and between 1880 and 1890 Weld County valuation passes Larimer County, Colo., also valuation Laramie County, Wyo., goes ahead of Larimer County, Colo., and

Albany County, Wyo., is below them all. Between 1890 and 1900 Laramie County, Wyo., falls from $4,842,330 in 1890 to $3,932,450 in 1900.

Between 1900 and 1910 there is very rapid increase in Weld County, rapid increase in Larimer County, Colo., but not as rapid as in Weld County. There is about same rapidity of increase in Laramie County, Wyo., and not so rapid an increase in Albany County, Wyo.

In 1910 Albany County, Wyo., shows valuation improved farms of $7,592,886.

Laramie County, Wyo., shows $17,400,926.

Divided area of Larimer County, Colo., shows $19,071,431. Original area Larimer County, Colo., shows $21,839,856.

Present area Weld County, Colo., shows valuation of farm lands $45,001,628 and original area Weld County shows $77,041,935.

(Defendants' Exhibit 93 offered in evidence).

Defendants Exhibit 98 shows development irrigated area as far as was possible for me to obtain facts from United States
2406 Census reports. This diagram shows four counties again, Weld and Larimer counties, Colo., Albany and Laramie counties, Wyo. Beginning with 1890, was unable to find data concerning irrigated area at any time previous. Weld County, Colo., is at head of list in 1890 with 112,080 acres. Larimer County, Colo., shows second with irrigated acreage of 103,483 acres, which is not marked on plat.

These diagrams are drawn to scale. You can read it right off. A trifle above 100,000 acres is what plat shows.

In 1890 acreage irrigated in Albany County, Wyo., was 34,522 and in Laramie County, Wyo., was 33,553.

In all four counties we have increase between 1890 and 1900, more rapid in Weld County than any of others.

During decade between 1900 and 1910 we have another rapid increase in acreage of irrigated area in Weld County running up in 1910 to 395,514 acres. Larimer County, Colo., shows very slight increase between 1900 and 1910 due to division of county. If original area were taken it shows rapid increase, more rapid in fact than any of others, running up to 322,450 acres. With present area of county, we have in 1910, 170,600 acres of irrigated land.

2407 Albany County, Wyo., during decade from 1900 to 1910 shows increase running up to 151,926 acres.

Laramie County, Wyo., shows also increase running up to 122,021 acres in 1910.

Large part of Larimer County, Colo., is mountainous. Increase of only 1,572 acres in present Larimer county in 1910 was due entirely to setting off of large area of North Park, which is now known as Jackson County, Colo., and even with that taken away and placed in another county there is enough development to make increase in that last decade. Diagram for Larimer County for 1900 shows area of undivided county. Number of acres which were afterwards set

out in North Park, which were under irrigation at that time, would be deducted from 169,028, in order to show actual increase in remaining portion of county between 1900 and 1910.

(Defendants' Exhibit 94, a blue print, offered in evidence).

Defendants' Exhibit 94 is diagram representing value of all farm crops in Weld and Larimer counties, Colo., giving each one separately, and of Albany and Laramie counties, Wyo., giving each one separately.

Diagram runs from 1870 to 1910, inclusive. It shows that in 1870 value crops raised in Larimer County, Colo., is greatest of all four counties, amounting to $176,649. Weld County, Colo., comes second with value of $146,671. Albany County, Wyo., comes third with valuation of $29,700, and Laramie County, Wyo., comes fourth with valuation of $1,000.

There is increase in value of farm crops to be noticed in all four counties in decade 1880 to 1890, and decade 1890 to 1900, most rapid increase being in Weld County, Colo. In 1880 Weld County has gone ahead of all other counties, Larimer County, Colo., second, Laramie County, Wyo., third, and Albany County, Wyo., coming last.

There is more rapid increase in all four counties from 1880 to 1890 and still more rapid increase in Weld County, Colo., and Larimer County, Colo., between 1890 and 1900, also more increase in Albany County, Wyo., but less rapid increase in Laramie County, Wyo., for decade between 1900 and 1910.

2408 The greatest increase is in Weld County, Colorado. Value farm crops in that county in 1910, considering present area of county amounts to $7,256,601. If original area of Weld County is considered value farm crops produced in 1909 for the 1910 census gives $11,777,884.

Larimer County, Colo., comes second. Its present area being considered, value of farm crops produced in 1910 is $3,401,749. If original area is considered, it amounts to $3,728,380.

Laramie County, Wyo., in 1910 shows value of all farm crops to be $1,488,976.

Albany County, Wyo., during decade from 1900 to 1910, shows decrease in value of farm crops, falling off from $804,565 in 1900 to $586,157, in 1910.

That portion of Larimer County, Colo., now included in Jackson County is that section of state known as North Park. That is mountain park near headwaters of North Platte River. Principal crop raised there is native hay.

Comparison of diagram Exhibit 94 with Exhibit 93, particularly with reference to divided county of Larimer, Colo., shows that in decade from 1900 to 1910 there was large area irrigated in North Park but when it comes to valuation of crops produced, the value of crops does not correspond with the amount of acreage set off, so that decrease between valuation of farm crops of original area and divided area is not as great as decrease in irrigated area of
2409 land in original area and divided area. Difference in irrigated area in 1910 between original and present area of

county is 151,850 acres. Difference in value farm crops on same comparison for 1910 is $326,635.

This, then, shows that value of hay crops per acre on increased acreage in no wise compares with values of agricultural crops down in Poudre Valley region.

(Defendants' Exhibit 95, a blue print, offered in evidence).

Defendants' Exhibit 95 is diagram showing production of wheat, in Weld and Larimer Counties, Colo., and Albany and Laramie counties, Wyo. It shows total production in bushels.

Data runs from 1870 to 1910. In 1870 greatest amount of wheat was produced in Larimer County, Colo., amounting to 12,933 bushels. Second amount comes from Weld County, Colo., with production of 8,307 bushels. No wheat was grown in Laramie County or Albany County, Wyo., at that time according to the report.

1880 shows rapid increase in number of bushels of wheat grown in Weld County, running ahead of all other counties, Larimer County coming second, and no wheat in Albany County or Laramie County, according to the report.

1890 more rapid increase in Weld County than in any of others. A rapid increase in Larimer County, Colo. Laramie County, Wyo., shows production of 730 bushels with no production in Albany County, Wyo.

1900 shows still more rapid increase in Weld County, a decrease in Larimer County, Colo., slight increase in Laramie County, Wyo., and 770 bushels raised in Albany County, Wyo.

1910 shows decrease in wheat production in Weld County, Colo. Amount produced in present area of county amounting to 1,628,022 bushels. If original area Weld County is taken it shows increase to 2,499,425 bushels in 1910.

There is increase in Larimer County, Colo., and in 1910 there was produced 580,250 bushels of wheat.

Amount produced in Laramie County, Wyo., was 107,800 bushels in 1910.

Amount produced in Albany County, Wyo., was 4,068 bushels in 1910.

Cause of decrease of production of wheat in present county of Weld was due in last decade to raising of sugar beets. The acreage went into sugar beets instead of wheat. Sugar beets are more valuable crop than wheat.

(Defendants' Exhibit 96, a blue print, offered in evidence.)

Defendants' Exhibit 96 is diagram showing average yield of wheat per acre in four counties in question. It runs from 1880 to 1910—
for Weld and Larimer counties, Colo., and from 1890 to 1910
2411 for Laramie and Albany Counties, Wyo. It shows increase in
average yield per acre in two Colorado counties for each decade, starting in with average yield of 21.4 bushels per acre for Larimer County, Colo., in 1880 and 21.3 bushels per acre for Weld County in same year. An increase for each until 1910 it reached

an average of 29.3 bushels per acre for Larimer County, Colo., and 29 bushels per acre for Weld County, Colo.

For two Wyoming counties shows average yield per acre for Albany County in 1890 of 21 bushels per acre, rising to 22 bushels per acre in 1900, and a decrease to 14 bushels per acre in 1910. For Laramie County, Wyo., in 1890 average yield per acre was 18.6 bushels. In 1900 it was 17.2 bushels and in 1910 it was 13.3 bushels.

Averaging the decades it gives for period of 40 years in Weld County, Colo., 25.95 bushels per acre; for Larimer County, Colo., 25.3 bushels per acre; for Albany County, Wyo., for period of 30 years, 19.1 bushels per acre and for Laramie County, Wyo., 15.8 bushels per acre.

Average in Colorado counties for period of 40 years and Wyoming counties for 30 years. There are four census reports for Colorado counties and three for Wyoming counties.

If same average of 30 years were taken for Colorado counties as was taken for Wyoming counties, average for Colorado counties would be more bushels per acre.

Most remarkable thing shown in this diagram is increased yield per acre shown in Colorado counties. It shows decrease in Laramie County, Wyo., a continual decrease. Albany County, Wyo., shows slight increase and then very great decrease.

2412 Average yield is constantly increased in Colorado counties during 40 years and is decreased in Albany County, Wyo., during last decade and decreased in Laramie County, Wyo., during last two decades. I attribute high average yield per acre in 1890 in two Wyoming counties to be due to small acreage of wheat produced. There was very small acreage produced and it probably was in very advantageous position so far as new area is concerned, both for climate and moisture, and consequently with only few acres planted, it does not give as good average condition in county. As acreage increases yield falls off. I refer to 1890 in first case and 1910 with increased acreage as shown on previous diagram or in acreage an increased amount produced and consequently increased acreage. Diagram Exhibit 96 taken in connection with previous Exhibit 95, shows clearly what I have in mind.

To make comparison of Colorado counties with Wyoming counties for last two decades in average yield will state that, taking last three decades for Colorado counties gives for Weld County, 26.4 bushels per acre and for Larimer County 26 bushels per acre as average yield for these three reports. I would like to add here also that this is total yield of wheat, dry land and irrigated land, so that we take into consideration the whole yield and that cuts average yield down on irrigated acres. When I refer to average for decade I refer

2413 to report for each decade. Between years 1890 and 1910 have included reports for 1890, 1900 and 1910.

(Defendants' Exhibit 97, a blue print, offered in evidence.)

Defendants' Exhibit 97 shows total production of oats for Weld and Larimer counties, and Albany and Laramie counties, Wyo., in

bushels. Total yield of oats in bushels. This runs from 1870 to 1910 and we find:

1870, Larimer County, Colo., was producing greatest number of bushels of oats, 40,213. Weld County came next with 24,207 bushels. No oats were raised in Laramie or Albany counties, Wyo.

1870 to 1880 increase in production of oats, Weld County being ahead of all the others, producing 92,449 bushels, with Larimer County, Colo., producing 77,106 bushels. Laramie County, Wyo., produced 525 bushels and Albany County, Wyo., produced nothing.

1880 to 1890 there was increase in all four counties. Rapid increase in Colorado counties and slight increase in Wyoming counties.

1900 we find increase in production of oats for Weld County. Decrease in production of oats for Larimer County, Colo., slight increase in production of oats for Laramie County, Wyo., and decrease in production for Albany County, Wyo.

1900 to 1910 we find very rapid increase in production of oats in Weld County, Colo.; rapid increase in production of oats in Larimer County, Colo.; rapid increase in production of oats in Lara-
2414 mie County, Wyo.; it running ahead of Larimer County, Colo., and an increase in production of oats in Albany County, Wyo.

1910 present area Weld County produced 856,544 bushels of oats. If original area of Weld County were considered production would be 1,446,620 bushels.

Amount produced in Larimer County, Colo., was 514,553 bushels.

Laramie County, Wyo., produced 632,949 bushels.

Albany County, Wyo., produced 120,449 bushels.

Heavy increase from 1900 to 1910 in Weld and Larimer Counties, Colo., was at time when large areas were being devoted to sugar beets.

(Defendants' Exhibit 98, a blue print, offered in evidence.)

Defendants' Exhibit 98 shows average yield oats per acre Weld County, Colo., and compares it with average yield of oats in Laramie County, Wyo. It shows average yield of oats per acre in Weld County in 1880 to be 27.2 bushels, in 1890 to be 30 bushels, in 1900 shows 32.4 bushels and in 1910 to be 32.2 bushels. For 1890 Laramie County, Wyo. shows average yield oats per acre to be 23.25 bushels, 1900 to be 23.6 bushels per acre, and 1910, 21.6 bushels per acre.

2415 Taking last three reports for Weld County, Colo., and averaging them shows average yield to be 31.5 bushels per acre, and for Laramie County, Wyo., average yield to be 22.7 bushels per acre.

I took these two counties for comparison because they were the two high counties in production of oats.

(Defendants' exhibit 99, a blue print, offered in evidence.)

Defendants' Exhibit 99 represents number of bushels of barley produced in Weld County and Larimer County, Colo., and Laramie and Albany counties, Wyo. It runs from 1870 to 1910.

1870 Larimer County, Colo., led in production of barley, with Weld County, Colo., coming second and no production of barley in either of Wyoming counties. It shows increase in production of barley for two Colorado counties from 1870 to 1880 and rapid increase in production of barley in Weld County from 1880 to 1890. It shows slight decrease in production of barley in Larimer County, Colo., for that same decade, and shows still nothing produced in two Wyoming Counties at that time in so far as barley is concerned.

1890 to 1900 shows rapid increase in Weld County, rapid increase in Larimer County, very small production in Laramie, Wyo., and nothing produced in Albany County, Wyo. Do not have figures down here for that county but so far as diagram is concerned it shows nothing grown in Albany County.

1900 to 1910 shows rapid increase in production of barley
2416 in Weld County and increased production barley for Larimer County for this same decade. Also increase Laramie County, Wyo., but not so rapid as in either of two Colorado counties, and increased production of barley in Albany County, Wyo., but very little produced even at that.

1910 production of barley for Weld County, Colo., present area, 577,637 bushels. Original area considered, 760,452 bushels. For Larimer County we have 179,847 bushels barley produced. For Laramie County, Wyo., 21,946 bushels of barley, and for Albany County, Wyo., 10,361 bushels of barley.

(Defendants' Exhibit 100, a blue print, offered in evidence.)

Defendants' Exhibit 100 represents average barley yield per acre in Weld County, Colo., and Laramie County, Wyo. These are the two high counties in their respective states in the production of barley. They also adjoin each other at the interstate line. Diagram gives yield per acre for period covered by four reports in so far as Weld County is concerned, and for three reports, 1890 to 1910, in so far as Laramie County, Wyo., is concerned.

(Defendants' Exhibit 101, a blue print, offered in evidence.)

Defendants' Exhibit 101 represents number of bushels of potatoes produced in Weld County, Colo., Larimer County, Colo., Albany County, Wyo., and Laramie County, Wyo.

2417 Diagram runs from 1870 to 1910 inclusive. Shows that in 1870 Larimer County, Colo., was producing greatest number of bushels of potatoes amounting to 26,074; Weld County coming second with production of 8,065 bushels; Laramie and Albany Counties, Wyo., producing no potatoes.

1870 to 1880, Weld County goes ahead in production of potatoes and counties come in following order: Larimer County, Colo., Laramie County, Wyo., and Albany County, Wyo.

1880 to 1890 increased production of potatoes in Weld County, Colo., then comes Laramie County, Wyo., then Larimer County, Colo., and Albany County, Wyo., with very small yield comparatively speaking in comparison with Weld County.

1890 to 1900 there is very heavy increased production of potatoes

in Weld County, an increased production of potatoes in Larimer County, Colo., and slight decrease in production of potatoes in Laramie County, Wyo., with very small production in Albany County, Wyo.

1900 to 1910, very rapid increased production of potatoes in Weld County, Colo., amounting to 5,867,691 bushels for county as it exists as present. Taking original area Weld County it is some higher, I have not it marked but can read it off approximately from scale, it is about 6,300,000 bushels. Production of potatoes in Laramie County, Wyo., comes second, being 203,016 bushels. Larimer County, Colo., comes third with production of 198,506 bushels. Albany County, Wyo., comes last with about 43,729 bushels of potatoes.

(Defendants' Exhibit 102, a blue print, offered in evidence.)

Defendants' Exhibit 102 shows average yield potatoes per acre for Weld County, Colo., and Laramie County, Wyo. These are taken because they are the two leading counties of the four under consideration.

I have three reports for each county, 1890, 1900 and 1910. Taking these three reports and averaging them, we obtain the average yield of potatoes per acre for Weld County, Colo., of 107.4 bushels; average yield for Laramie County, Wyo., of 57 bushels per acre.

1890 the counties started out very closely together; Laramie County, Wyo., running 44.5 bushels per acre, approximately reading from diagram, and Weld County, Colo., about 49 bushels per acre, showing rapid increase in average yield per acre for potatoes in Weld County to 1900 and increase continuing but not so rapid to 1910. It shows decrease average yield per acre for potatoes in Laramie County, Wyo., for 1900 and increase in 1910.

1910 average yield for Weld County was 151.8 bushels per acre. For Laramie County, Wyo., the average yield was 88 bushels per acre.

2419 (Defendants' Exhibit 103, a blue print, offered in evidence).

Defendants' Exhibit 103 shows tons of hay produced in Weld County, Colo., and Larimer County, Colo., also Albany and Laramie Counties, Wyo. It covers production of hay as shown by census reports from 1870 to 1910 inclusive.

1870 Weld County was producing the most hay. Larimer County, Colo., and Laramie County, Wyo., were producing practically same amount at that time. Albany County, Wyo., was lowest of four counties.

1870 to 1880 Weld County shows increased production of hay, then more rapid increase from 1880 to 1890, and that degree of increase continues from 1890 to 1900 and then from 1900 to 1910 an increase but not so rapid as previously. Larimer County shows increase from 1870 to 1880, more rapid increase from 1880 to 1890, still more rapid increase from 1890 to 1900 and decrease from 1900 to 1910. That is due to division of county, cutting off large hay

producing area commonly known as North Park, now Johnson County.

Laramie County, Wyo., shows increased production of hay from 1870 to 1880, but not as rapid increase as either Weld or Larimer counties in Colorado. Shows a more rapid increase from 1880 to 1890, about the same degree of increase from 1890 to 1900, and an increase, more rapid than any other period, from 1900 to 1910. Albany County, Wyo., shows more rapid increase from 1870 to 1880 than either Larimer County, Colo., or Laramie County, Wyo. In 1880 it stood second in all counties in production of hay. That increased from 1870 to 1880, and was practically maintained throughout next decade.

2420 1880 to 1890 other increased more rapidly, going beyond Albany County in production of hay in that decade. Albany County shows more rapid increase from 1890 to 1900 than in two preceding decades, but not as rapid as other three counties, 1900 to 1910 increased hay production of Albany County falls off and we have an increase but not as marked as in preceding decade.

Albany County, Wyo., total production hay in 1910, 52,748 tons.

Larimer County, Colo., with North Park area deducted, 109,792 tons. Not considering divided county of Larimer, we have production of 175,040 tons.

Laramie County, Wyo., shows 116,700 tons hay.

Weld County, Colo., with present area, shows production of 168,214 tons and for original area Weld County the production would be 280,181 tons.

Referring to line indicating present County of Weld, account for lack of same ratio of increase to production of sugar beets. Alfalfa is crop that has been plowed up to great extent for production of beets. Present county of Larimer is affected the same way.

Under the classification of hay I have included both native hay and alfalfa. It is given in census reports as total hay production.

2421 (Defendants' Exhibit 104, a blue print, offered in evidence.)

Defendants' Exhibit 104 represents number live stock in Larimer and Weld counties, Colo., and Laramie and Albany counties, Wyo.

Term "live stock" includes cattle, sheep, swine, asses, mules and bulls, separately listed. I have summed them all together.

Diagram runs from 1870 to 1910 inclusive. It shows in 1870 Albany County, Wyo., had greatest number of live stock, 14,980; Larimer County, Colorado, second in number, 6,155; Weld County, Colo., third, 5,643; Laramie County, Wyo. fourth, 25.

Laramie County, Wyo., shows marked increase from 1870 to 1880, and same increase practically continues to 1890. From 1890 to 1900 there is increase but not so rapid. From 1900 to 1910 a more rapid increase.

Albany County, Wyo., shows marked increase but not as great an increase as Laramie County, Wyo., between 1870 and 1880. A decrease from 1880 to 1890. Then rapid increase from 1890 to 1900; slight increase from 1900 to 1910.

Weld County, Colo., shows increase from 1870 to 1880, which is comparable with Albany County, Wyo.; decrease is shown from 1880 to 1890; increase from 1890 to 1900 and slight decrease from 1900 to 1910.

Larimer County, Colo., shows increase from 1870 to 1880. Shows slight decrease from 1880 to 1890, increase from 1890 to 1900 and decrease from 1900 to 1910.

2422 Laramie County, Wyo., in 1910 shows 552,153 head of live stock.

Albany County, Wyo., same year shows 199,103 head live stock.

Weld County, Colo., same year shows 84,850 head live stock, present area. Considering original area shows 273,296 head.

Larimer County, Colo., for same period shows 49,753 head live stock.

Laramie County, Wyo., is large sheep producing district.

Defendants' Exhibits 86 to 104 inclusive, were prepared by me. Data for these Exhibits was taken from the U. S. Census reports.

Summing up, showing made by Exhibits 86 to 104, inclusive, they show that the Weld County and Larimer County, Colo., are agricultural counties and that Laramie county and Albany County, Wyo., are stock producing counties.

I have made examination of meteorological records for purpose of comparing climate of Weld County, Colo., with climate of Albany County, Wyo. Obtained data from government meteorological reports. From stations of Laramie, in Albany county, Wyo., and at Greeley, Colo. Station at Laramie, in Albany County, Wyo., is connected with experiment station at that point.

Temperature records were taken by what we call the self-registering thermometers, which are housed in little houses with slat sides so as to do away as much as possible with effect of radiation.

2423 They are placed that way, as I understand it, for purpose of comparison. For instance, in city of Fort Collins, we have instruments at college housed in this way. We also have self-registering instruments outside, 6 inches above ground. There are other place- in city where instruments of similar nature are owned and operated. Those that are housed are not materially affected with radiation. Temperatures obtained from these instruments are more nearly comparable than outside instruments near ground. It is for that purpose, I believe, they specify housing of instruments in that way. That is plan generally adopted by United States

2423 through its Weather Bureau. These records were taken in same manner at both Greeley and Laramie.

(Defendants' Exhibit 105, a blue print, offered in evidence.)

Defendants' Exhibit 105 is plot showing minimum temperatures throughout year for two stations mentioned, Greeley, Weld County, Colo., and Laramie, Albany County, Wyo. It was taken from temperatures which were taken from thermometers registering minimum temperatures from government records.

Minimum temperatures were selected instead of maximum tem-

peratures, because I desired to show relatively length of season above frost in each of two counties.

(Defendants' Exhibit 105 offered in evidence with qualification that chart marked Exhibit 105 covers years 1893 to 1902 inclusive, and has been extended to show succeedings years up to and including 1912, but chart has not been prepared for print and said chart when printed will be substituted on enlarged chart for Exhibit 105, witness will testify from originals.)

2424 Defendants Exhibit 105, dotted line running all way through shows temperatures. It is line showing minimum temperatures for each month as given for Laramie, Albany County, Wyo. Solid line shows minimum temperatures as given by reports for Greeley, Colorado. Chart is graded to show temperatures −30 to +60 Fahrenheit. At point designated +30, heavy line running transversely across sheet indicates temperature of 43 degrees Fahrenheit, freezi' g; where temperature lines run above this freezing line it indicates that if line is wholly above during that month, there was at no time a temperature as low as freezing. Referring to Exhibit and record of successive years commencing with 1893, with comparison of temperatures above freezing at the two stations and length of period during which there was no temperature as low as 32 degrees above zero, we find:

Weld County, Colo., during June, there was at no time a temperature below 32. During month of July there was no time temperature below 32 degrees, in fact, minimum temperature for July was 44 degrees. During August minimum temperature was 34 degrees. During September temperature dropped below freezing line.

2425 Station at Laramie, Wyo., during June, early part of month there was temperature below 32 degrees, at least once, and may have been more. It was extreme minimum that I plotted. During July there was temperature during that year just 32, minimum temperature. During August there was temperature as low as between 24 and 23 degrees.

Comparing two records I figured that there was period of about three months and one week in Weld County, Colo., where the temperature was above 32, and one month and three weeks in Albany County, Wyo., where at all times temperature was above freezing. I have noted on map 90 days in 1893 when temperature at no time in Weld County, Colo., dropped below freezing; 48 days when temperature at no time dropped below freezing, at Laramie City, Wyo.

In year 1894 there were 108 days in Weld County, Colo., when temperature was above freezing and 75 days in Albany County, Wyo.

1895 there were 97 days for Greeley, Weld County, Colo., and 45 days for Laramie, Albany County, Wyo., when temperature was above freezing.

A peculiarity of temperature line for Laramie City, that year, 1895, is that it shows heavy frosts in June and heavy frosts in early part of August. You will also note that in that particular year there

was frost in Weld County, Colo., in early part of August, earlier than usual.

Year 1896 there were 130 days when temperature was above freezing at Greeley, Weld County, Colo., and 70 days at Laramie, Albany County, Wyo.

In year 1897 there are 138 days when temperature was above freezing at Greeley, Weld County, Colo., and 48 days at Laramie City, Wyo.

2426 For year 1898 there are 124 days when temperature was above freezing at Greeley, Colorado, and 75 days for Laramie City, Wyo.

For year 1899 there are 127 days when temperature was above freezing at Greeley, Colorado, and 70 days for Laramie City, Wyo.

For year 1900 there were 130 days when temperature was above freezing at Greeley, Colorado, and 80 days when temperature was above freezing at Laramie City, Wyo.

For 1901 there were 140 days when temperature was above freezing at Greeley, Colorado, and 80 days at Laramie City, Wyo.

For year 1902 there were 120 days when temperature was above freezing at Greeley, Colorado, and 50 days at Laramie City, Wyo.

For year 1903 there were 111 days at Greeley and 85 days at Laramie City when temperature was above freezing.

For year 1904 there were 128 days at Greeley when temperature was above freezing, and it frosted every month in the year at Laramie City, Wyo., so that the record stands at zero.

For year 1905 there were 128 days at Greeley, Colo., and 51 days at Laramie, Wyo., when temperature was above freezing.

For year 1906 there were 153 days at Greeley, Colo., and 61 days at Laramie, Wyo., when temperature was above freezing.

For year 1907 there were 153 days at Greeley, Colo., and 66 days at Laramie, Wyo., when temperature was above freezing.

For year 1908 there were 151 days at Greeley, Colo., and 18 days at Laramie, Wyo., when temperature was above freezing.

For year 1909 there were 132 days at Greeley, Colo., and 85 days at Laramie, Wyo., when temperature was above freezing.

For year 1910 there were 127 days at Greeley, Colo., and 40 days at Laramie, Wyo., when temperature was above freezing.

For year 1911 there were 132 days at Greeley, Colo., and 65 days at Laramie, Wyo., when temperature was above freezing.

For year 1912 there were 117 days at Greeley, Colo., and 40 days at Laramie, Wyo., when temperature was above freezing.

This makes average for 20 years of 126½ days for Greeley, Weld County, Colo., and 57.6 days for Laramie, Albany County, Wyo., when temperature was above freezing.

General view of record for 20 years shows that minimum at Laramie even through period when temperatures were above freezing, was always lower than minimum at Greeley. In other words, summer temperatures indicated by summer temperatures at Laramie, are always lower than at Greeley. This is true with one

exception, in 1903, when minimum temperatures in August at Greeley was lower than minimum temperature at Laramie.

Temperature of 32 degrees Fahrenheit recorded by thermometer placed inside of one of these little thermometer houses, does not necessarily indicate killing frost. It usually does, however,
2427 because records of temperatures at 6 inches above ground as shown by our station at Fort Collins, show that the minimum temperatures thus recorded register from 6 to 8 degrees lower with these thermometers than temperatures obtained and recorded in thermometer houses. Crop growing on ground would be affected by these outside or lower temperatures.

Minimum temperature recorded near ground is from 6 to 8 degrees lower than minimum temperature recorded in thermometer houses. This is the experience of the record of station maintained at Fort Collins, where we have the two thermometers. Probability is that freezing temperature indicated by thermometer in house is indicative of lower temperature obtained close to ground.

Probability is that temperature of 32 degrees recorded in temperature house is indicative of a killing frost on the ground. Difference of temperatures recorded between thermometer in house and one at ground would be relative to line indicated on chart 105. Chart necessarily shows relative comparison. You cannot declare with absolute definiteness that there are so many days between killing frosts, but comparing temperatures between two places taken by accurate thermometers under like conditions, relative temperatures are shown, and relative length of season is also shown. Relative differences in temperatures throughout the seasons is
2428 also shown. I wish it understood that number of days given here is taken from scale and may vary a little one way or another. Period indicated may be a little too long or a little too short and may not show exact number of days between frosts, but does show relative comparison between two places. Any error would be compensating and taking period of 20 years, we have very fair estimate of length of season.

Temperature lines on Exhibit 105 indicate minimum monthly temperatures.

Direct*ion*-examination, continued, by Mr. Delph E. Carpenter:

I stated that Exhibit 105 shows not only minimum monthly temperatures at Laramie, Wyo., and Greeley, Colo., but also gives idea of difference in temperatures during growing season.

During 1913, I made practical observations on ground relative to difference in growing seasons of these two areas. I obtained plans of cutting of alfalfa and of harvest of grains around Fort Collins and Eaton in Cache la Poudre Valley, and made some observations during July in Albany County, Wyo. Latter observation was as to development of crops.

2429 Alfalfa and native hay are perennial crops. Alfalfa is about as fair a crop as could be selected for demonstration of growing seasons of two areas.

First cutting alfalfa in Eaton district, Weld County, Colo., began

May 26th on farm Charles Camp. Yield 1½ tons per acre. On property of Bruce G. Eaton, foremen reported crop ready to cut June 6th and cutting began June 10th. In their opinion first cutting usually begins one year with another, from June 5th to June 10th. Cutting on farm of George Nusberger, 4 miles east of Eaton began May 28th, in 1913. Yield 2 tons per acre. First cutting Wm. McClelland, southeast of Eaton 5 miles, May 27th in 1913. R. M. Haythorn began June 16th and reports crop ready and ripe for cutting earlier. Fred Mimmack reported first cutting June 12th. Yield 2 tons per acre.

In Fort Collins district, first cutting of alfalfa began on farm C. P. Chandler on June 12th. Interviewed a number of
2430 farmers in that district. Time of first cutting ranged from June 12th to June 20th. Time of first cutting in Fort Collins district is about 10 days later than in Eaton in year 1913. The farm belonging to Bruce G. Eaton represents many thousand acres under Larimer and Weld Canal. It comprises estate of former Governor Eaton.

June 7th or 8th is average date of first cutting of alfalfa in Eaton district during year 1913. It was about one week or ten days later in Fort Collins district.

Was in valley of Big Laramie River during time of first harvest of first cutting alfalfa on Hart Ranch. That was on July 16th and July 17th, 1913. They were also putting up hay on Grable Ranch. This was first cutting alfalfa.

Defendants' Exhibit 106 is photograph I took of Hart Ranch, July 17, 1913, showing hay in stack, first cutting alfalfa, and at time of taking picture on this ranch they were putting up
2431 Hay. Hart Ranch is located above Laramie City on Laramie Plains. I also noted number of hay stacks shown in picture. These stacks are very much scattered. There are not many of them as on ground having great amount of hay. Stacks are much smaller than they make them in Poudre Valley. This is demonstrated by size of man standing to left of first stack in foreground in picture. I am comparing with stacks in similar field where 2 ton harvest has been made near Eaton.

Defendants' Exhibit 107 is photograph showing first cutting alfalfa on Grable Ranch on S. E. ¼ of Sec. 17. Tp. 14 N., R. 75, W., on Laramie Plains, taken July 16, 1913. Land irrigated under Fischer Ditch. They had finished stacking hay on that ranch at time photograph was taken. It evidently had been completed for few days only. There was no indication of second growth as yet. It was stubble. By comparison of two photographs it will be noticed that stand was not nearly so good on this as on Hart's ranch. Quantity of hay cut and put up was not so large. There are only three stacks shown in whole view of range of camera, and it was best photograph I could get at time I was there. Stacks were very small and yield had not been heavy. Size of stacks can be ascertained by comparison with size of man in foreground in picture. This

man would weight about 174 pounds and stand about 5½
2432 feet tall.

These two fields of alfalfa were the best that we saw, by far, in the Laramie Plains region. We traveled very much over the irrigated area on this trip.

(Defendants offer in evidence their Exhibits 106 and 107, photographs.)

Perennial crop like alfalfa is indicative of differences of growing season because plants simply develop as season develops, and mature with season. An early season would mature an early crop of alfalfa. Seeding has nothing to do with it.

Observations made by me of growth of this perennial plant, alfalfa, for year 1913, compare very favorable with observations noted on my temperature chart, Exhibit No. 105. The observations made on the ground confirm the deduction shown on Exhibit 105.

Made observations of dates of barley harvest on various farms in Poudre Valley, principally near Eaton, Colo. These observations show:

Barley harvest near Eaton, Colo., began July 11th to 15th, 1913. I saw number of fields that were being harvested at time I was there on July 19th and took picture of one. From observations by me and assistants I obtained the fact that barley harvest on farm of C. W. Gavin, Eaton, Colo. began July 15th, 1913; On ranch
2433 R. D. Hughes began July 16th; Farm B. C. Nix began July 5th; Ranch A. T. Searles began July 9th; Ranch Asa Decker began July 19th.

Average date barley harvest Eaton district would occur between July 5th and July 15th. Dates obtained by me were fair example of the beginning of barley harvest in that region. On July 19th there were many fields where barley was harvested and in shock.

Defendants' Exhibit 108 is photograph taken by me of barley harvest in field about one mile east of Eaton, July 19, 1913. Field was on N. ½ of Sec. 6, Tp. 6 N., R. 65, W. Binder was working in field; cutting was just being completed. It was a large field and practically all of barley was in shock. Yield was quite heavy.

(Defendants' Exhibit 108, a photograph, offered in evidence.)

On July 16, 1913, observed no fields of barley in process of harvest on Laramie Plains. I took photographs of grain that was growing. Took photograph of two best rye fields I saw in valley and also photograph of barley on ranch of Mr. Grable, which was just heading out at that time. It was very spotted, heading out in places. That photograph was not a success but rye picture was.

2434 Defendants' Exhibit 109 is picture of rye field on farm of Chris Olson, situate on N. W. ¼ of Sec. 24, Tp. 14 N., R. 76 W., taken July 16, 1913, by me. Rye was thin, of sparse growth all over field and just beginning to head out.

Defendants' Exhibit 110 is photograph of oat field showing

growth and development of oats and soil conditions in N. ½ of Sec. 4, Tp. 14 N., R. 76 W., taken by me July 16, 1913. Oats were very sparse on field. Field was very stony. Stony condition can be noticed by comparing it with hat that is lying in foreground in field. Plants were coming up between stones.

(Defendants' Exhibits 109 and 110, photographs, offered in evidence.)

July 16, 1913, while on trip on Laramie Plains, observed growth of grain wherever I saw it for purpose of comparison of growth with like grain in Poudre Valley. Alfalfa had at that time just
2435 been cut on Laramie Plains. Rye and barley was not ready for cutting. Plants showed late season, just as did first cutting of alfalfa. Would say that grain showed about same relative lateness. Was not there when any of grain was harvested. This was observed by McAnelly, or one or two engineers who were associated with him on the survey. They will testify to this fact subsequently.

Visited Wheatland district, July 17, 1913. Crop development in that region was much better than on Laramie area, but not so good as in Cache la Poudre area.

Crop development on Wheatland area was about midway between crop development on Laramie area and Poudre area. This was evidenced by maturity of crops at time we were there.

Considered soil conditions in Laramie Plains region primarily from agricultural values. Examined soil and took number of soil samples in different places in valley. During trip visited portion of Laramie Plains situate between river and Lake Hattie, and east of Lake Hattie Supply Canal, or Lake Hattie Inlet Ditch. Observed soil conditions in that region. Surface of land was gen-
2436 erally comparatively smooth and the lay of the land was very good. Slope was good for application of water. From mere superficial examination of area as we went along the usefulness for agricultural purposes appeared to be good. Further examination of the soil demonstrated the soil to be very poor. It consisted of thin top soil underlayed with bed of gravel, and top soil filled with boulders varying in size from robin's egg to as large as your two fists. The latter I would designate as boulders. I took photograph of soil in the vicinity of Lake Hattie Inlet, in field of oats, and this is shown on Exhibit 110, and there is another picture showing depth of surface soil where Lake Hattie Inlet cuts through country.

Defendants' Exhibit 111, is photograph of Lake Hatite Inlet, showing soil conditions through which cut is made. Taken in Sec. 20, Tp. 14 N., R. 76 W., by me July 16, 1913.

Photograph is taken to call attention to thin surface soil and boulder bed underlying it. Thin top soil runs from 1 foot to 1½ feet in thickness. In some places it is perhaps 2 feet in thickness. This canal is of recent construction. The soil noted in Ex-
2437 hibit 111 is the same soil of which surface conditions are noted in Exhibit 110.

Defendants' Exhibit 112, is a photograph taken by me July 16, 1913, on farm of E. A. Watson on Sec. 22, Tp. 14, N., R. 76 W.

It shows excavation being made for cellar. Shows stony condition of soil. He had pierced surface layer and was just into boulder layer below. Ground was wet in bottom of excavation, showing water table very close to bottom of cellar. Excavation was about 2½ feet to 3 feet in depth. Mr. Watson is shown in distance.

(Defendants' Exhibits 111 and 112, photographs, offered in evidence.)

Defendants' Exhibit 109 also shows soil conditions. It shows same boulder condition of soil as we noticed in practically all of pictures offered thus far.

Defendants' Exhibits 110 and 111 show what is designated by U. S. Geological Survey Maps as Laural Sandy Loam. Soil conditions further down toward Laramie are better than conditions shown in Exhibits 109, 110, 111 and 112. Surface soil seems to be deeper.

2438 There is considerable gravel in soil throughout the entire region. Best field I noticed was on Hart ranch. On this ranch best soil conditions were found and best soil sample was obtained. We did not make soil sample examination of soil at Agricultural College experiment station at Laramie.

Second growth or cutting of alfalfa harvested near Eaton, Colo., during 1913, beginning July 14th. Cutting began about July 16th near Fort Collins.

Second cutting alfalfa on Eaton estate near Eaton Colo., began July 14th, 1913. It was ready for harvest on July 8th.

Second cutting of alfalfa in Poudre Valley, near Eaton in 1913 began about same time as first cutting of alfalfa on Laramie Plains.

From my observations I would state that in my judgment the Laramie Plains region is not an agricultural section. The reasons for that opinion are the short growing season, low temperatures, poor and thin soil. Yield as shown by data in census reports would point to fact that it is not what you would term an agricultural section.

It is generally recognized that it costs approximately as much to produce a poor crop as it does a good crop on any given area.

2439 Value of country for agricultural purposes depends upon crop it will produce.

Net crop returns give value to country for agricultural purposes. I procured data for harvest of wheat and oats in Poudre Valley during 1913. Have notation of harvest of winter wheat 3 miles southwest of Fort Collins on July 9th on farm of W. O. Johnson. Harvest winter wheat E. E. Larson 1 mile southeast of Fort Collins July 12th. Do not have data for harvest of spring wheat with me, but it ran about 10 days or two weeks later than harvest of winter wheat. Reports gathered around and about Eaton show harvest of spring wheat about last of July. Oats harvested about one week earlier. Those are dates when harvest began. Harvests extend- over considerable time throughout summer. Continues two or three

weeks. Dates I gave are of first cutting. Oats were spring
2440 oats. Winter wheat is not raised around Eaton to any extent. Data I obtained there was with relation to harvest of spring wheat.

While visiting Laramie Plains went over Riverside Ranch and took soil samples. Hay meadows on that ranch were not very uniform. Would call them spotted. By spotted I mean that in places *there* were evidently producing small yield. In other places production of hay would be heavier. I saw nothing on Laramie Plains that would compare with meadow lands of Poudre Valley in production of hay. They would not yield so much. Do not think Laramie Plains meadows would yield more than ¾ to 1 ton per acre. Yield heavier in Poudre Valley. I refer to meadows where more native hay is raised.

E. B. HOUSE.

2441 Cross-examination by Mr. N. E. Corthell:

The charts numbered Exhibits 86 to 104 inclusive were made from Federal Census Reports and are simply translations of the statistical figures into graphic form, involving no analysis of the reports nor investigation of the basis upon which they are made. I did not know that since 1870 there has been frequent and great changes in the boundaries of Albany and Laramie Counties in Wyoming. I knew that two new counties had been organized out of Laramie County, but I did not know about any others. The comparisons of the different census reports are then merely nominal. The lines shown on the charts indicate absolute increase or decrease, and not the percentage of increase or decrease. I do not know whether a consideration of the percentage of change would make any radical difference in the result. The number of farms in Albany County, Wyoming, increased from 20 in 1870 to 453 in 1910, and in Laramie County, Wyoming, from 1 in 1870 to 1933 in 1910. In Weld County, Colorado, the increase was from 105 in 1870 to 3,981 in 1910, so that the percentage of increase was greater in Wyoming counties than in Colorado. In giving figures in regard to the wheat production in Wyoming and Colorado I have made no distinction between irrigated land and dry farm land. I have understood that there has been considerable dry farming in Wyoming in the last ten years, and this would probably reduce the average production per acre. I do not know how much dry farming there is in Laramie County, Wyoming, nor what part of the grain production is upon such land.

2445 I cannot give the average acre yield of oats for Albany County, Wyoming and Larimer County, Colorado, for 1910, as my graph upon that subject was limited to Laramie County, Wyoming, and Weld County, Colorado, which had the higher yields for their respective states. I did not purposely omit to show the average yield per acre of oats in Albany County, Wyoming.

2446 In preparing these charts I did not take into consideration the statement of the census bureau that the figures for the dif-

ferent censuses are not entirely comparable on account of variation from census to census in the definition of farm land and improved farm land, because I thought it fair to suppose that the same instructions in regard to any one census would be filed in both Wyoming and Colorado, so that the relative amount would be about the same.

2448 The census reports show that in 1870 there were more people in the Wyoming counties than in the Colorado counties, and that in Wyoming it was found that agricultural development was not as successful as stock raising, and the stock industry has therefore shown a big increase in Wyoming, while agriculture has shown a big increase in Colorado. Although I knew that there was this difference I did not realize its extent until I examined these census reports. I knew that a large part of the farm products in Wyoming is fed to livestock, but I made no investigation to ascertain whether this fact was taken into account in making up the Census reports. If a considerable quantity of grain is fed to stock in Wyoming without threshing returns being available this would affect the report as to the total yield, but I do not believe it would affect the report as to the average yield, as the acreage from which such crops were procured would not be included in the Census report. I do not know positively whether this is true or not. I endeavored to procure from the Census reports data relative to the value of livestock produced and marketed, but was unable to do so as variations are too great. I do not believe that I could now succeed in any such examination.

2449 I could not secure satisfactory data relative to the production of alfalfa, for in the earlier Census reports no distinction is made between alfalfa and native hay.

2450 The charts showing temperature which I have introduced have been made for the sole purpose of showing the minimum temperature from month to month and lines have been drawn from point to point showing the lowest temperature in each month with no attempt to show the minimum each day. Any error which arises through the use of this system would be compensating. Temperatures frequently occur considerably below freezing point without perceptibly damaging vegetation, and the damage is

2451 different with different kinds of crops. I would say that if the temperature is 26 degrees it would be a killing frost with respect to all farm crops. I would not say that a temperature 8 degrees below freezing would kill all crops, but it would injure them and stop further development. I do not believe that wheat just headed subjected to a temperature of 24 or 26 degrees would ever head out. I do not consider alfalfa as a crop of which to make comparisons with all agricultural conditions, but it is a crop by which to compare the seasons of two different locali-

2452 ties. The one visit I made to the Laramie Plains with a view to examining agricultural conditions was for three days in July, 1913. At that time we took five or six soil samples. We made no photographs other than those offered in evidence. On the last day of the trip we visited the Wheatland area, being the

2453 only time we went there. When we were on the Laramie Plains the cutting of the alfalfa had been going on for a few

days, I do not know how long, and I have no other knowledge as to the usual date of the first cutting of alfalfa.

Redirect examination.

2453 By Mr. Delph E. Carpenter:

A large percentage of grains raised in Weld and Larimer Counties in Colorado are also fed to live stock. This is particularly true of barley and oats. Some rye is fed.

2454 JOHN L. ARMSTRONG, a witness in behalf of defendants.

Direct examination by Mr. Delph E. Carpenter:

John L. Armstrong, Water Commissioner of District No. 3, State of Colorado. District No. 3 includes Cache la Poudre River and its tributaries. Have been water commissioner or acting water commissioner 24 years. This covers period of 31 years. Was in office 7 years during the 31 years.

Duties of water commissioner are to distribute water of river to ditches and reservoirs of district according to decreed rights as determined by District Court. I am local water officer for the district. My immediate superior is the Division Engineer of Division No. 1.

2455 Division No. 1 includes the entire drainage area of South Platte River and its tributaries. It is subdivided into water districts. I am commissioner of water district No. 3 in this division. Division Engineer is chief over entire water division.

State Engineer, Mr. John E. Field, at present is superior officer to Division Engineer. He is the chief official over all divisions and sub-divisions and districts throughout the state.

My duties have nothing to do with the fixing of priorities on stream. This is done by District Court. Statute provides that this court shall establish these priorities. I execute the decree.

Began as official in 1883. Was acting commissioner during absence of commissioner. Acted as deputy water commissioner during years 1883 to 1886. B. S. Lagrange was water commissioner during those years. He was absent part of the time. I was on active duty those years in irrigating season.

2456 Became Water Commissioner for district March 1887. Continued until April, 1889. Again became commissioner July 1, 1890 and continued until May, 1893. Again became commissioner January 1, 1895 and remained until April, 1889. Again became commissioner April, 1903 and have continued until present time. During these years that I have been water commissioner have resided at or near La Porte in water district No. 3 near Fort Collins.

During years when was not in office have been working for some of irrigation companies generally and have been in close touch with irrigation matters. Have had intimate knowledge, both officially and otherwise, of Cache la Poudre River since 1883. During all these years have not been absent from valley more than a day

or two at a time. Prior to 1883 had practical experience in
2457 application of water. Began irrigating in 1873. Became practical irrigator prior to becomeing deputy water commissioner. Had experience as superintendent of canal before becoming deputy water commissioner. Had charge of Larimer County Canal No. 2. The one I refer to is on opposite side of river from Larimer County Ditch. It heads perhaps three miles further down the stream and goes past Fort Collins on south and west and irrigates what we call Harmony District. The Larimer County Canal comes out on the north side of the river not far below north of canon and irrigates lands north and east of Fort Collins, Windsor and Eaton and over into Lone Tree Valley. This latter canal is the one owned by The Water Supply and Storage Company.

Official duties have placed me in position to observe general irrigation development in Cache la Poudre Valley since 1883. In 1883 ditches were comparatively small and those most easily constructed at that time. Those lands easiest to irrigate were first reclaimed. Structures were not expensive in the first construction. The Larimer and Weld and Greeley No. 2 Canals had been constructed at that time but had not been used to the extent that they are at present. They have both been enlarged and extended from time to time to a considerable extent. They were in operation at that time, however. Larimer County Canal was a small ditch at that time. It has since been extended to cover territory at present reclaimed. These three large canals cover more territory now than they did in 1883. Also carry more water. They have changed irrigation and crops.

Crops have changed from grain to production of which the land was largely devoted in 1883, to general farming, including sugar beets, potatoes, cabbage, onions, market gardening and fruit to a great extent. In earlier period nothing was talked about except grain farming.

During last fifteen years grain has been planted principally as a nurse crop for alfalfa and for preparation of soil to adapt it for cultivation of other crops. Alfalfa is almost universally planted with grain during first year. Alfalfa has brought our soil back to better condition than it was in its virgin state. During grain farming the lands ran down so that we had to put in alfalfa to bring about a better soil condition.

2459 Alfalfa itself is a profitable crop. It is a necessary crop in order that we may raise sugar beets, potatoes, and feed cattle and sheep. Feeding is one of principal industries in valley. In first year of feeding we obtain good grain crop and stand of alfalfa but not much crop of latter.

In 1883 irrigation development was nothing in valley as compared with present. Irrigation system has developed into entirely different proposition now from what it was then. At that time we simply had ditches taking water directly from river and when water came we would use it. Since then we have constructed reservoir systems and provided for times when there is no natural flow in stream. We have also extended larger canals so as to more than double area of land covered. The area is much more than doubled.

Reservoirs have been constructed, maintained and operated by farmers as a rule. The necessities of the valley forced the construction of the reservoirs. We found we were at the limit in raising grains and had to do something else. We had to provide water for later crops which were more profitable and keep the land in a higher state of fertility. Grain alone did not prove a profitable crop.

2460 The water commissioner is the official who has charge of the water exchange system in Cache la Poudre Valley. This exchange system more nearly resembles a banking system than anything else to which I can refer, with the water commissioner as the Clearing House. The occasion for the development of the exchange system in the Poudre Valley was occasioned as follows: In about 1888, we had reached a point where it was evident that some change was required. I was Water Commissioner. It was year of lowest water since 1874. Grain farming had demonstrated that it was going to become an absolute failure. Potatoes were coming to front as a very important crop and farmers were finding out they could raise alfalfa, fruit, vegetables and many other crops beside grain, and in which there was more profit. Under many of our ditches it was evident that it was useless to plant crops that would require late irrigation. Grain needed irrigation in June. Other crops required late water. Reservoirs were required for use in conjunction with natural flow of stream to enable irrigator to raise crops requiring late irrigation. A number of ditch companies found natural basins in which, by building dam on lower side, they could impound large quantities of water. These were constructed in many cases. They found many of these basins in such a position that they could fill from their ditches, but could not divert the water into their ditches again because their reservoir was lower than the ditches. The problem then was to get water below your ditch above the same ditch so that it would be available for diversion.

2461 To illustrate: About that time the North Poudre System had a number of basins that could be filled only by their own canal. The Larimer County ditch owners found a number of basins they could fill from their canal, and the Larimer and Weld Canal, the next large canal below the Larimer County, found a very large basin north of town of Windsor below their canal but above the Cache la Poudre Canal or Greeley No. 2. This was the Windsor Reservoir. A large reservoir was constructed on this site—the largest we have in the district. All of these reservoirs were filled during the winter season and during the flood periods.

Windsor Reservoir is lower than the Larimer and Weld Canal, but is filled by that canal and discharges its water directly into the Cache la Poudre Canal, commonly called Greeley No. 2 Ditch. The North Poudre Canal is the highest up stream. The next canal down stream was the Larimer County Ditch at that time. Since that time the Poudre Valley Canal has been constructed between the two. The next canal down stream was the Larimer and Weld Canal, commonly known as the Eaton Ditch. The next and lowest large canal on the north side of the stream is the Cache la Poudre Canal or Greeley No. 2 Ditch.

At the close of season of application of water by irrigation until the next season, all waters available in stream are stored in these reservoirs. The filling of these reservoirs is completed with the spring rise in the river. At that time we usually have a little surplus to finish filling the reservoirs.

The North Poudre Canal, which is the highest canal up-stream, is the canal having the last or poorest priority. It is the first ditch requiring water from its reservoir system. It so happens that the canal having the first priority, senior or better priority or claim to the waters of the river, is the Greeley No. 2 Canal, situated the lowest down the valley. It also happens that the claims for water between these two large canals becomes inferior as you go up the stream. Greeley No. 2 or Cache la Poudre is the senior, Larimer and Weld comes next above it, Larimer County is next in priority and is above the Larimer and Weld Canal on the stream, North Poudre Canal is fourth and above all three in priority and location.

Before the necessity of using reservoir water begins the Windsor Reservoir Company will hold a meeting and declare a dividend of water from the amount they have on hand, that is, they will decide what number of cubic feet they have available to be apportioned on each water right or share of stock in the company. The great majority of that water has to be used under the Larimer and Weld Canal which is located higher up stream and above the Windsor Reservoir. As soon as they declare the dividend, they will notify me that they require, say for example, 500,000,000 cubic feet of water transferred above the reservoir so it will be available at their ditch.

2463 They say, as soon as you can get water above us, get it, we will turn from Windsor Reservoir into Greeley No. 2 Canal any quantity you want when there is call for reservoir water above. Let us supply Greeley No. 2 Canal so we can get it later.

The Larimer and Weld Canal does not need to use reservoir water as early as does the North Poudre Canal and Larimer County Canal, because the river priorities of the latter are inferior to the former.

At the time of the beginning of the exchange, Greeley No. 2 Canal has a full supply of water in the stream. As soon as water begins to get scarce, the first canal to shut down will be the North Poudre, the highest canal up the stream and the junior appropriator. Instead of cutting off the water supply from their ditch as in former years, we don't do that at all. They, for example we will say, require 200 second feet of water. We don't disturb that at all. They continue to use it but turn out an equivalent from Windsor Reservoir into Greeley No. 2 Canal, for the reason that the shortage would occur at that canal as it is furthest down the stream. Instead of making up the shortage by shutting off the North Poudre Canal I leave whatever there is flow in that canal and turn the same amount out of Windsor Reservoir to make up the shortage in the river, but don't pay Windsor Reservoir Company any water yet. The equivalent of the water turned out of Windsor Reservoir is held back for the Larimer and Weld Canal by the North Poudre people in their reservoirs Nos. 5 and 6, or Fossil Creek Reservoir, or wherever it is most desirable to take it from as the season develops.

During perhaps the next week or two, the river will keep on dropping and Larimer County Canal will lose its right to divert water from the river and will be forced to draw upon its reservoir supply. We will suppose Greeley No. 2 Canal would still be entitled to 150 cubic feet of water per second after diverting 150 cubic feet per second into the North Poudre Canal. In such case we let the 150 cubic feet per second due to Greeley No. 2 Canal flow into the Larimer County Canal and turn an increased amount out of Windsor Reservoir to supply the shortage thus occasioned to Greeley No. 2 Canal. The Larimer and Weld Canal has not required the use of any reservoir water as yet, as they are still getting their river appropriations but by this process I am getting the water out of Windsor Reservoir and above the Larimer and Weld Canal and in the reservoirs of the North Poudre systems and the Larimer County System.

2464 Most of the owners of capital stock in the Windsor Reservoir Company draw their water through the Larimer and Weld Canal or Eaton Ditch which is located higher up the stream and above the Windsor Reservoir, but by this system I am getting the water represented by their stock up into the reservoirs belonging to the North Poudre Irrigation Company and The Water Supply and Storage Company, to the extent of from 250 to 280 cubic feet per second. Whenever the river supply for the Larimer and Weld Canal becomes insufficient, we pay back to that canal the water already taken from Windsor from reservoirs Long Pond, Rocky Ridge, Richards No. 2, 3 and 4 of the Water Supply and Storage Company's system. These all discharge into Larimer and Weld Canal and the North Poudre system pays for water it took out belonging to Greeley No. 2 by discharging the waters of Reservoirs No. 5 and 6 into Larimer County Canal, and the Larimer County Ditch pays what it owes by discharging, as I have said, from these four reservoirs into the Larimer and Weld or Eaton Ditch, until the bill is paid. If they draw more than they have advanced, they will balance accounts by discharging water from their reservoirs into Greeley No. 2 Canal, so that 100 cubic feet of water per second of time from Greeley No. 2 Canal river appropriation serves to exchange 100 cubic feet per second of reservoir water belonging to the North Fork System,

2465 100 cubic feet of water per second of time belonging to the Larimer County Ditch System, and 100 cubic feet of water per second of time belonging to the Windsor Reservoir Company.

This exchange system, in its final analysis simply amounts to taking out 100 cubic feet of water per second of time, for example, from Cache la Poudre River at head of North Poudre Canal instead of at the head of Greeley No. 2 Canal, and the running of that 100 cubic feet of water per second of time from head of North Poudre Canal to Greeley No. 2 Canal through a series of artificial canals made up of ditches and reservoirs, down through the various steps I have described, in lieu of letting the water pass down the river past those several headgates and to the headgates of Greeley No. 2 Canal. So that, while for all purposes Greeley No. 2 Canal is getting 100 cubic feeta of water per second of time on its so-called direct river appro-

priation, in fact it is getting water that was stored and diverted from the Poudre River many months previous.

The whole system of exchange simply amounts to compensation by one ditch company to another company for water taken and measured in quantity. The illustration I have given prevails throughout the Poudre Valley wherever it is possible. This system was brought about through the necessities of the case. Reservoir water was absolutely necessary.

2466 The exchange system has brought about such an economy in the use of water that we now have big sugar factories in operation, making sugar to their limit. Without the exchange system we could not raise beets enough to supply one factory. It has resulted in great economy in the use of water.

Rights to use of water from the Cache la Poudre River are represented by decrees issued by the District Court of Colorado—the Eighth Judicial District. When I speak of ditch or direct decrees, I refer to decrees authorizing the appropriation of water for irrigation for direct and immediate use from the stream to ditches and not for filling reservoirs. The reservoirs were constructed at a much later date. They have decrees authorizing diversion of water from the river on later priorities. We have separate decrees for reservoirs obtained in separate proceedings. The rights to divert water by reservoirs were adjudicated apart from those fixing the rights to divert water by ditches.

By the exchange system I am utilizing water obtained upon junior decrees to compensate for water taken from the river belonging to senior decrees. If we could not utilize and put into full force and effect this system of exchange on the Cache la Poudre river, it would have a very damaging influence and the water could not be made to do the same service as at present. A large amount of the water would be wasted and would pass down the river. We might compensate that to a certain extent by building ditches above, but it would result in heavy expense and we could not use the water as extensively as at present.

2467 Am familiar with Colorado statutes authorizing exchanges of water in manner I have described. I wrote the bill. The drafting of this bill and its enactment into law followed the actual practice of exchange of water in the Poudre Valley. When it was first initiated we had no law authorizing it. The practice was authorized by law four years subsequent to the initiation of this method of handling this problem. This has been the history of nearly all irrigation law of Colorado, from the earlier days down to the present time. The law has usually followed the practice. The settlers first constructed the canals, and irrigated and formed their rules which were later enacted into law.

The Cache la Poudre Valley was ahead of the rest of the state in development and demand for enactment of laws governing irrigation. It was the first district adjudicated in the state. The priorities date back to 1860 in some cases. The water rights were fixed by decree in 1882, although irrigation had been practiced since 1860.

2468 First water commissioner on Cache la Poudre River was appointed in 1879 or 1880, but was unable to perform any services except in advisory capacity until 1882, when decrees were entered. The enactment of law providing for water commissioners was brought about because of continuous increase in use of water to such an extent that it became very scarce. On lower portion of streams some irrigators had prior ditches to those canals above and it was found absolutely necessary to have some authority over the stream in order that the lower canals and older appropriators might get their water. Some regulation was necessary in order to do justice to early appropriators. In other words, the junior and inferior claimants were robbing the senior and superior claimants of their water supply. If no river commissioner had been appointed, there would have been considerable violence and a great deal of unnecessary trouble over water distribution. The man entitled to receive it would not get the water except by power of might and it was impossible to let the matter go in that way. It was necessary to have an adjudication. Even if regulated by litigation and enforcement of court decrees it would have entailed a great deal of expense and taken a long time and innumerable suits.

2469 Shortage or lack of water brought about the police regulation of streams in Colorado. This shortage first occurred in Cache la Poudre Valley. Up to the time of the beginning of the construction of larger ditches out of this valley, there was water enough for the smaller ditches on the river bottoms, and there was not much need for supervision until the construction of ditches for taking the water out onto the plains. The latter canals were large. The first ditches were constructed for the irrigation of river bottoms.

If it were the fact that no river commissioner were needed or called upon to make distribution of water from streams for a period of years, it would be indicative that there was water enough in the stream to supply those who needed; otherwise, there would be need for supervision. This lack of supervision would signify water supply more than sufficient to supply the demands; there would have to be a surplus of water. Supervision has been a necessity throughout the West, wherever there has not been a surplus of water. Irrigators diverting water from a stream without supervision are not inclined to take less water than they really need.

2470 About 305,000 or 310,000 acres of land are covered by ditches and irrigation works in the Cache la Poudre Valley outside of the acreage included within the Greeley Poudre Irrigation District. This acreage given would be subject to proper deduction for roads, reservoirs, and some large ditches, and some lands that lie higher than the canals; it is proper to describe them as sort of knobs. Small deductions should be made for various other reasons.

2471 In 1883, when I first became water commissioner, there was not more than one-half the acreage under irrigation that is reclaimed at present. Would think that there would be about half of the present irrigated area in 1890. Think the area has about doubled since 1890. Extension of irrigated area has been brought about from different causes. One important cause is construction of

reservoirs. Another is additional supply of water derived from other water sheds, such as Laramie, Grand and Michigan Rivers. Another very important cause is knowledge gained by irrigators as to best methods of applying water and economy in its use, curtailment of waste which used to exist under old methods, etc. We can make water irrigate more land than we used to. All three of these I have mentioned are factors in extending the area of reclaimed land.

It has been my custom and the custom of the other officials in Poudre Valley to prevent waste wherever possible. When we find appropriators wasting water we cut off supply to extent we believe they are making wasteful use. We keep supply shut off until we are satisfied they really need an increased supply or take pains to put it to better use than they did before.

2472 These various reservoirs belonging to different owners in valley are frequently used under my direction for impounding waters other than those to which such reservoirs are entitled from their decrees. It so happens that in some cases our old reservoirs are located lower down the stream than our later reservoirs. It is our aim, as nearly as possible, to fill upper reservoirs even though they are junior to later reservoirs, still guaranteeing a full quota to those reservoirs. We have more water available lower down than higher up stream and sometimes if we supplied appropriations in usual order of priorities, after we fill lower senior reserviors we would have plenty of water below which would go to waste after such reservoirs were filled. So that, in so far as we can, we fill upper reservoirs first, even though junior in priority, and guarantee to lower reservoirs that if they are not filled they will have their quota from upper reservoirs. We generally get the owners of the reservoirs together upon a proposition and have an understanding with owner of upper reservoir that he is taking the water out of his turn on condition that senior reservoir below must be supplied, and if it turns out later that we do not have enough available water below, it is recognized that the lower reservoirs' water is in the upper reservoirs, and that the seniors must have it and, being in reservoirs above, it is easy to turn it down. If the water were in the reservoirs lower down it would not be possible to get it into the upper reservoirs. There is no statute permitting this, but we have been doing these things by amicable agreement, regardless of want of authority by statute. It all works for economy of water. This practice

2473 has been recommended by State Engineers. The present State Engineer, Mr. Field, has recommended that I do it wherever possible. Mr. Comstock, his predecessor, also recommended it.

When exchanging water, I credit the senior reservoir with the amount of water in the higher or junior reservoir and notify the senior reservoir that there is water in the junior reservoir subject to the demand of the senior, and that they may draw upon it whenever they desire. At the close of the period of storage, we have a reckoning and notify the lower and senior reservoirs of the amount of water belonging to them and on storage in the upper and junior reservoirs.

It also sometimes happens that some system, such as, for example, The Water Supply and Storage Company might have water coming from a foreign watershed which they do not need at the time of its diversion, and which would be stored in the reservoirs of some other company by consent and on payment of a toll charge.

2474 This water is later withdrawn by the owner and applied in the irrigation of lands. Outside of such cases the storage of water in upper and junior reservoirs, which in fact belongs to lower and senior reservoirs, is a gratuitous service.

All reservoirs of valley are not only under my supervision as police officer, but are also placed at my disposal for use of empty space as my best judgment may dictate throughout season.

I keep in touch with various headgates and diversion works on river and outlet works at numerous reservoirs by telephone. Communication is had daily and sometimes several times a day, and I make it my business to visit all of them I can in valley as frequently as possible. Every part of diversion system of Poudre Valley, including outlets of reservoirs, is in constant touch with my office.

My office is a clearing house for the water system of the Cache la Poudre Valley. I keep a debit and credit account of exchange system. One reservoir may be out, for illustration, 2,000,000 cubic feet of water before they ever get a drop back, and I have to keep an account of this. They draw the water when they can make the best use of it. They put off demanding the reservoir waters as long as they can and hold this water as a reserve as long as possible and only use it when required to do so for growing of crops. Necessity alone prompts its withdrawal from reservoirs.

2475 Reservoirs are also used through exchange system for fragmentary runs of water that otherwise would be lost in the ditches. For illustration, instead of giving a ditch 30 feet for half a day or 60 feet for half a day, according to fluctuation of the stream, we might let them go without any water for a week and then turn out 100 to 150 cubic feet per second until their credit in the reservoir is exhausted, thus making it worth something to them, while if run directly from the river the water would be wasted in the canal. By this method of diverting these fragments of flow into a common receptacle and thereby accumulating them, we tend to greater economy.

From the standpoint of economy and efficiency in use and service of water, there is no comparison between the method of diversion and application of water directly from the stream and the diversion of water from the stream and storage in reservoirs for later application. The reservoir method of diversion, storage and distribution is by far the more economical. By the reservoir method, an acre foot of water brought to the land through process of diversion, storage and distribution, will do greater service and perform greater

2476 duty in irrigation of lands than an acre foot of water turned directly from the stream to the land. If you own 1,000 acre feet of water in a reservoir and your river supply is cut off, you will be just as economical with that water as you would be with your bank account. The water in your reservoir is your reserve and you

will be as economical as possible and apply it only when you need it. You can even shut it off at night and use it only in the daytime. But you must use river water when it is at your headgate. In other words, the only time you can use water diverted directly from stream, is when water is at headgate of ditch. The moment it passes your headgate it is beyond your control. The tendency follows to take all you can, when you can. You will draw it and may even let it pass out through the ditch, without use; but you would not do that with the reservoir; you would shut it off. It
2478 has been the experience that ditches will divert and water will be applied to lands already wet with heavy rains or from other cause, simply in order to avoid shortage later. This was experience before reservoir system was started.

Delivery of water from reservoirs of Cache la Poudre Valley is regulated to consumers upon order. Consumer will place his order with secretary of company, one or two days previous to time he will need water, and secretary each day totals up how many shares are ordered for carriage from reservoir and notifies superintendent, giving him list of stockholders drawing water for the following day. Superintendent knows night before how many shares are ordered of reservoir water for following day. He has proper amount turned into his ditch for delivery on the next day for those who have ordered water. This water is ordered according to rules fixed by company and a certain amount is required to be ordered to avoid waste. They could not run small quantities economically. They require a minimum amount of water to be ordered before a run will be made.

Each share at beginning of delivery represents so many cubic
2479 feet in reservoir. They generally run on basis of one cubic foot of water per second of time. Sometimes they will run less, depending upon conditions. A share, however, represents so many cubic feet of water in reservoir. In delivery it represents certain flow of water measured in cubic feet or fractions of cubic feet per second. They figure they have a cubic foot of water coming for so many days during season. An irrigator divides that up in time so as to irrigate his crops to what he considers best advantage. He may draw a few days now and then lay off a week, and then draw three or four days at a time. Irrigators have different ideas and each one decides for himself how he will draw his water.

One million cubic feet of water in a reservoir is equal to between 22 and 23 acre feet. A cubic foot per second of time of water running for 24 hours will deliver about 2 acre feet; that is, will deliver enough water to cover 2 acres a foot deep. There are about 11½ days constant run of a cubic foot of water per second of time for each million cubic feet of water in the reservoir. That is the usual way of estimating and delivering the water. This water is ordered and delivered to the farmers in the quantity desired in every in-
2480 stance, subject to the rule of minimum quantities in canals.

A water right in reservoir simply refers to the established unit among water users. It varies on different water systems. The Windsor system has 4 shares of stock which is termed a right of reservoir water by the farmers who own the reservoir. Other reservoir com-

panies have rights made up of varying number of shares of stock. These matters are not in my supervision. Superintendent tells me what he wants in cubic feet, and if he has it in reservoirs above, he obtains what he ordered.

Outlet gates of all reservoirs are regulated on my order. Keeper of outlet gates is employe of company owning reservoir, but takes his orders through my office. Could not make orderly distribution of water if did not have this method of discharging water from reservoirs.

2481 Economy in use of water requires the fixing of minimum amount of water that will be run in canal at any one time. If each irrigator under canal were allowed to draw his water independently of anyone else, you can see that in a long ditch the small quantity of water to which individual consumers would be entitled would be lost if run alone. You have to accumulate a large enough head so that you can deliver without unreasonable loss. There is bound to be a loss in any case. We always have to turn out more water than we can deliver to stockholders in order to make up for shrinkage in delivery, but we want to cut that loss down to the minimum. The stockholders have to stand the loss occurring between reservoir and their lateral headgate. The old canals are used as conveyers or carriers for the water stored in reservoirs. These canals are compensated for carriage in different ways. In case of Greeley No. 2 Canal a charge for carriage of reservoir water is made to stock holders. The reservoirs owners have shares also in the ditch company, but they are two separate corporations and they sometimes have different sources of reservoir supply. Some stockholders in Greeley No. 2 Canal have water rights in Windsor Reservoir and some in the Timnath Reservoir, and the company charges for carriage of reservoir by the quantity conveyed.

Farmers, even in management of their laterals, make a custom to run water together, so as to carry as large a head as possible. Even between individual farms in distribution, it is custom, when head is small, to exchange between one another, that is, one may will to take his own water and that of two or three neighbors for a certain number of hours and then the other man will take the whole head, etc.

2482 Custom is to give such crops as beets, potatoes, cabbage, onions, peas, beans, and like highly cultivated crops, light but frequent irrigations. The irrigators stay with the water every moment of their time, day and night.

Loss of water for running in canals is occasioned by evaporation and seepage. The larger the head the less the ratio of loss.

Water flowing from the Cache la Poudre River at mouth of cañon is divided from day to day by system of gauges up and down river at important canals. We have rating station in cañon itself gauges at convenient places down the rivers. Have reports from all those ditches every morning and evening and sometimes every noon, showing amount of fluctuation. Large ditches all keep headgate man all through season, day and night. I get reports from them as fre-

quently as I wish. I always demand a report the first thing in
2483 morning, which is usual time of rise of water in river. At headgate of Larimer County Canal the rise comes very early in morning, reaching other stations as they go down stream. I begin calling headgate men from 4:30 A. M to 5 A. M. Continue calling from two to three hours.

In early part of season, when we have a high river, fluctuations during day are as much as 500 second feet between the high and low water marks. High water comes in early morning and low water comes in afternoon. If Larimer County Ditch, for instance, is entitled to its full appropriation at high waters, I give headgate keeper a mark below his headgate which is sufficient to supply prior appropriators below, and I order him to keep the river up to that mark, whatever it may be, knowing that is just what I need to supply prior appropriators below. As ditch reaches point where he has only water he is entitled to, that is, water from the Laramie, Grand and Michigan and appropriations from river, he shuts headgate down to that point. If water goes below mark on gauge in river, he notifies me he cannot keep river up. Then I come to next junior, which would be Larimer and Weld, and give him an appropriate order. This may require him to cut out 50 or 100 cubic feet per second out of canal, but it does not make any difference, he keeps up the amount for prior appropriators below. In afternoon, when flow has reached its minimum, I know next change will be a rise, and at night I tell man at Larimer County headgate that when river comes back to certain point he may take water. As river rises, he takes rise into canal. The same is true with Larimer and Weld Canal. If latter canal is cut out during afternoon, when river is up in the morning he takes on water just so he allows required amount to pass. That is the way the ditches are regulated. With little ditches I sometimes go and shut headgates myself or order superintendent to do so.

I do not use deputies in distribution. Only ones I use are to keep track of water coming from other water sheds, which is quite a way off from my point of observation. I attend to distribution alone. I could not do this work alone without aid of telephone.

First telephone lines in valley were private phones built by ditch companies for use of river commissioner and company employes.
2485 These phones have been done away with. They were used until we could do better. When the general telephone system became installed through country, we found it more handy to use it. Both ditch companies and water users used the general telephone. Installation of telephone in first instance was required for communication between me and ditch people. It would be impossible to make distribution under the very complicated and elaborate system prevailing in Cache la Poudre Valley without these various headgate and reservoir men at their stations day and night.

The gauges at fixed canal headgates of which I spoke, are located just below the dams of these headgates. They are used to keep account of water passing. Principal rating station is at mouth
2486 of cañon, a little above the mouth.

I have kept general account of amount of water passing

out of Cache la Poudre Valley at its mouth and entering South Platte River. I have been required to report on that the same as I report on amount of water that goes into ditches. My duties are performed in connection with duties of other water commissioners, and state officials require knowledge of amount of water going into other districts as well as into mine. I am only one spoke in the wheel, and in order to make proper distribution in districts below me, Division Engineer and State Engineer have to know the amount of water flowing into that district from various sources.

Am compelled to report amount of water going out of Poudre River into South Platte River on account of ditches taking water from South Platte River below mouth of Poudre. It assists man below to distribute. He must know how much he has to distribute. There are many ditches taking out of south of Platte River below Poudre. There are some very large ones. This is true throughout the river to the interstate line.

2487 The water flow discharging from mouth of Poudre for a large part of time is mostly seepage water. At times there is flow greatly in excess of seepage water, due to large amount of snow melting in June and July and to rains. These are flood waters that have passed diversions on Poudre. The passing of this water does not signify that every ditch on Poudre is necessarily diverting its full head of water. It sometimes happens that water is needed badly, but we have to run the water down into the Platte because of broken ditches.

Excess of water, over and above that coming from seepage and percolation, passing out of mouth of Poudre River occurs during month of June particularly, it may happen in latter part of May and early part of July. Have kept a memorandum showing general idea of amount of water discharged from Poudre River over a number of years.

(COPY OF DEFENDANTS' EXHIBIT 113.)

Water Flowing from Poudre to Platte River.

1909.		1910.		1911.		1912.		1913.	
Jan. 2	110	Jan. 1	180	Jan. 7	60	Jan. 6	85	Jan. 4	170
" 9	160	" 8	180	" 14	60	" 13	85	" 11	168
" 16	150	" 15	175	" 21	60	" 20	80	" 18	164
" 23	170	" 22	165	" 28	60	" 27	75	" 25	165
" 30	160	" 29	160	Feb. 4	60	Feb. 3	75	Feb. 1	125
Feb. 6	160	Feb. 5	155	" 11	60	" 10	75	" 8	125
" 13	160	" 12	160	" 18	60	" 17	75	" 15	135
" 20	150	" 19	160	" 25	60	" 24	75	" 22	128
" 27	170	" 26	160	Mar. 4	60	Mar. 2	75	Mar. 1	140
Mar. 6	160	Mar. 5	160	" 11	60	" 9	75	" 8	100
" 13	160	" 12	120	" 18	60	" 16	85	" 15	97
" 20	160	" 19	110	" 25	60	" 23	80	" 22	100
" 27	180	" 26	90	Apr. 1	60	" 30	80	" 29	100
Apr. 3	240	Apr. 2	90	" 8	45	Apr. 6	80	Apr. 5	105
" 10	170	" 9	100	" 15	45	" 13	80	" 12	144
" 17	180	" 16	80	" 22	45	" 20	80	" 19	110
" 24	200	" 23	60	" 29	45	" 27	90	" 26	160
May 1	200	" 30	60	May 6	45	May 4	70	May 3	140
" 8	100	May 7	70	" 13	45	" 11	130	" 10	80
" 15	85	" 14	75	" 20	45	" 18	200	" 17	270
" 22	160	" 21	200	" 27	45	" 25	80	" 24	80
" 29	185	" 28	70	June 2	45	June 1	100	" 31	707
June 6	1608	June 4	70	" 10	45	" 8	700	June 7	50
" 12	2700	" 11	40	" 17	45	" 15	200	" 14	55
" 19	4500	" 18	40	" 24	45	" 22	150	" 21	55
" 26	2720	" 25	40	July 1	45	" 29	220	" 28	50
July 3	2000	July 2	40	" 8	60	July 6	200	July 5	50
" 10	885	" 9	30	" 15	50	" 13	75	" 12	40
" 17	40	" 16	30	" 22	50	" 20	70	" 19	40
" 24	60	" 23	30	" 29	50	" 27	250	" 26	120
" 31	60	" 30	30	Aug. 5	50	Aug. 3	200	Aug. 2	50

Aug. 7	60	Aug. 6	30	" 12	50	" 10	70	" 9	50
" 14	60	" 13	30	" 19	50	" 17	70	" 16	40
" 21	60	" 20	30	" 26	50	" 24	70	" 23	40
" 28	60	" 27	30	Sept. 2	40	" 31	70	" 30	40
Sept. 4	60	Sept. 3	30	" 9	40	Sept. 7	70	Sept. 6	40
" 11	100	" 10	30	" 16	40	" 14	100	" 13	60
" 18	130	" 17	30	" 23	40	" 21	180	" 20	90
" 25	150	" 24	45	" 30	40	" 28	110	" 27	150
Oct. 2	120	Oct. 1	30	Oct. 7	40	Oct. 5	115	Oct. 4	264
" 9	110	" 8	50	" 14	70	" 12	115	" 11	90
" 16	130	" 15	80	" 21	40	" 19	125	" 18	120
" 23	130	" 22	85	" 28	70	" 26	140	" 25	120
" 30	130	" 29	105	Nov. 4	60	Nov. 2	135	Nov. 1	120
Nov. 6	130	Nov. 5	125	" 11	90	" 9	130	" 8	120
" 13	130	" 12	125	" 18	90	" 16	160	" 15	120
" 20	140	" 19	102	" 25	90	" 23	160	" 22	110
" 27	200	" 26	50	Dec. 2	90	" 30	170	" 29	110
Dec 4	190	Dec. 3	50	" 9	90	Dec. 7	130	Dec. 6	120
" 11	210	" 10	55	" 16	90	" 14	170	" 13	120
" 18	210	" 17	60	" 23	90	" 21	170	" 20	120
Dec. 25	190	" 24	60	" 30	85	" 28	170	" 27	110
Total in acre feet for year	288,558		60563		41236		91983		85942

Defendants' Exhibit 113 is a statement showing amount of water flowing from Cache la Poudre River into South Platte River during years of 1909, 1910, 1911, 1912 and 1913. Table was compiled from weekly reports of water commissioner of District No. 3 to State Engineer. It is made up from my own reports. I stated there is constant flow from mouth of Cache la Poudre River, occurring from seepage and percolation. Referring to Exhibit 113, will state that in year 1911 there was no flow of water from mouth of Cache la Poudre into South Platte River other than that occasioned by seepage and return waters. Amounts given in column for 1911 on Exhibit 113 indicate the amount of seepage and return flow escaping from river during that year.

In year 1909 there was very large excess of water, over and above seepage and return water, passing down into South Platte River. It is year of largest excess flow shown on this sheet. There was also some in 1912 and in 1913 and probably a little in 1910.

Have calculated amount of discharge of water from mouth of river during 1911, that being year when no other than waters coming from seepage and return escaped at that time. Amount is approximately 41,236 acre feet.

I calculated amount of water passing from mouth of river in 1909, being year of largest flow. The flow thus obtained includes the flow from seepage and return water as well as from flood water. Aggregate amount escaping in 1909 was 288,558 acre feet.

Years 1909 and 1911 respectively represent the high and low years in the history of the flow of the stream during my administration.

2488 In 1911 we had no more water than was necessary to supply demand on streams by ditches, and in fact did not have enough. There was general shortage of water in 1911, also in 1910. Think we had more water in 1911 than in 1910, but 1910 followed big year of 1909, continued to deliver more return water in proportion to amount coming through cañon than in 1911, because 1911 followed low year 1910.

Have calculated amounts of discharge of water from all sources, both seepage, return and flood, during 1910, in acre feet. Total amount was 60,563 acre feet.

Have calculated amount of such flow for 1912. It amounts to 91,983 acre feet.

Of the 5 years that I have given on this table, 1911 carried the least water into the South Platte River. The discharge of 41,236 acre feet for that year, may be taken as low discharge for seepage and return water into South Platte River from Poudre.

2490 The Ogilvie Canal diverts water from Cache la Poudre River and receives its supply almost altogether from seepage and return water. It is situate about 4 miles above the mouth of the Poudre. They have a reservoir, Seeley Lake, filled by Greeley No. 2 Canal. This reservoir receives its supply from seepage water. Greeley Colony Canal No. 3 receives a large portion of its water from seepage and return water. Boyd and Freeman Ditch also receives principal supply from same source and same is true of Wm.

R. Jones and B. H. Eaton Ditches. This Eaton ditch is not the large canal of the Larimer and Weld Irrigation Company sometimes called Eaton Ditch. The B. H. Eaton ditch is a small ditch that heads on South Side of river southwest of Windsor.

Whitney Ditch obtains large portion of its supply from seepage and return water, and same is true in small measure of Greeley No. 2 Canal and Box Elder Canal.

2491 At times we are required to let more than the seepage water go by the headgate of Greeley No. 2 Canal in order to supply older priorities below. At times there is not enough seepage water to supply them and at other times there is. This varies with conditions.

There is some seepage and return water intercepted by ditches themselves. This is true of all canals below the upper one. These canals also intercept rain water that otherwise would go into river.

Seepage water appears at various places under larger canals, in low lying lands and draws. This water is generally used for irrigation and it is the custom to use all of it.

Amount of water which I have given as flowing from mouth of Cache la Poudre River into South Platte River in the year 1911, represents the net amount of return and seepage water left or remaining after all uses and re-uses of the return and seepage water has occurred in Cache la Poudre Valley.

Defendants' Exhibit 113, a tabulation, offered in evidence.

There was greater flow of return and seepage water in year 1910 than in 1911, on account of fact that 1910 followed year 1909, which was year of high flow. That is general experience in Cache la Poudre Valley. In year of high flow, everybody has all water they need, all reservoirs are filled, and land is thoroughly irrigated. This causes continual discharge of return water during next season.

Irrigation systems, such as that of Greeley-Poudre Irrigation District, with its works located as they are, would not get any benefit of water discharged from Cache la Poudre River at its mouth and coming into that stream from sources of seepage and return. Of all the water which is discharged from mouth of Poudre, only part upon which this system could depend for its supply, would be that portion in excess of amount required by prior appropriators, coming from cañon mouth. No waters coming from cañon mouth are considered seepage and return waters. This is called original water.

2493 The irrigation system of the Greeley-Poudre Irrigation District would be compelled to depend upon surplus of that class of water as its only source of supply from the Cache la Poudre River. I refer to surplus over and above amounts necessary to supply needs of prior appropriators.

Under term "prior appropriators" I include all prior approriators on South Platte as well as Poudre River. All water of Poudre river is just as much subject to demand by appropriators on South Platte as it is with those on Poudre River in the order of priority.

Decree of water right on Cache la Poudre River or any other stream, does not amount to guarantee that the owner will receive amount of water specified in decree, unless it is among the very earliest priorities. It is a pretty good guarantee if the priority is early enough, but it would have to be pretty early. The decree merely represents that if there is enough water to supply all appropriators, then you can have the next turn at the water to the amount of your decree. Even then you would not be entitled to that water if you did not have actual need for it. This is implied or expressed in the decree itself. Each of these decrees carry prohibition against waste and excessive use.

Residue of flood water to which Greeley-Poudre System would be entitled from Poudre River after all prior appropriators on both Poudre and South Platte have been satisfied, would not be sufficient in the aggregate to warrant construction of any expensive works for its utilization. That is, this supply of water taken alone would
2494 not warrant such construction. To warrant expenditure of required amount of money necessary to obtain use of these excess flows of Cache la Poudre River, it would be necessary to supplement that supply by construction of reservoirs and diversion of water from other water sheds, where it is available.

Laramie River system of Greeley-Poudre Irrigation district, consisting of tunnel and diversion ditches, would constitute valuable source of supply, or at least a partial supply which, augmented by system of reservoirs for impounding water when not immediately needed and which added to amounts they could get periodically from Poudre River, would probably constitute sufficient supply to warrant the outlay necessary for construction of the elaborate system of works contemplated.

Defendants' Exhibit 113 represents fluctuations which may be reasonably expected on Poudre River.

I remember when Sky Line Ditch, Grand River Ditch, Michigan Ditch, Laramie Lake, and Lost Lake Reservoirs of Water Supply and Storage Company were constructed. Reason for construction was that appropriations to Laramer County Canal from Cache la Poudre River were not sufficient to irrigate the lands intended to be reclaimed by that canal. The appropriations from Poudre River were woefully insufficient. In fact it was seen the canal was going to be a failure, if dependence were placed on Poudre River
2495 alone with the prior appropriations that existed. Construction of those inter-watershed division systems made just the difference between bankruptcy and prosperity for the territory lying along and irrigated from Larimer County Canal. It gave them a tangible water supply to depend upon. They knew no matter how low the Poudre got that they had some water coming, and no matter how curtailed the amount, they had some water by which they could raise crops. They had a steady stream from Grand and Laramie Rivers and they could get some water for their grain and alfalfa, but for their growed crops, the crops in which there was

money, they could not depend upon getting any water from the Poudre River at all.

Irrigation farming requires crop yielding good, heavy return in money. This is especially true where they have to go to expense that Water Supply and Storage Company did to obtain water and to keep up the system. Returns from construction of Sky Line Ditch and other inter-watershed ditches of Larimer County Ditch system justified the expenditure. Since completion of these inter-watershed ditches, they have raised good crops under the Larimer County Canal, and not only that, but they have extended their irrigation area largely since they acquired these additional
2496 waters. Generally speaking, crops are as good under that canal as they are under either the Eaton Ditch or the Greeley No. 2 canal, which hold earlier priorities.

During year 1913 crops under Larimer County Canal and irrigated by it, compared very favorably with the crops raised under that canal for the last ten or fifteen years, in fact, they raised more crops in 1913 than they did ten or fifteen years previous. A larger acreage. The production would represent pretty fair average with other years, except with potatoes. In last two or three years, potato blight has bothered the crop, regardless of water supply. Crop was better in 1913 than in 1912. Potato crop in 1913 was not as good by any means under any canal as it was in 1909 or 1910.

Other than for potato crop, crops under Larimer County Canal in 1913 would be better than in previous years. There was a larger acreage covered and their water system is getting down to better and steadier basis every year. Management is improving with experience and they know better how and when to apply water
2497 than they used to. Greater economy of water is promoted by better cultivation and more skill in cultivation and irrigation.

Irrigation over long period of years diminishes amount of water required. Land does not require more than one-half the water, after period of years as in the first instance.

There are additional unreclaimed lands which may be reclaimed and irrigated by extensions of all the several large canals in the Cache la Poudre River. There are possibly hundreds of thousands of acres that may be so reclaimed. These canals will be able, if it should in the future prove that they have more water than they need for the present acreage, to extend their lines and take in additional acreage.

Older canals on Poudre River are senior to the Greeley-Poudre System with diversion from Poudre River. Their claim would be preferred to that of the Greeley-Poudre System. In the
2498 matter of extension of areas, they would naturally have preference in so far as their decrees permitted. The decrees of these older canals are not limited to any amount of acreage.

Extension of acreage irrigated occurring from better and more economical use of water under old canals is gradual. A little added from year to year. It requires continuation over quite a period of years to bring about any considerable expansion.

About 55,000 acre feet of water are discharged on average each year at mouth of Poudre River, coming entirely from seepage and return waters. That is net discharge after all ditches have taken all they can from Poudre River.

2499 JOHN L. ARMSTRONG.

Cross-examination by Mr. N. E. Corthell:

There are about 305,000 to 310,000 acres of land under irrigation in Poudre Valley, including highways and some high lands. Some parts of each 160 are not irrigated, of course. In my official reports, I stated there were 220,000 acres irrigated in 1911 and 240,000 acres in 1912, but I want to explain that when I made that compilation it was required to report number of acres of alfalfa, cereals and beets and did not include anything except actual acreage in crop. The area I have just given includes the irrigated area,
which would be quite different.

2500 My estimate of the acreage actually irrigated in the Poudre Valley would be from 240,000 to 250,000 acres. This includes no lands within the Greeley-Poudre Irrigation District and if any lands are irrigated in that district, I have not included them in my report. I included nearly all of the lands that are actually watered, but there are some little mountain ditches and some seepage irrigation that I do not report. I have not included quite all the smaller ditches. From memory, I should say that in 1890 only about one-half this area was irrigated. In 1883 I would estimate that there were not more than 100,000 acres irrigated and possibly not that much.

The present system of control which I use is to utilize the employes of the various ditch companies. I telephone my orders to
them in the mornings and evenings, and the greater part of
2501 the day I devote to visiting various headgates and to ascertaining that my orders are being followed.

The construction of reservoirs in the Poudre Valley was largely the result of the very dry year of 1888, but the construction of large
reservoirs did not commence for a couple of years, until about
2502 1890. Aside from several basins used by individual irrigators to store their ditch water at night, there are perhaps seventy or a little more reservoirs in the valley, running from those with a capacity of about 1,000,000 cubic feet to 18,600 acre feet. The average would be about 100,000,000 cubic feet or 2,300 acre feet. I do not know how much land is covered by these reservoirs. The depth varies from 5 to 70 feet, and the average depth of these reservoirs would be, I would estimate, between 25 and 30 feet. The largest reservoir, the Windsor, is only 37½ feet deep, whereas the Halligan Reservoir, with about one-third of the capacity, is 70 feet
deep.

2503 Most of the reservoirs in the Poudre Valley are located on the plains. The large ones run from 30 to 38 feet in depth. The small ones are less in depth. There is a loss in transit in handling water from reservoirs through the ditches to the consumers.

The seepage from storage of water is not always a loss. It would only be a loss to the lower reservoirs. Evaporation is a loss under any condition. The seepage loss is not very great in the valley reservoirs. The seepage is captured by the ditches below. The seepage water that goes down the Poudre and appears on the low land accounts, to a great extent, for the water that seeps out of the Poudre into the South Platte.

The figures of run-off from mouth of Poudre at intervals of one week for four years were obtained by my knowledge of the
2504 amount of water that would go in if there was any surplus. There have been frequent measurements on the river at the lower end by deputy state engineers and the government station at Fort Collins, and I was always furnished with these figures. I would know what would be going if the Ogilvy ditch and No. 3 Ditch were drawing, and at times measurements were made when these ditches were not drawing. I would know what was going through and the amount of the surplus going by Greeley No. 3. The figures I give are not from gauge records kept at mouth of Poudre, but Professor Carpenter made a series of measurements at the same time and during the years I made these figures, and actual measurements made by Professor Carpenter and figures I furnished tallied so closely that it was surprising. My knowledge of amount of water flowing in the stream up above was obtained from gaugings and my estimates were based upon my knowledge of previous measurements and by applying my observation to the condition of flow of the stream, coupled with experience in handling water in the stream. You might call them estimates. The measurements were not made on the day I reported them, but they were actual measurements made on days preceding them. I do not now have
2505 my estimates for any year prior to 1909, but I recall in a general way that the flow from the oPudre into the South Platte was formerly less than at the present time. Average run-off based upon such estimates over a period of five years and due only to return flow and seepage and exclusion of surplus flood waters would be 55,000 acre feet. The total flow from the Poudre into the Platte in 1913 I estimate to be 85,942 acre feet, and the total run-off at the mouth of the Poudre for the last five years would be approximately 113,000 acre feet per annum, but this is abnormal because the year 1909 had a very excessive run-off so that I would say that the average run-off over a longer period would be about 90,000 acre feet.

2506 Direct examination, continued, by Mr. Delph E. Carpenter:

I calculated amount of discharge of water from Poudre River in acre feet during year 1913. Amount was 85,942 acre feet. That included all water that passed out of Cache la Poudre River into South Platte, including seepage, return, flood waters, and the waters from every source.

Cross-examination by Mr. N. E. Corthell:

2507 I believe that the run-off at the mouth of the Poudre for the years 1912 and 1913 would give an average close to the general average for a longer period. Of the 90,000 acre feet flowing from the Poudre into the Platte I would say that 55,000 acre feet consists of return flow and seepage water, and 35,000 acre feet is direct flow. A record has been kept of actual measurements of the flow of the Poudre at its mouth, but I do not have it. Many years ago I had supervision of these measurements but not in late years.

2508 The reservoirs in the Poudre Valley in the bed of the stream are the Halligan Reservoir on the north fork, with a capacity of 6,440 acre feet, Chambers Lake, near the head of the Poudre, with a capacity of 6,670 acre feet, the Cameron Pass Reservoir above Chambers Lake with a capacity of 805 acre feet, Sheep Creek Reservoir on Sheep Creek, with a capacity of 160 acre feet, Zimmerman Reservoir with a capacity of 115 acre feet, Fossil Creek Reservoir on Fossil Creek with a capacity of 11,730 acre feet, which has a natural stream running into it and which is also supplied by a ditch from the main river and by a number of

2509 canals, and Douglas Reservoir, which has a small creek running into it and which has a capacity of 8,000 acre feet, being filled chiefly by a ditch from the Poudre River. The Worster Reservoir is filled from an inlet ditch, and sometimes water is conducted into both Chambers Lake and the Cameron Pass Reservoir from other streams.

2510 There is no time of the year in which it is impossible to store the water of the Poudre in the reservoirs in the valley, excepting that there are two mills at Fort Collins which have to be supplied with water power, and there are only two reservoirs below these mills in which water can be stored, and when these two reservoirs are filled the water which runs past the mills cannot be stored. When the mills are running we have to furnish 60 second feet of water for about eleven hours a day. This year from about

2511 the middle of February until the water is used for direct irrigation the amount of water flowing past the mills will go down to the South Platte. Our winter flow this year has been greater than usual, so we have been filling the reservoirs more rapidly. Any average year the mill water which is not stored runs to the South Platte but a very short time; a month might be the average. These two lower reservoirs are Fossil Creek Reservoir, with a capacity of 11,730 and the Cache la Poudre with a capacity of 9,545 acre feet, and besides the water running past the mill there are

2512 accretions of perhaps 20 second feet to the river above the points of diversion for the reservoirs. More than half of the water that is stored in Fossil Creek Reservoir is taken from the Poudre River.

When the Larimer County Canal was started it was proposed to have some storage reservoirs, but none of them were constructed to start with, and the only storage capacity which the system had was the small amount already found in Chambers Lake, which had been

made into a reservoir for tie purposes. There was surplus water in the Poudre River at that time, and for a short period
2513 this surplus would be large, but it was beyond the financial means of the Company to construct reservoirs, which could hold this surplus water and it was a great deal cheaper to get water from the Laramie River through the Skyline Canal than to build channel reservoirs such as are now proposed by the Greeley-Poudre District. Although the original cost of channel dams may be
2514 great, channel reservoirs when constructed are more efficient and economical than reservoirs away from a stream. Large reservoirs are also more efficient than small ones.

My principal duty is to superintend diversions from the stream and from the reservoirs, and I do not give particular attention to investigation of the use of the water unless someone brings to my notice some instance of waste.

2515 Cross-examination by Mr. John D. Clark:

The statements relative to the use of water in my district contained in the annual reports of the State Engineer come from my annual reports. It was my practice to make annual reports covering the amount of water used through the various ditches and the number of acres irrigated, and these reports have been summarized, classified and printed in the annual report of the State Engineer. I do not recall the contents of my report on these matters, but I assume that my reports are the basis for the State Engineer's reports showing the amount of water used through the various ditches in District No. 3 in 1909 and 1910 as follows: Dry Creek Ditch in 1909, 3.78 acre feet per acre, in 1910, 2.94 acre feet per acre; Boyd and Freeman Ditch, 1909, .87 acre feet per acre; in 1910, 2.09 acre feet per acre; Whitney Ditch, 1909, 2.2 acre feet per acre; in 1910, 1.75 acre feet per acre; the B. H. Eaton Ditch, 1909, 1.12 acre feet per acre; in 1910, 2.23 acre feet per acre; John Ames 1909, 2.62 acre feet per acre; in 1910, 1.07 acre feet per acre; Cache la Poudre Irrigation Ditch, 1909, 3.12 acre feet per acre; in 1910, 3.41 acre feet per acre; New Mercer Ditch, 1909, 2.08
2516 acre feet per acre; in 1910, .59 acre feet per acre; Canal No. 3, 1909, 3.47 acre feet per acre; in 1910, 3.37 acre feet per acre; Cache la Poudre Irrigation Company Ditch, 1909, 2.12 acre feet per acre; in 1910, 1.16 acre feet per acre; Larimer County Ditch, 1909, 2.62 acre feet per acre; in 1910, 1.07 acre feet per acre; Pleasant Valley Ditch, 1910, 2.03 acre feet per acre; Larimer and Weld Ditch, 1910, .97 acre feet per acre; J. G. Coy Ditch, 1910, 7.94 acre feet per acre; Box Elder Ditch, 1910, 2.5 acre feet per acre; Bristol Ditches Nos. 1 and 2, 1909, 1.64 acre feet per acre; Fort Collins Canal, 1910, 1.03 acre feet per acre; Lake Canal, 1910, .91 acre feet per acre; Larimer County Canal No. 2, 1910, 1.12 acre feet per acre. All of these ditches have appropriations in excess of 25 second feet, but some of them do not carry this much water.
2517 In the year 1909 the flow of the stream was exceedingly large and in 1910 very low.

Cross-examination by Mr. N. E. Corthell:

The total capacity of the diversion works from the Poudre River in 1912, including reservoir inlets, was 3,486 cubic feet per second. Not taking into account the extraordinary freshets, when I believe I have seen 30,000 second feet of water in the stream, the maximum high water stage of the Poudre River is between 5,000 and
2518 5,500 second feet, so that that flow exceeds the capacity of the diversion works by from 1,500 to 2,000 second feet. The winter flow of the stream is more important than the flood flow because it covers a long time and can be all taken care of, whereas we frequently have to let a considerable part of the flood water get away.

2518 Redirect examination.

By Mr. Delph E. Carpenter:

3,486 cubic feet of water per second of time as total diversion for 1912 includes reservoir inlets. The question by counsel for plaintiff included diversion, and of course, that includes reservoir diversions. That does not include diversions made by channel reservoirs.
2519 They have no inlet ditches. It applies only to those diversions accomplished by canals. Mr. Clark asked concerning reported duties of water in acre feet during 1909 and 1910. In ascertaining these duties it was impossible for me to distinguish between amount of water diverted by ditch and amount used by lands under the canal. I simply reported amount diverted by canal regardless of whether the whole amount of water was used, with nearly all canals used to irrigate bottom lands, the bulk of the water returns to the river, and I have no way of stating how much water returned and how much was retained by land. It didn't make any difference because the lower ditches obtained the benefit of the return. For example, the John G. Coy Ditch takes water out of Poudre River for irrigation of bottom lands on bank of stream. It is a short ditch and returns water to river within very short distance of place of diversion. He uses the ditch sometimes for power purposes, and it is not always possible to ascertain how much of that water he is using for irrigation and how much he is turning back to the river. I simply referred to the diversion. Where I reported 7.94 acre feet for that canal for 1910, I simply meant that he diverted that much water into his headgate. I don't know what the actual duty of the water was for the irrigation of crops. It was not important to me how much of the water he used if it again returned to stream. This canal irrigates according to this report, 290 acres.
2520 As another illustration of this class of canal I might mention the Dry Creek Ditch and also the Little Cache la Poudre Ditch. Both these canals are used as reservoir feeders. This Little Cache la Poudre Ditch is the one in this report that I gave as diverting 3.18 acre feet per annum in 1909 and 3.41 acre feet in 1910. It is used to feed the Larimer and Weld reservoir commonly known as Terry Lake. It is actually used to irrigate about

1,600 acres of land. The Dry Creek Ditch was used to irrigate 2,200 acres of land in 1909 and 2,300 acres in 1910. For this canal I gave the duty in 1909 as 3.78 acre feet, and in 1910 2.94 acre feet. This ditch has very excessive appropriation as compared to land under it and it takes a great deal more water at times than it needs. It is also used as feeder for Long Pond. This reservoir gets water from river through this ditch and a portion of that water undoubtedly found its way into that reservoir. The owners of this ditch have contractual relations with owners of Water Supply and Storage Company Canal, by which Water Supply and Storage Company furnishes water of Larimer County Ditch to supply shares of stock owned by the Dry Creek Ditch and in lieu of the water for those shares of stock is permitted to go on down into Long Pond. I do not know how much of it goes into Long Pond. Com-
2521 piling the figures mentioned I simply reported the amount of diversions. All those figures in the column read by Mr. Clark refer to diversions only. In my report to the Division Engineer, I think I followed my general custom which is to let them figure out the acre feet. I reported the diversions in second feet. I did not embody in my report details of situation on the ground as I have enumerated them here. They were not cognizant of those facts.

Greeley No. 3 Canal of the Greeley Irrigation Company irrigates lands entirely underlayed with course gravel. The soil is
2522 thin. It takes more water to irrigate under that canal than any other canal on the Poudre River. These lands lie adjacent to Poudre River. They surround the city of Greeley. This is small canal with capacity of 100 to 120 cubic feet per second. It irrigates about 4,200 acres. It also serves water for city of Greeley for local use and for additional supply to that furnished by water works system. The canal is what is originally known as the city ditch for Greeley.

Whitney Ditch irrigates lands along river bottom. It is one of smaller canals. Capacity is perhaps 40 or 45 feet. Original appropriation was 48 feet, but it does not draw that amount all the time. Has very old decree and is entitled to all the water it wants, and generally takes it.

The B. H. Eaton Ditch has old decree and irrigates bottom land. It has excessive appropriation and appropriates all water that it has use for. They generally take all they care to run. I do not remember having shut the headgates of either of these canals during my life. It don't make any difference to me how much or how little they take. If they take more than they can use the surplus goes right back into the river and is available for other ditches below. There could be no actual waste in that regard.

Greeley No. 2 Canal, in addition to supplying lands with water for irrigation, supplies Windsor Lake, Seeley's Lake, and a few other small reservoirs. Water of Windsor Lake, in addition to being used for irrigation, is used to operate the sugar factory at Windsor to wash the beets during campaign. The work at the

factory consumes considerable water. This water is returned to the stream lower down.

2524 Pleasant Valley Canal, noted in tabulation appearing at page 66 of State Engineer's reports of 1909 and 1910 from which counsel read yesterday, is first canal that comes out of river below mouth of canon and is situated immediately at mouth. This was the fourth small canal constructed from Cache la Poudre River at beginning of our ditch construction. That was in the early 60's. It was constructed to irrigate a small tract of land on river bottom adjacent to river and was so maintained until 1879. Land is located inside of first hogback of mountains and on other side of Bingham Hill. This is little round valley of bottom hay land with a little farming. The bulk of the land was hay and they continued to use it that way until 1879. Then new people came into valley and found a lot of nice upland outside of hogback and they

2525 set about and homesteaded and preempted. They found only feasible way to irrigate this new tract was to extend Pleasant Valley Ditch and they went to the owners of this canal and made them proposition that if the owners of the ditch would deed it over to them and let them enlarge it and extend it to cover their lands, they would give the farm owners contract guaranteeing them all the water they wanted forever and would pay all expenses of maintenance. Superintendent of Pleasant Valley and Lake Canal has no control over the headgates, of the original owners. He does not open nor shut them. They simply help themselves.

When original adjudication of priorities was held, all these old ditches obtained excessive decrees. First appropriation for Pleasant Valley Ditch is No. 4 and amounts to 40.6 cubic feet per second, which is twice as much as could possibly be used on land in Pleasant Valley. In addition to this they obtained a later decree. Result is that people in Pleasant Valley holding these contracts draw excessive amount of water to irrigate this land on margin of river and a great deal of the water finds its way back into the river before it has passed Bingham Hill and out onto plains. In other words, this little valley known as Pleasant Valley is a small valley lying between mouth of canon and last range of foothills to east.

2526 River leaves these foothills at Bingham Hill. That is above headgate of Larimer and Weld Canal and most of other large canals.

Have consulted my report since testifying yesterday afternoon. Duties in acre feet as noted in the table from which inquiry was made by counsel were not calculated or noted by me in my report. In my report all I assumed to give was amount of water diverted by the various canals. This water was thus diverted under my supervision. The acreage given under the various canals is an approximation from best information I could obtain by talking with ditch superintendents and farmers under ditches. I never made a measurement.

Ditches diverting water and applying it along banks of Cache la Poudre River, occurring between mouth of canal and diversion by Ogilvie Ditch and which I used for irrigation of bottom lands,

are Dry Creek Ditch, Whitney Ditch, B. H. Eaton Ditch, J. G. Coy Ditch, Josh Ames Ditch, Bristol No. 1 and No. 2 from Box Elder Creek, Burnham and Emerson Ditch from Long Pine Creek. Very little difference is made in flow of stream by allowing diversions to these canals, because if they take more water than they need on the land, it returns immediately to the stream and we get a great deal of that which they use. There are other small ditches
2527 taking water from branches of the Cache la Poudre River and noted on this table. Conditions are practically the same with relation to these.

None of the ditches I have named are in any way to be compared with the larger canals such as Larimer County, Larimer and Weld, Greeley No. 2 and North Poudre System. The decrees of those smaller ditches are always excessive, more than they can possibly use. They are always entitled to water; whether they take more than they are entitled to or not is immaterial. For example, the John G. Coy Ditch has never been considered by me in carrying water down past the Larimer and Weld Canal. I regulate river at Larimer and Weld Canal to supply what I know is needed for larger ditches below that go out to irrigate land on plains. But in sending down amount required, I do not consider whether John G. Coy Ditch is irrigating or not. It makes no practical difference, and even if they are using water, the bulk of what they use goes back into river anyway and is available below for other ditches.

It is fact that larger canals irrigate very different kind of territory than that irrigated by smaller ditches along margin of stream. The territory irrigated by the larger canals is upland and has deeper soil and different sub-strata and the return waters from it do not get back so soon to the natural stream as they do from bottom lands on margin of stream. This is also true in large measure of those canals diverting water from South side of Cache la Poudre River and irrigating territory lying south and west of Fort Collins.

In Cache la Poudre Valley we have two classes of ditches
2528 taking water. There is the class of little ditches constructed in the 60's, most of which lie along margin of stream and cut little figure in ultimate distribution of water. There is then, the class of larger canals under which more intensive agriculture is practiced and where greater economy is used and where water is taken out on uplands and into plains district. In each instance, however, as the table of 1909 and 1910, as shown in State Engineer's Report on page 66, shows, my figures simply gave amount received at head of canal.

Total diversions of 3,476 cubic feet of water per second of time as capacity of canals taking water from Cache la Poudre River, as stated by me yesterday, includes all irrigating ditches and such irrigating ditches as are used for reservoir feeders. In other words, some of ditches are used not only for diversion of water directly from river for irrigation, but also for carriage of water into reservoirs. These figures include this class of ditches. It does not
2529 include those canals constructed or now used exclusively for diversion of water from river for delivery into reservoirs.

It does not include Poudre Valley Canal, which has thus far been used only as reservoir feeder. It does not include inlet from river to Cache la Poudre Reservoir. It does not include inlet from river to Fossil Creek Reservoir. There are also missing from this list some small ditches along river.

Referring to report of 1909 and 1910 and in conjunction with table appearing at page 66, which is part of chapter 6 entitled "Abstracts of Report of Water Commissioners," the following statement appears: "The first series shows for each ditch to which 25 cubic feet per second or more has been decreed. First and last day on which water was used, number of days water was carried, average amount of water, number of acre feet used, number of acres irrigated, duty of water under ditch, all for seasons of 1909 and 1910 separately. In some of the figures there is evidence of unreliability, but it is believed that most of them are correct. It was not thought best to omit any unless they were obviously incorrect." I am aware of that notation at the head of this abstract.

Halligan Dam of Halligan Reservoir is constructed across
2530 channel of North Fork of Cache la Poudre River, which is commonly known as the North Poudre. The lowest point in the dam is 70 feet high. Wings are 60 feet high from bottom of stream. Dam goes below bottom 15 or 20 feet. North Poudre River rises earlier than main stream and goes down earlier. The flow fluctuates a good deal. It has very heavy flows in that stream at times and at others it is very light. It is rather notorious as giving enormous flows for a short period of time. These flows are occasioned by heavy rains over very large watersheds. Construction of Halligan Reservoir has permitted us to distribute flow of North Poudre River more uniformly than we could in manner in which it came down naturally. Construction of this reservoir saves a great deal of water. When one of these floods comes down, we cannot make use of it as fast as it comes. We can hold it back temporarily and let it down in such a head as we can divert and make more economical use of it. In other words, this reservoir holds back water which otherwise would go to waste. This reservoir was first used in 1911.

Only waste of water we have in Poudre Valley is from large canals at points far distant from river, or from canals located right along margin of river. I attempt to keep track of those as far as possible and have assistance of other appropriators who might be
injured by excessive diversion by ditch in which they are not
2531 interested. If large canal on plains is wasting water while junior ditch is shut off, juniors are very willing and anxious to report those wastes to me. Owing to difference in priority, junior appropriator acts as detective on senior in matters of waste and never fail- to report it. When I receive those reports I check them up. Any waste or seeping water is generally turned into most convenient water course and back to river.

Waste water is never run into dead lakes and evaporation depressions over the territory. Wherever there is lake or depression where water accumulates, there are headgates and outlets so that water can be used. In case reservoir depression is so situated that

outlet gate cannot be conveniently constructed, they put in a pump and pump the water out. Pumping is usually done by electricity, sometimes by gasoline engine, where the power lines do not come near enough.

Water is considered to be of some particular value in Cache la Poudre Valley. The constant re-use of seeping water is caused by fact that we have a large acreage of land and are short of water with which to irrigate it.

2532 Some portion of water annually stored in reservoirs is rented. This is caused by fact that some people have more reservoir water than they could use on their places for that particular year. Consequence is that this water is rented to neighbors who do not happen to have enough. By virtue of my exchange system which we carry on in the valley, surplus water in most reservoirs is available for distribution and rent throughout the valley.

Price obtained for rental of reservoir water varies with different years. Water Supply varies with different years. Prices range from $40 to $160 per million cubic feet, for the season. In years of scarcity they are paying $160 per one million of cubic feet of water in the lake. This is generally reckoned at point of delivery to canal. Farmer bears proportion of loss in shrinkage and carriage from point of receipt at main canal to point of use. These prices

2533 are paid for water with which to perfect the crops. Our reservoir system is used as an auxiliary to our river supply, and always in the latter part of the season. The price which I have mentioned amounts to price paid for delivery of constant flow of one cubic foot of water per second of time for period of eleven and one-half days measured at point of delivery from reservoir into main canal. It is also the price obtained for 23 acre feet of water. This price does not include tolls or carriage charges necessarily incurred in carrying the water through the main canal for delivery to laterals. These carriage or toll charges are in addition to the rental charge I have mentioned.

Stock in reservoir which would yield annual quantities of water of one million cubic feet or 23 acre feet, sells on open market for from $700 to $1,000. This is price paid for one million cubic feet or 23 acre feet. After purchase he must carry the proportionate burden of maintenance and operation of reservoir. He must also bear toll charges necessarily incurred in carriage of water through canal to his land.

2534 Stock in these reservoirs is generally held by farmers. Exchange of capital stock by purchase or otherwise is general among farmers. Variation in price of reservoir water in case of purchase of stock is occasioned by location of reservoir and priority. Further up stream reservoir is, more ditches water may be used in, and this causes higher figure. Older priority of reservoir the higher the figure stock will command. Reservoirs depend on priority for filling. If priority is late, reservoir does not always fill, and in that case stockholder only gets pro rata share of what water is in reservoir. If priority is such that there is certainty of filling reser-

voir, the stock is higher in price than with one where the supply is doubtful. Price of reservoir water is not so much dependable upon nature of land to be served as upon geographical location of land and also priority. The land served is practically all upland.

Some of reservoirs have not been filled each year because there was not water enough available after prior rights were supplied. For that reason priority is factor in establishing reservoir water values.

2535 In making inspection trip to various parts of my water district, I go at irregular times in different directions, so that nobody knows where I am going.

I compel obedience to my orders to headgate men on ditches by reason of fact that when I find man violating my orders or stealing water, I don't allow that man to touch the headgates. Consequence is, man loses his job and man who takes his place knows why the former man lost his job, and if he does same thing he will also lose his job. I know of no other way in which I could regulate distribution of waters of stream correctly. By this method I have been able to substitute employees of ditch companies in lieu of deputies.

I do not make all of my inspection trips by days. I am on duty during the full 24 hour period. I never permit any warning

2536 to go out to where my next visit will be. During part of day I am carrying on a clearing house of the water of the Cache la Poudre Valley and during remainder of day I am on police duty. I generally do my figuring in mornings and evenings. During day I am generally out on line and sometimes at night.

Cross-examination by Mr. John D. Clark:

2536 I presume that the Poudre Valley prides itself on having the most efficient administration of the distribution of water and the most economical use of it of any part of the mountain region. I have very little knowledge as to the method of administration of use in other parts of the state, however.

The smaller ditches in District No. 3 are mostly old ditches in the river bottom and having early priorities so that it is not necessary to give a great deal of supervision to their use of water. In my opinion it is not a matter of much difference whether they take more water than they have an absolute need for or not, for the water will return to the stream very quickly. This return is not only through the water flowing from the end of the ditch to the stream, but through the water which has been spread over the land seeping back to the river.

2537 I do not believe that in my reports for 1909 and 1910 I filled out the columns showing the number of acre feet used through the various ditches. I believe that the data upon which the State Engineer made the report showing this item was secured from the Division Engineer. He made it from the balance of my report showing the number of days the water was carried through the various ditches and the average daily amount of water so carried, and the computation of the number of acre feet would be merely a

mathematical calculation made by the Division Engineer. My report also showed the number of acres irrigated, and this, while approximate, was intended to show the land actually irrigated and not the acreage contained in the entire tracts upon which irrigation was practiced.

2538 Among the ditches with early priorities and which do not materially affect the irrigation from the stream on account of seepage returned is the Dry Creek Ditch, irrigating about 2,300 acres. It is about 4½ miles long and carries water more than a mile distant from the river. Another such ditch is the Whitney Ditch which irrigates 3,500 acres, is four or five miles long, and the land irrigated may extend for a mile from the river. With a lateral at the end of the ditch it may be 7 miles long. Generally speaking, the larger canals are subsequent in priority to the smaller ones. Accord-

2540 ing to the State Engineer's Report for 1911 and 1912, page 70, covering all of the larger ditches in the district having appropriations exceeding 25 second feet excepting the North Poudre Canal, the amount of water used during the season of 1912 was 364,680 acre feet and the number of acres of land irrigated 190,880. Preceding this table is the following paragraph of the report:

"The first series of tables shows for each ditch the first and last day on which water was used, the number of days water was carried, the average daily quantity in cubic feet per second, the number of acre feet of water used, the number of acres irrigated, and the duty of water for each of the seasons 1911 and 1912. In some instances the figures given by the Water Commissioners' Reports were obviously in error, and such have been omitted. Other cases a part of the information desired could not be obtained. However,

2541 the table contain- a sufficient volume of information, especially on the much disputed question of the duty of water, to repay careful study. The tremendous variation in the duty is due partly to real differences in economy in the use and distribution of water, and in some few cases to inaccuracy in figures furnished by the water commissioners. By far the greater portion of this information, however, is believed to be substantially correct."

According to this table the average duty of water in 1912 in the district was 1.91 acre feet per acre.

2541 Recross-examination by Mr. N. E. Corthell:

In addition to the ditches in the Poudre Valley mentioned in my report as having a combined capacity of 3,486 cubic feet per second, there were three other ditches. The Poudre Valley Ditch has an estimated capacity of 400 second feet, but it is a new ditch, the banks of which are not settled, running around many hills in poor soil for the retaining of water, and when we have turned in 400 second feet the ditch washes out. The capacity of the inlet of the Timnath Reservoir is 70 second feet. The estimated capac-

2542 ity of the inlet to the Fossil Creek Reservoir is 400 second feet, but it will not carry that much and we usually run from 125 to 150 feet as a matter of practice. In regulating the diversion

of water into the ditches in the valley I do not ordinarily lock the headgates nor post notices.

2542 Redirect examination by Mr. Delph E. Carpenter:

According to table appearing on page 70 of State Engineer's Report of 1911 and 1912 and table to which counsel called my attention, total acreage served by ditches from Poudre River is noted at 190,880 acres. I check up that figure and find it is low regarding some of the large canals. Under Larimer County Canal, Larimer and Weld Canal, Greeley No. 2 Canal, they have been increasing their acreage more rapidly than I have noted in reports. I have not kept track of increased acreage at lower end of these three canals. I attempted to give acreage as nearly as I could approximate it from all information I could get from various parties, but there is tendency among some of those people who are extending canals, not to talk any more than they can help about new lands being brought under cultivation. They are afraid it might affect their rights.

2543 There is some litigation in courts now affecting that subject collaterally. This has been pending for several years and has not been decided yet. I have not been out to investigate in person to determine acreage under these extended areas.

If area given in table is too small, then increasing acreage would increase duty of water over that noted in table.

The years 1910 and 1911 were both years of very low water in the Poudre River. Effect of years 1910 and 1911 was that lands did not get required amount of water and they were very dry when the season of 1912 came. In 1912 irrigation began earlier and there was heavier demand because condition was not normal. Land was drier than normal. 1912 was year of large supply, that is, large compared with two previous years. There was a good deal more water available and farmers took advantage of it and used heavily. 1912 was above normal year in point of demand for water.

During recent months State Engineer put deputy in field to ascertain as accurately as possible number of acres irrigated in Poudre Valley. He found my reports were low on acreage and he had better means of finding out than I did, because he had nothing to do during the time and had more resources with which to do the work. We found that the acreage which I had been given in my reports was low on ditches which I have particularly mentioned. There were other errors but not so great as on the canals I have spoken of.

364,680 acre feet of water given in State Engineer's report for 1912, as number of acre feet used during season, does include water we carried over and did not use that year. It includes diversion, but there was a great deal of diversion that was not used that year. If reports show that at close of 1912 there was carried over 83,994 acre feet of water in reservoirs for use in 1913, that amount should be deducted from the total of 364,680 acre feet in order to get correct amount used in 1912.

Our main irrigating season closes in the middle of September and if we get a run then we go to storing water and this water is

reported on Nov. 1, 1911, and was probably obtained after we quit irrigating, because my recollection is we used all reservoir water in 1911 and did not have enough then. If there were 16,322
2545 acre feet in reservoirs November 1, 1911, that should be considered part of our storage for that winter. It was all used in 1912.

307,208 acre feet were used during 1912, after making due allowance for water carried over from November 1, 1911, 16,322 acre feet, and 10,000 acre feet held in channel reservoirs, and after deducting 83,794 acre feet, amount carried in storage November 1, 1912.

Duty of water for water used during 1912 would be 1.61 acre feet per acre, even assuming for time being that acreage of 190,880 appearing in report, which I state is underestimated, is taken as basis of calculation. The duty would be increased accordingly as acreage is in fact increased.

2546 Recross-examination by Mr. John D. Clark:

The headings and classification used in the tabulations upon page 40 of the report of the State Engineer of Colorado for 1911 and 1912 are identical with those on the reports which I made for those years, but instead of taking the separate ditches as I reported, the totals for all of the ditches have been here printed. Referring to Heading No. 12 showing the number of acre feet of water used by canals during the season, my impression is that in my report upon this matter in some instances I included all of the water diverted by the ditches irrespective of the amount used upon the land. I do not know whether this same situation exists with respect to the reports affecting the other districts in the state or not. The total amount of water used by all canals in District No. 3 in the year 1912 as given in this report is 419,368 acre feet and the total acreage of land irrigated in the same year is 224,180 acres.

2547 As part of my duties I have kept a record of the amount of water taken into District No. 3 which covers the Poudre Valley, from District No. 48, which includes the Laramie River. The report for 1911 shows a total of 18,874 acre feet, carried from District No. 48 into District No. 3, and I think this is very nearly correct. This covers the diversion through the Skyline Ditch. Whether it also includes the diversion through the Sand Creek Ditch I do not know, as I forget whether there was any diversion through that ditch in that year. The total amount of water carried from District No. 48 into District No. 3 for 1912 as given in this report is 28,068 acre feet. I do not know whether this includes both the Skyline and Sand Creek Ditches or not. I
2548 do not know whether the record upon this matter for 1913 has yet been compiled. I get reports once a week or sometimes twice a week from the man in charge of the Sand Creek Ditch showing the amount of water diverted by it from District No. 48. I can not, without referring to the records, state how much water is generally carried in that ditch.

2549 T. J. MONTGOMERY, a witness in behalf of defendants.

Direct examination by Mr. Fred Farrar:

Have resided at Fort Collins since fall of 1877. Am in real estate, loan and investment business. Came to Colorado June, 1866. Located at Golden City, now Golden, the then capital of the territory. Golden is 12 miles west of Denver. Governor Hunt was then governor of territory. There were no railroads west of Missouri River that spring when we left the river. Union Pacific railroad was building from Omaha west that spring. I drove 6-mule freight team to Colorado. Followed South Platte River.

2550 Was clerk in store and local telegraph operator at Golden. Line of telegraph came out following Platte River to Fort Sedgwick. The Fort was very near to Eastern line of Colorado just across river and 4 or 5 miles this side of present town of Julesburg. There was a branch line built from Fort Sedgwick to Denver and then to Central City, Colorado. There was another line which was formerly owned by Atlantic and Pacific Co., first line across continent, which went up Pole Creek 40 miles. Then line crossed over along Deer Creek to Muddy Springs and followed parallel with North Platte River, but back in bluffs to *which* is known as Chimney Rock or North Platte. From there it followed river to Fort Laramie and then westward to Fort Bridger. Just previous to that time they had constructed telegraph line from Denver northward by way of Fort Collins and on to Laramie Plains at Fort Saunders, and thence west. They had not made any connections when I quit the line. The original Atlantic and Pacific line had been purchased by the Western Union Telegraph Company. In *new* few months they connected their lines so that they did through business by way of Denver and north by way of Fort Saunders, and eventually abandoned line from Fort Sedgwick to Chimney Rock and by that route to Fort Laramie. They also constructed telegraph line from Cheyenne over to Fort Laramie and had one north by Fort C. S. Smith and Phil Kearney.

I think government had something to do with construction
2551 of that line in order to get communication with government post. Western Union Telegraph Company owned line time I was operator at Golden.

Closed telegraph office at Golden and reported at Denver. From there was sent to Fort Sedgwick. It was chief office west of Missouri River at that time. Division superintendent was located there. From there I went to Mud Springs, Nebraska. It was on plateau between North and South Forks of Platte River. Remained there until November, 1867, when was ordered to vacate office and report to Fort Sedgwick. Was out over the telegraph line during the meantime.

February, 1868, became acquainted with Union Pacific construction. Was engaged in work of construction of telegraph line of that road at time same reached Cheyenne. Construction of line was of temporary character and required repairs. I had charge of line repairs as well as installation of offices on frontier of road from time it left Cheyenne. Construction of telegraph line was maintained a

little in advance of construction of railroad. I installed offices as road built up.

Spring of 1868 first saw Laramie Plains. I installed first telegraph office in Laramie City, Wyoming, May, 1868. I went into
2552 Fort Saunders with orders from commander of post. I took instrument and batteries from Fort Saunders to Laramie the morning of the 20th of May. Installed office in Laramie that afternoon.

Union Pacific railroad reached Laramie City May 19, 1868. Am absolutely correct on day of month. On night of 19th track was just a little beyond Fort Saunders. That was 2½ miles from present city of Laramie.

I continued installing offices west of Laramie. I installed station at Two Rivers, known as Wyoming station. Present Wyo-
2553 ming station is not located at same place. Old station was at point they now call Two Rivers. I was operator at Wyoming station and remained there and ran office for a week or ten days. I continued to go on with the road, installing offices, but was at Laramie City a great deal, during 1868. Had occasion to go up and down Big Laramie a number of times. Used to go out Sundays hunting up river.

Hutton's Grove was location of stage station or ranch on
2554 Overland Stage road. Overland stages to California went that way. Amount of water in Laramie River is recalled to my mind, owing to fact that when we went into Laramie City the river was full of ties that had been cut up on Bull Mountain toward state line. These ties had been floated down river, were boomed at Laramie and taken out there.

Fort Saunders was constructed summer of 1866. I was clerking in store of my uncle who owned his own freight outfit. He had bull outfit and a mule outfit. We called mule outfit the "lightning express." In 1866, railroad having started west, Mr. Loveland thought it advisable to dispose of his freight outfits as we would soon be able to get our goods much nearer the Missouri River and I think I am correct in saying he sold a portion of these freight outfits and that they were taken up to Fort Saunders to haul out timbers from mountains in construction of posts.

2555 Remained in Wyoming until December, 1870. From there went back East. Made trip to Colorado in 1874. Returned permanently to Colorado in 1877. Was at Golden in railroad office about 30 days and then went to Longmont which was then terminus of old Colorado and Central railroad, now the Colorado and Southern railroad, where I remained about two months, and on completion of Colorado Central Railroad south from Cheyenne, was sent to Fort Collins and opened first office at that point. First portion of Colorado and Central Railroad terminated at Longmont and was constructed from Denver. After road changed hands, construction was commenced at Cheyenne and terminated at Longmont. It passed through Fort Collins on Cache la Poudre River. It was first railroad which reached Fort Collins or Cache la Poudre Valley in that vicinity. I went to Fort Collins October 7, 1877, and first train

entered town a few days later. Road was later constructed on to Longmont.

2556 Fort Collins had population of about 275 or 300 in 1877. Laramie City had had a railroad for nine years on a transcontinental line. Was first agent and operator at Fort Collins and worked in that capacity until July, 1881.

That portion of Colorado and Central railroad from Cheyenne to Longmont was built by my uncle W. A. H. Loveland. He was man I have mentioned as owning the freight teams. Present City of Loveland, Colorado, was named for him. First railroad service Fort Collins obtained was by way of Cheyenne.

Denver Pacific Railroad from Cheyenne to Denver had been constructed prior to 1877 but that crossed Cache la Poudre Valley at Greeley, Colorado. This road is now owned by Union Pacific Railroad. Think it was first railroad to reach Denver and shortly after that the Kansas Pacific reached Denver. Subsequently Colo-

2557 rado and Central Railroad was constructed from Denver to Golden and Longmont. By this way we had outside communication for that road.

June, 1881, the grading commenced on railroad up and down Poudre Valley. Prior to commencement of construction between Greeley and Fort Collins, Union Pacific Railroad was grading from mouth of Poudre Cañon up the river. This was done to block the B. & M. people who were in cañon surveying a route. When they had surveyed as far as the Narrows, they considered it impassable and withdrew to mouth of North Fork. They then surveyed line up North Fork of Cache la Poudre to Sheep Creek, up Sheep Creek and over Boulder Ridge into Cameron Pass. I gave notice to Union Pacific that B. & M. was at work in the cañon and they sent engineer out and he and I drove over there in evening. It was late but he discovered stakes and immediately went to Omaha and a few days later we obtained train load of graders and engineers and entire construction outfit and went to work in cañon and covered up stakes of B. & M. and they were grading when the B. & M. engineers were right where the dam of the Halligan Reservoir is now situate. This was before they had found out that our people were constructing. After it became known that B. & M. people were whipped out, they conceived idea of building railroad across to Greeley. Union Pacific built this line and incorporated it under name of the Greeley, Salt Lake and Pacific Railroad. They started that construction. They took largest part of outfit from cañon and constructed greater

2558 portion of line to Greeley that summer. That was in 1881. The Burlington and Missouri Railroad had not as yet constructed into Colorado. None of the roads up Poudre Cañon or the North Fork of the Cache la Poudre were ever constructed. When the whole scheme of building a railroad up the Poudre Cañon was abandoned, the grading outfit then turned their attention to construction of road between Greeley and Fort Collins. Construction of this railroad connected the Colorado and Central Railroad at Fort Collins with Denver Pacific Railroad at Greeley. The road from Fort Collins to Cheyenne was then abandoned. Abandonment of

this portion of road was due to fact that Union Pacific had acquired control of Denver Pacific and the Union Pacific grade from Greeley to Cheyenne was better than existing Colorado and Central grade between Fort Collins and Cheyenne.

Was elected county clerk of Larimer County, Colorado, in
2559 fall of 1881. Served four years. County seat of Larimer County was Fort Collins. After serving as county clerk purchased and resided on ranch on Sheep Creek for three years and operated ranch nearly five years when disposed of it. Sheep Creek is tributary of North Poudre River. It lies northwest of Fort Collins. After disposing of ranch returned to Fort Collins. First year was deputy secretary of State Agricultural College. At end of year went into real estate, loan and insurance business. That has been my vocation ever since.

My business has made me generally acquainted with agricultural conditions, especially those under irrigation. Have been in every agricultural district in Colorado and very largely over southern Wyoming and have made trips into other western states.

First time went back into Laramie River Valley was in 1885 and have been in various parts of that valley from Laramie City to headwaters of stream almost every year since.

My business has made me acquainted with farm values and matters which go to make up farm values. Have had a great deal to do with farms and farm lands. Was in Laramie Plains region during summer of 1913, from July 7th to October 1st. Was sent there by the attorney general of Colorado for purpose of securing whatever evidence or data might be of benefit to State of Colorado in suit now pending. Think I saw practically every section of land below Woods Landing to Laramie City and which was supposed to be under irrigation. I inspected the Little Laramie country. Inspected the country between Laramie City and Wheatland Reservoir. I visited the Wheatland district. Used an automobile.

From knowledge and observation of Laramie Plains region since 1868 and until present time, I cannot say that climatic conditions have changed any. It has always been to me the coldest, windiest country I ever knew. The climate is very cold. Springs are late and falls are early. They have frequent frosts during summer. Everyone seems to speak of country as being high, extremely cold, and windy, especially during summer. It is my experience that wind blows in Laramie Plains greater portion of the year. These winds are very cold. I would judge they blow from north and northwest, although they have winds from east and southeast. They have considerable wind in Cache la Poudre Valley. Difference between winds of Cache la Poudre Valley from those of Laramie Plains *are* expressed by fact that I never experienced as cold and chilly winds in the Poudre Valley as we had in the Laramie Plains. Whenever we get a cold wind in Poudre Valley everybody expresses
2562 it as having come from Laramie Plains. Prevailing winds in Poudre Valley are much warmer.

Climate is cool in Laramie Plains region during summer months; nights are quite cold. They are very different from climatic condi-

tions around Fort Collins and Greeley. There is vast difference between Wheatland outside of the range of mountains and the Laramie Plains region. Wheatland area is much milder in its claimate. Agricultural conditions verify this.

On July 30, 1913, very heavy frost in Laramie Plains. On morning of 31st I rode out past experience station near Laramie. Potatoes were black. I noticed that condition on all potato patches along that line of road. Don't remember just how far I went that morning but several patches along the road were badly frosted. I noticed that alfalfa was slightly affected, but it did not show very materially. I think it killed the potato vines.

2563 Frost in middle of summer is not unusual in Laramie Plains. I understand that it is not unusual to have frosts there any month in the year.

Crops which grew in summer of 1913 over plains of Laramie Plains region were native hay, alfalfa, a few fields of wheat, some oats and one or two small fields of wheat, some oats and one or two small fields of rye. Native hay seemed to be fair. Alfalfa was not what I would term a full crop. Oats were very inferior in my judgment. One field of wheat looked fairly good. Other fields did not look to be up to standard. When speaking of alfalfa was comparing with crops in Poudre Valley.

First cutting alfalfa Laramie Plains July 8 and 10, 1913. This was some three weeks later than cutting of first alfalfa in Poudre Valley. Two cuttings of alfalfa are obtained during summer

2564 on Laramie Plains. Second cutting alfalfa 1913 was during latter part of August and forepart of September. Best alfalfa I saw was on Grable Ranch and Hart Ranch.

Yield of alfalfa, first cutting, on Laramie Plains, did not in any way compare with first cutting obtained in Poudre Valley. The Poudre Valley crops seem to be so much heavier. Plants were thicker on ground and produced larger tonnage in Poudre Valley. Am basing these conclusions on my observations. Alfalfa did not grow to the same heighth as it does in Poudre Valley.

Oats in Laramie Plains would not, in my judgment, yield more than half as much grain as oats in Poudre Valley. I saw them harvesting their oats there in 1913. Did not see any threshing. Saw no evidences of any threshing. Saw one threshing machine standing idle. Think all the oats that I saw harvested were bound.

Potatoes were not extensively cultivated. My observations

2565 were quite general throughout the region. Made trips every day.

Uplands of Laramie Plains are noted for their coarse gravel. River bottom lands are those lands immediately joining the stream. In order to describe gravel on uplands it will be necessary to make statement in reference to lands lying under Pioneer Canal west of Laramie City. When you first reach neighborhood of Riverside Ranch, in fact, after passing Grable Ranch, going west and north to Little Laramie, ground that is broken shows coarse gravel from size of marble to as large as your *first*. Some fields are covered with large

coarse gravel, which I should term cobble stones. As you go
2566 towards Laramie you get out of the coarse gravel and there is a little more soil intermixed with the gravel. The gravelly condition diminishes some as you go toward Laramie. I noticed excavation near Laramie, soil seemed to have appearance of lime shale. There is considerable alkali, lime and gypsum in all the soil throughout the Laramie Plains. They have heavy deposits of gypsum. There are two or three manufacturing plants utilizing gypsum for plaster. Two of these mills are almost within the city limits
2567 of Laramie. Soda Lakes southwest of Laramie were once utilized. A railroad was constructed there for purpose of utilizing soda. Do not know how extensive the deposits were.

Did not observe any seepage excepting in portion of country lying west of Laramie City. I was forcibly struck with fact of seeing water along that road and on the ridge and standing in many places. Road itself showed where it had been graded up, that water was very close to surface. I think that condition extends over quite an area, three or four miles and probably a mile on either side of road. Don't know whether seepage is caused by Pioneer Ditch or from Lake Hattie, but there is quite an indication of seepage water close to surface. Would suppose it extends over three or four miles square.

Had occasion to go into Big Hollow. There was some water in there. Know Big Basin. Last time went through there they were running some water into the basin. Parties living there stated they were running water into basin. There was water in the lake. I made no specialty of obtaining the prevailing market price of lands on the Laramie Plains region. Prices were quoted to me on several occasions. I have learned what they are asking for them. I understand the water company was selling raw lands with water for $60 per acre, and some of the farm lands and ranch properties were quoted at $35 per acre with water, and I think I remember an instance where someone asked $20 per acre for lands without water. The lands for which $35 per acre was asked were average lands.

Laramie Plains region is absolutely undeveloped in comparison with Cache la Poudre Valley. Laramie Plains are about as far advanced as Cache la Poudre Valley was in 1868, excepting that I believe that Laramie Plains have more ditches today than we had at that time.

T. J. Montgomery.

2569 Cross-examination by Mr. N. E. Corthell:

The summer of 1913 was the only one I ever spent upon the Laramie Plains, and I have never been there for any considerable period of time at any other time. My almost yearly visits since 1885 have been upon fishing trips principally, and upon these trips I have travelled along the road from Laramie to Woods Landing and to Boswell's ranch, and sometimes have travelled by stage from Laramie into North Park. In 1913 I had no business upon the
2570 Plains except investigating conditions in the interest of the defendants in this action. While there I kept no records of

the direction or velocity of wind nor of the temperatures. The only frosts I noted were at the end of July and then again before we left, which was some time in October. In addition to noting the effect of the July frost at the experiment station I think I noted its effect upon one or two other patches of potatoes. One patch was across the road from the experiment station and may have belonged to it, and the other some place in the same vicinity. I made no inquiry or investigation afterwards to ascertain if the frost prevented the potatoes from maturing. While upon the Laramie Plains I lived at the Custer Hotel while in town. Once
2571 I stopped at the Sodergreen ranch for three or four days. the only vegetables from their garden that I recall were lettuce and radishes.

2572 I took no soil samples upon the Laramie Plains and made no investigations excepting as I could note the soil conditions where excavations had been made and where the ground had been plowed and broken. I am not a soil expert. In several instances I walked out into the fields where plowing was going on. I noted a difference in the soil conditions between the vicinity of Laramie City and the west side of the river. Near Laramie City the gravel is not as noticable as further to the west. I recall noticing some gravel in the soil in a little garden and in a field near
2573 Pahlow's ranch house and also at the point where the road from Laramie to Two Rivers crosses the North Canal. So far as I noted the soil in Laramie City is the same as that immediately west and across the river. I made no investigation of the alkali conditions at any place nor of the soda deposits.

2575 L. H. BAILEY, a witness in behalf of defendants.

Direct examination.

By Mr. Fred Farrar:

Reside at Ithica, New York. Vocation at present is writing and editing of books. Publications are along agricultural lines in a broad sense. Am editing series of books written by other persons along all kinds of agricultural lines, stock-raising, mechanics of agriculture, fruit growing, and like subjects. Am writing, more or less, books of my own on agricultural subjects, largely educational.

Raised on farm. Graduated from Michigan Agricultural College in year 1882. Spent two years at Harvard as assistant to Asa Gray, Botanist. Was not an assistant in Harvard University but personal assistant to Asa Gray. After that went back to Michigan Agricultural College for four years as professor, in horticulture and landscape gardening. And about 1888 became connected with Cornell University at Ithaca, New York, as Professor of Horticulture, and held that position for 15 years. Was then made Director of Cornell Agricultural Experiment Station beginning in year 1903 and continuing until close of last July, 10 years. In meantime I had developed this editorial and authorship work and I finally resigned

my connection with university and have devoted my whole
2576 time to that up to present. My whole life has been devoted to agricultural work, using the term in its broad sense and in relation to rural civilization and education.

My work and investigations have taken me into all states of the Union, with agricultural interests in mind, either educational or otherwise. Have made number of trips to Europe and in general through Canadian provinces, more or less, and West Indies as far as Trinidad. Think I have been in Europe eight times. Have been number of times to England, three or four times in Ireland, two or three times in Scotland, also in Norway, Sweden, Denwark, number of times in Germany, France, Austria, Italy, Switzerland, Belgium and Holland. The trips were all for purpose of studying agricultural conditions and subjects pertaining thereto, and education pertaining to agricultural efforts. Travels through United States and Canadian Provinces have been frequent. I think there has not been a year since I began public work, that I have not taken trips to some of them, at all events I have gone rather long distances.

I was chairman of Mr. Roosevelt's Country Life Commission appointed in 1909.

Could not give the books which I have edited off hand, but can give a number of them. For example, in Rural Text-Book Series, a book on Manures and Fertilizers by Dr. Wheeler, formerly of Rhode Island Station; a book on soils by Lyon and Fippin of Cornell University; a book on plant Physiology, by M. B. Duggar, now of St. Louis Botanical Gardens, and one on Southern Field Crops by J. F. Duggar, of Alabama. I am puting one through at present moment in that series, by Dr. Widtsoe, President of Idaho Agricultural College on Irrigation Practice. One on Farm Management is now on market, by C. F. Warren of Cornell University, and others in that series. Also, The Rural Science Series, comprising over 30 volumes. The Rural Manual Series comprising three or four volumes, and some others also. By the term editing I mean that I have the general editorial management of these particular series of books published by McMilland and Co. I arrange with the authors for writing the books, talk with them as to the plan of the work, what they wish included, and endeavor to inform myself as to wants for such books, and secure people to white other books to fill the needs. When manuscripts come in I edit them and put them in shape. In many cases I re-write them. I look after illustrations and in general see to form of book, general design, paging, etc.

2578 I have edited two encyclopedias and am now editing the third. First was Encyclopedia of American Horticulture, issued about 14 years ago in four volumes. That encyclopedia is being entirely remodeled now under title of Standard Encyclopedia of Horticulture, in six volumes. I released the first volume for printing last week. Present work is more comprehensive than former encyclopedia. Former was American encyclopedia and present includes many more plants than old one, comprising many plants offered by European dealers, because gardeners and horticulturists

of this country are now purchasing more supplies from Europe. It also gives more attention to tropical possessions of the country, as they have come into knowledge of our people since last encyclopedia was written. The third is The Encyclopedia of American Agriculture. The Encyclopedia of American Agriculture was issued four years ago. All these are edited by myself, but contributions are made by different men. I presume there are 300 persons now contributing in one way or another, to this encyclopedia, and the articles appear over or under their own names on the special topics.

I could not say how many works I have written, perhaps 12 to 20. Have written one of Country Life Movement, another on The Nature Study Idea, another took up The Outlook to Nature, another The State and the Farmer. These should comprise a set called The Outlook Set. I have also written a book on fruit-growing, The Nursery Book, Plant Breeding, Pruning Book, Forcing Book,
2579 Evolution of our Native Fruits, a book on evolution of our cultivated plants, Principles of Agriculture, The Farm and Garden Rule Book. Also three or four botanies for schools.

I am not at this time connected with Cornell University. My present vocation consists in my private editorial and authorship work. Have made good number of trips into middle west and further west for one reason or another. Not so much for investigation as to give addresses at meetings and was with Country Life Commission in its trip around country. That commission made trip from Washington through south to California, where it split, one branch going back through Nevada and Colorado, and another branch going north through Washington and Montana, both branches joining again at Omaha on to Boston and back to Washington. On that expedition I took northern route, coming back I did not pass through Colorado. Have been considerably interested in development in California. Had one hearing of Commission on Country Life at Bozeman, Montana, and one at Spokane, and also here, but
2580 before other branch of Commission at which I was not in attendance. Have been in Snake River Valley and at Twin Falls and looked that country over. I have forgotten the date, but think it was in 1910. I did not mean to say that the trip of the Country Life Commission was the only trip I have taken through this part of country. Have taken other trips west, largely going through to coast.

First visited Laramie, Wyo., a year ago last month. Was through Wyoming previous to that. Occasion of visit was installation of new president, Dr. Duniway of University of Wyoming. I delivered address on occasion of dedication of agricultural building. That was on same trip.

Have made trip over area known as Poudre Valley in state of Colorado and also Laramie Plains region in Wyoming. Made journey September 16, 17, 18, and 19, 1913. Arrived in Denver September 15, 1913. Trip was made at solicitation of attorney-general of Colorado, who desired that I look over the two areas in question in order to express my judgment as to which of the districts was producing greater wealth per acre, supporting greater number of persons

from products of land, and which would be likely to continue
2581 so to do in time to come. No indication was given me in correspondence as to what I was to look for beyond that. No statements were made as to character of two regions. It was desired that I should express my opinion as an outside person without any interference from any one concerned with the litigation. The plan, so far as either side of this controversy is concerned, was carried out, absolutely. I was given a perfectly free hand from first to last and I was surprised during the whole trip as to how careful persons were on both sides to endeavor not to bias my judgment. There was no effort to influence my statement and I was able to arrive at an impartial conclusion. I was not coached or interfered with.

I knew nothing about the two areas previous to that time, except in a general way. As to riding over it, I had never seen the Greeley region, or met a person, so far as I know, who lived in the Greeley region. I had seen Laramie Plains from train and had also been at Laramie last January at occasion of installation and there had met officers of Agricultural College and Experiment Station and a number of persons from surrounding country. Aside from that I had no knowledge of situation. I came as a stranger.

Request made of me was that I reach my own conclusions free from any suggestion or argument from any person representing state of Colorado, directly or indirectly, or from any of the defendants in this suit. That was not only the statement but it was carried out in practice, absolutely. During whole trip I don't know or recall that I asked for opinion on subjects I was expected to survey, unless I wished to volunteer it. They gave me every facility to see what I thought was best and worst.

2582 The trip through Poudre Valley Region was made by automobile. We traveled about 75 miles through Greeley District, exact route with distances being shown on map. Was accompanied by Prof. L. G. Carpenter throughout trip both in Colorado and Wyoming. Now and then other persons would be taken with us for greater or less time in order to point out to me some of the features of country. I think I saw average conditions in Greeley district. I was informed there are about 300,000 acres of land in Greeley District already improved and under ditch, and that the new project is to comprise about 125,000 acres, and I saw enough of that to satisfy myself, so far as I could by study in time at my disposal, that the district was practically the same as the adjoining district at Eaton.

I mean that the district included within the Greeley-Poudre Irrigation District is practically the same as the adjoining lands. It seemed to me to be so. My problem was therefore to determine what had been development of Greeley District.

After visting Greeley-Poudre Irrigation District lands I went up to Fort Collins region. My observations extended generally over Cache la Poudre Valley.

Went from Fort Collins to Laramie. Have not figured number of miles of travel in Laramie Plains, but my impression is that miles were more than in Colorado District, and I present here a map show-

ing course that was taken in the two days that we gave to Laramie region. We came into region at Tie Siding and then to Laramie, from Laramie we went on other side of river to Lund Orchard, to Sodergreen Ranch and to Riverside Ranch and back again to Laramie.

I understood that that country is irrigated by Pioneer Ditch.

Next day we followed marks of these road lines, going out in this direction in sight of James Lake, but not going to it. Went through Blackburn Ranch and following these road lines back, came out at Seven Mile Lake at Casterman's Ranch, and back again to Laramie.

Next day took trip back to Fort Collins way we came. Generally speaking we made reconnaissance of Laramie Plains country to south, west and northwest of Laramie. We included valleys of Laramie River and of Little Laramie River and went in sight of James Lake. I requested particularly that I should see best of Laramie Plains and I was told that I had seen it by the local people.

2583 I was left absolutely free and untrammeled by both sides at all stages of the reconnaisance.

After making reconnaissance I arrived at general conclusion as to agricultural conditions in the two regions, as much as I could arrive at it from short observations that I had made, and after I got back home, for my own benefit, wrote a statement of these con-

2584 clusions. I purposely did not read any reports before I made the trip or consult any of the census reports, desiring to secure my impressions from locations themselves as far as possible. After I returned I looked up census reports. I looked over soil survey reports of two regions, the government Soil Survey. I consulted certain bulletins and printed matter in regard to them, in order that I might check up my own observations and determine whether I had gone far astray.

It was three months after I made the trip, before I wrote anything like a formal report. Following my usual custom in such cases, I like to have the matters mature in my mind, to think them over, to arrive at what might be perhaps a safer judgment.

This formal report made three months after my trip was first report I made to State of Colorado.

In my own mind, these two areas, that is, Poudre Valley and Laramie Plains, are not to be compared. I contrasted them.

I might preface my testimony as to my conclusions and the reason therefor, of the development and future possibilities of the two areas, explaining difference and similarity, if any, by saying I have no possible interest in either of these areas. I have no interest in this litigation or its results. I was asked to express an opinion as to agricultural differences of these two regions and I have done so in as impartial a way as I possibly could. Of course, I have not been able to make any detailed study of farm management and farm practices of two regions. I have looked rather for certain marks of agricultural development which I have learned to look for in other regions. These, of course, were of general character.

I was very much impressed with development of Greeley region

by great number of people I saw everywhere, indicating rather densely populated section. Was impressed also by great number of teams I met on road and wagons carrying produce.

Was impressed also by great number of roads, following so many of section lines, indicating regularized and well laid out, well developed road systems, which indicates reather densely populated and productive section.

Was interested also in character of dwellings, their number, and I counted from four to seven houses to a section of land. Some places I think more than that. These houses looked to be established homes, mostly with good yards, some of them with small orchards about them, some of them with good vegetables gardens and good poultry establishments, and shade trees.

Was interested in number of vigorous share trees along highways and also in variety and vigor of natural vegetation along highways and irrigating ditches.

There were frequent schools. I was particularly struck and much surprised at number of thriving villages and small towns which I saw, such as Laramie, Ault, Windsor, Severance, and Eaton, all of which seemed, so far as I could determine to be real rural towns, that is depending upon agricultural development of region, and not being manufacturing towns, except as concerned sugar manufacture which is agricultural product.

Was interested in soil as I saw it, which seemed to me to be mellow, fine, fertile soil with relatively few deposits of gravel, and I saw very little alkali in this district.

Was impressed with fact that here was high developed agricultural region, impressing much as good agricultural regions do in
2586 much older parts of the country. Everywhere was evidence of thrift and ability to make a good living on the land. I was impressed with crops that I saw, alfalfa, beets, potatoes, and garden stuff. I saw good storage cellars, and sugar factories.

Altogether it seemed that in that region there was highly developed rural section founded directly on agriculture.

I do not mean to limit my observations entirely to the Greeley region. I speak in general terms of the whole region that I saw. I am speaking of course of developed region there, all tributary to Greeley and that country.

I then went over into Laramie region in Albany County, Wyoming and found very different state of conditions.

Country was more open with relatively small number of houses, relatively few teams on roads, very excellent roads but not so many of them laid out along rectangular lines as in the other region. Fewer shade trees and natural vegetation less vigorous.

I saw no rural towns outside of Laramie, founded on agricultural business. I saw fewer people everywhere outside of Laramie. Saw many very attractive places, some establishment that appeared to be first class, of course, were not so numerous as in the other region.

Soil appeared to me to be more diverse and various, in many parts topography was various. I was impressed that there was more gravel, at least visible, much of soil being coarser and I also saw some

alkali. I saw some good crops of certain things, but of course not nearly so many of them as in other district, and they were in places here and there and not continuous. Saw very little garden
2587 truck. So far as I recall, there are no fruit trees in bearing with single exception of those at Mr. Lund's place. This place is located southwest of Laramie and was furthest point we reached in travel. It is almost at Colorado-Wyoming line right on the Laramie River.

Became very much interested in Laramie region, even first day. Altitude, exhilarating atmosphere, assurance and enterprise, and so on, appeared to me. Became very much interested in this as problem in agriculture and wondering what was to be future of region. Saw good number of special crops and things on trial, largely at experiment station, which, however, I did not enter, because as I now recall, frost had killed a good part of experimental work of year.

I came away with distinct impression that, so far as new crops were concerned, practically everything was on trial as yet, and it seemed to me that the high development or intensive agricultural developments would be in special places where there is some particular peculiarity in soil and particularly where there is protection from climate.

The two regions appealed to me as being unlike and to be contrasted rather than compared. They represent different kinds of agricultural development and capabilities, with good points in both.

Laramie Plains struck me as being primarily a region of live-stock adaptibility and general Greeley District as already a highly developed cropping region.

It struck me that Greeley District, acre for acre, is capable of maintaining the more intensive and diversified cropping business yielding as a whole, more crop produce and sustaining a denser population from agricultural products of the lands. All these con clusions appealed to me as being self-evident.
2588 I arrived at these conclusions from my general observations of the two regions. Of course, when I came to analyze the observations, I find that they rest on two general classes of facts so far as I have been able to analyze them.

In first place, fact of actual relative lack of development of Wyoming district, as compared with Colorado district, and second, very considerable natural differences in elevation, configuration, latitude soils and climate.

If one goes into new or developing country as a stranger, he thinks he is able to judge very well of it by observing what has already taken place in older or developed parts near by. It is approximately only method one has to apply. Although these two regions were open to settlement at approximately same time, there is very marked difference in state of development of them.

Colorado region, under discussion, is of course known as one of the highly developed agricultural districts in the west. It has long ago secured and established reputation for its potatoes, sugar beets canning crops and other products. It is no longer a doubtful

experimental region or in the stage of pioneer development. The agricultural success of the region seems to me to be assured. So far as I could determine, as I have already testified, the new Greeley-Poudre District now proposed to be developed, has apparently as good natural adaptabilities as the adjacent region about Eaton.

By the new Poudre District, I refer to the lands of the Greeley-Poudre Irrigation district, and the extension of the area in only the extension of known and proven, permanent conditions.

2589 Laramie Plains district on other hand is sparsely settled. Average values as they were given me, were low as compared with Colorado region. Relatively little of land is under plow, and although there are certain well-established and apparently profitable ranches and establishments, region in general is as yet in its pioneer or at least its early stage of development.

In Colorado district under consideration, ranches or farms are small, indicating relatively intensive cultivation.

In Wyoming district they are large, indicating less production per acre. Of course there are exceptions in both cases.

I find by census figures that in 1910 average size of farms in Weld County, Colorado, was 229.6 acres, of which 103.1 acres, or nearly one-half, were improved.

In Albany County, Wyoming, average size was 2,361.5 acres of which 236.9 or about one-tenth were improved lands. These figures are an average for counties as whole, and I assume include irrigated and unirrigated lands.

How large holdings are in developed region in Weld County, Colorado, I have no exact means of knowing. I have made a good many inquiries of persons whom I met as to size of their holdings and found them varying. My general impression was that in those developed regions, the holdings as an average were not far from 80 acres. Of course, each of these holdings usually have a family, as I have heretofore indicated, one could count on these sections from four to seven houses. I assume that all hold families and I assume that those families would run from four to five persons.

I had only the permanent homes in mind. I did not count the shacks used to house the laborers at all.

2590 I have no desire to quote census figures for purpose of quoting statistics. I looked over census figures to see how far I might be wrong or right in my general conclusions. I have some of those figures, which I think I should like to state. Inasmuch as I am giving those, not for statistics, I am stating them in round numbers.

Acres of improved farm lands in Weld County, Colorado, I find in 1900 to be 251,000; in 1910, 410,000. In Albany County, Wyoming, 1909, 149,000; in 1911, 107,000.

Number of farms in Weld County, Colorado, 1900, 2,000; in 1910, 3,900. Albany County, Wyoming, 1900, 374; in 1910, 453. These figures, I wish to repeat, are all in round numbers.

Approximate value improved farms in Weld County, Colorado, in 1900 was $9,500,000; in 1910, $45,000,000. In Albany County, Wyoming, in 1900, approximately $2,750,000; in 1910, $7,500,000.

Value of all farm crops in Weld County, Colorado, in 1900, approximately $3,500,000; in 1910, $7,250,000. In Albany County, Wyoming, in 1900, $804,000; in 1910, $586,000.

Yield of wheat per acre in Larimer County, Colorado, 40 years average, was 23½ bushels. In Albany County, Wyoming, 30 years average, 19.1 bushels. Total oat yield Weld County, Colorado, 1900, 394,600 bushels; in 1910, 856,500 bushels. In Albany County, Wyoming, in 1900, 7,910 bushels; in 1910, 120,400 bushels. Yield in bushels of oats per acre in Weld County, Colorado, 40 years' average, 31½ bushels. Laramie County, Wyoming, 30 years' average, 22.8 bushels.

Total barley yield in Weld County, Colorado, in 1900, 150,700 bushels; in 1910, 577,600 bushels. In Albany County, Wyoming, in 1910, 10,300 bushels.

Barley yield per acre in Weld County, Colorado, 40 years' average, 30.9 bushels. In Laramie County, Wyoming, 30 years' average, 14.05 bushels, with fluctuations from somewhat over 8 bushels in 1890 to over 20 bushels in 1900 and 13 bushels in 1910.

Total product of potatoes in Weld County, Colorado, in 1900, 2,800,000 bushels; in 1910, 5,857,000 bushels. In Albany County, Wyoming, in 1910 approximately 50,000 bushels. Of yield of potatoes per acre in Weld County, Colorado, 30 years' average, 107.4 bushels, being above national average yield. In Laramie County, Wyoming, 30 years' average, 57 bushels. Tons of
2591 hay produced, I assume that this includes alfalfa and wild hay that is cut, in Weld County, Colorado, in 1900, 164,400 tons; in 1910, 168,200 tons. In Albany County, Wyoming, in 1900, 44,900 tons; in 1910, 52,700 tons.

Number of head of live stock in Weld County, Colorado, in 1900, 94,500; in 1910, 84,850. In Albany County, Wyoming, in 1900, 204,600; in 1910, 199,100.

I should say that I have not gone back of these returns of these statistics, considering the method in which these statistics are given, and they are not given for the purpose of giving statistics, but in confirmation of the judgment at which I arrived independently.

I assume that the number of livestock as shown by these census reports does not include number of cattle and sheep that have been brought into districts to be finished.

I think the history of such regions has considerable significance in arriving at conclusions such as we are trying now to arrive at. Very evidently productive and fertile regions develop first in any country, so far as they are accessible and can be made accessible. Laramie Plains had advantage of a transcontinental railroad. Both regions have had possibility of developing good water
2592 supply for irrigation. As far as I am able to judge, Colorado region under discussion has developed continuously, or nearly so, with practically all of its irrigable lands under good or even high state of cultivation. Laramie region has developed here and there in large ranches, with some smaller establishments and very much other space that is merely fenced and used for grazing.

Of course, it is evident on the face of it, that settlers have desired Greeley region more than Laramie region. Of course, I am stating this, not in any discouragement to development of Laramie Plains, that must be understood, but as an assertion as to how two areas struck me, and also as indicating that two regions are of very different character. I think this fact must be recognized when Plains region is fully developed. It seems to me that that region will undoubtedly further develop approximately as a grazing and to some extent as feeding region with such accompanying forage as can be grown with profit, and for the most part, this probably will mean its development in relatively large areas. Taking that country as a whole, as I saw it, it struck me as a region of relatively low crop production, both in totals and per acre, and also a fluctuating production, not overlooking the fact, however, of exceptions in particular places.

Now, while census figures do not show reasons in all cases, they nevertheless support in a general way these statements. The counties of Weld in Colorado and Albany in Wyoming are comparable as to size. I might say that I find a discrepancy in records as to size of Weld County. Figures I have show Weld County having 4,022 square miles. I have seen it given as 3,918 square miles. I have seen figures given for Albany County, 4,401 square miles, but they are near enough in size to be comparable for general purposes.

2593 What is more important in my estimation, they are comparable also in being rural, with one large town in each county of about 8,000 people. Greeley, in Weld County, has a population in 1910 of 8,179, and Laramie, in Albany County, a population under same census of 8,237. Total population Weld County in 1910 was 39,177, and in 1900 it has been reported at 16,808. Population per square mile in 1910 was 9.7. Rural population per square mile was 7.7, showing large percentage of population was rural. Total population Albany County, Wyoming, 1910, was 11,574. In 1900 the population of Albany County had been reported as 13,084. Population per square mile was 2.6 in 1910. Rural population per square mile was .8, or about one-tenth of population per square mile in rural district as that given for Weld County. I don't know what is population on developed farms in either of areas, as I have no means of knowing that. How large rural population is in developed areas of two regions I have no real means of knowing. Of course, it must be much larger in Colorado developed area than for Wyoming developed area. Chamber of Commerce of Albany County states that at least 50,000 more may find support and prosperity in the county. The large areas and relatively cheap lands of county are of course an inducement to settlers. Of course, we have no exact means of measuring what would be future development of a country. It will depend not only, in any case, on wants of country itself, but on a great many more or less important matters, as railroads, markets, and the like.

What has been done indicates in a general way what may be expected. Much of this development in the Wyoming country has

been under irrigation, further irrigation may be expected. An extended area may generally follow, it will do more to extend the area than to intensify the business. The history of the areas indi-
2594 cate a new development in Colorado region, that is, in the Greeley-Poudre project. This will be able to grow a large range of tillage crops, but the Laramie Plains, except in favored places, will be largely devoted to live stock, small grain, forage and hay.

The Colorado district is able to secure three cuttings of alfalfa, to grow beets for sugar, potatoes as high class commercial produce in large quantities, peas and tomatoes for canning, field beans, market gardens, and to a lesser extent, table fruits. Of course, it is also able to grow the same grains and hay as can be raised in the Wyoming region.

I am told in Wyoming region alfalfa produces two cuttings and that their main crops, aside from wild hay, are oats, barley, wheat any rye. It is reported that the grass and the grain has a very high feeding value. I heard mentioned possibility of developing and growing Canada field peas, turnips, and I think, heard flax mentioned. Potatoes are grown to some extent, yielding a relatively small tuber, said to be of high quality. Wyoming region imports a good part of its feeding grains, such as oats. Except as to favored localities under cultivation it does not produce orchard fruits or tender vegetables. Its supplies of these commodities are mostly imported.

I was very much interested in the Lund orchard, because of the fact that apples are grown at such a high elevation. I had not known of such a case at that latitude. The orchard is located in a very protected nook or cove, at the base of the mountains. It is very small, apparently has not been very highly cultivated or tilled, and
2595 therefore has produced a hardy growth. The trees were bearing, the fruits relatively small. There may be other coves or places where small farms may be successful, but I should hardly regard the Lund orchard as an indication of what can be done in the Laramie country. It was to me an exceedingly interesting test. I do not remember number of trees in orchard, but would presume about 100. The apples that I saw were small. Whether that was due to lack of tillage or natural conditions, I do not know.

I have spoken of some of reasons that reinforce my general impressions. I have gone over one of the classes of reasons lying in the history of the two regions, and these statistics as to the productiveness and yield. I might state very briefly of the natural conditions, which are quite unlike as between the two regions. I speak of soil.

Both the Colorado and Wyoming regions under discussion have been soil-surveyed by the United States Government. It is possible, therefore, to compare the nature and agricultural value of the soil conditions in the two areas, and to arrive at perhaps some useful conclusions as to the agricultural possibilities so far as the soil types themselves are indicative. Geographically the areas are located not far apart.

Latitude of Greeley is about 40.5 degrees and of Laramie is about 41.5 degrees. I have said that geographically the areas are located not far apart, and physiographically they are much more widely separated. According to chart of country, as published by the Soil Survey, Laramie is in the eastern edge of the Rocky Mountain Province, with average elevation of about 7,400 feet above the sea, while Greeley region is in the western margin of the Great Plains Region with an average elevation of about 5,500 feet, that being about 2,000 lower than the Laramie area. In order that I
2596 might make no mistake regarding the statements concerning the soil conditions, I had the two soil reports by the government gone over by an expert in order that I might get his conclusion. The chief difference in the structural geology of the area, is in the presence of more sand stone, lime stone and granitic rocks in the Laramie, than in the Colorado region under discussion and particularly in the presence in the Wyoming district of extensive deposits of gypsum. There is also a high salinity in the shales, which undoubtedly accounts for some of the surface deposits of alkali.

Since the soil surveys were made and the reports published, the Bureau of Soils of the United States Government has made a reclassification of some of the soil areas, and has renamed them for purpose of making their classification more uniform and the soil surveys of any region are now likely to be compared under this new schedule, that is, schedule of Bulletin 96 of Bureau of Soils, a large volume. It is supposed that this new classification represents better the soil relations. In first classification, under the original soil surveys, as far as that is concerned, the soils of the regions fall into three different classes: the residual soils which are formed from rocks breaking up in place; the deposit soils, deposited there by old or by recent rivers; and the colluvial soils, which are soils formed from transportation of material from hills or mountains. According to new co-relation, 29.6 per cent of soils on the Laramie sheet are residual in origin as against 7.7 per cent in the Greeley sheet. On the Laramie soil surveys, 54 per cent are given as consisting of old river terraces, while the Greeley region 12.5 per cent. Soils of recent alluvial origin make up about 15 per cent of Laramie area and about 7.7 of Greeley area. In Laramie area ancient river deposits
2597 of a sandy and gravelly nature are very prominent and through these areas protrude heavy to medium residual soils. In Greeley area, as surveyed and reported, the soil conditions comprise chiefly areas of ancient and recent river deposits of a loam to a clay loam texture, cutting through large areas of residual soil of a loam to a fine sand loam texture.

On the whole, the soil-survey reports seem to indicate that the textural properties of the soils as surveyed in the Colorado region are preferable to the textural properties of those surveyed in the Wyoming region. In the latter, the terrace soils are increasingly coarse in texture with depth. And in the Greeley region the reverse is usually or often the condition.

It would seem from these figures that the textural properties of the Colorado area, coupled with the larger rainfall, would favor the

maximum utilization of the natural water supply. In both areas there is white alkali. The two surveys do not seem to be comparable in all areas, or definite enough to allow exact comparisons to be made. Over considerable areas of the lower and better soils in Laramie the water table is near the surface and the alkali liable to be troublesome. I have no clear contrast of the amounts of alkali but they are larger in the Laramie area than in the Greeley area. These, in both cases, are white alkali and soluble.

In general the soil conditions indicate that the agricultural development of the Greeley region, as surveyed, far surpasses that of Laramie region. Of course, latter was quite new at time survey was made.

2598 The climatic differences between the two regions are marked, due to latitude, elevation and exposure. The Laramie Plains is one of the most elevated agricultural regions in North America, and is therefore one of the most interesting. Its development, in my estimation, will constitute a valuable experience for the utilization of other high and exposed areas, all of which must be brought into use in time.

We can project elevation into latitude, which will give another picture of the conditions, although, of course, we must not confuse elevation with latitude, because other elements enter in, as the length of day, although the elevation is in some respects equivalent to latitude.

We can get another idea of the relative situation, by saying that Laramie might be equivalent, other things being equal, to a point of general latitude of Edmonton, Alberta, although the two areas are not compared because other factors enter in.

There are two factors to be taken into account, principally in considering conditions in climate, one the temperature and one the rainfall. The temperature in the Wyoming district is universally several degrees lower than in the Colorado district, and the rainfall is two or three inches less in Laramie than in the Colorado district. I might give some details to illustrate this, taken from the official records:

The climate of the Greeley region of northern Colorado may be indicated rather closely by a long series of records kept by the regular Government Observatory at Fort Collins since 1874, and of course, those at Laramie are indicated by those kept at Laramie at a similar observatory beginning in 1890 and being complete from 1891. Records were kept at Laramie before that time, so that we have a rather long series of records from 1869, with a num-

2599 ber of years entirely missing, however. The records that I have here are made from the official records kept at Fort Collins and by the two combined records kept at Laramie. The exposures of the two instruments have been practically identical as indicated in the reports. The physical conditions of the two regions appear to be similar except that the nearest mountain range, about 5 miles distant, lies east of Laramie and lies west of Fort Collins. There is a difference in the elevation of the two instruments of something less than 2,200 feet. This difference in elevation is im-

portant, because it seems to be one of the reasons for a difference in the temperature of about 7 degrees Fahrenheit; that is, in the average annual temperature.

The annual mean temperature at Fort Collins is 47 degrees, and the annual mean for Laramie is 40 degrees.

Of course these figures do not represent exactly the situation at Greeley, but I think that for all practical purposes they are nearly enough accurate for that region.

Now this difference in temperature as given, called the annual mean, seems to persist throughout the growing season; for example, mean annual temperature for the months of March to September is as follows: Fort Collins, March, 35; Laramie, March, 28; Fort Colline, April, 46; Laramie, April, 37; Fort Collins, May, 55; Laramie May, 47; Fort Collins, June, 64; Laramie, June, 57; Fort Colums, July, 69; Laramie, July, 62; Fort Collins, August, 68; Laramie, August, 62. September, Fort Collins, 59; Laramie 53. That is a very uniform lower temperature throughout the growing season, beginning even before the growing season of about six or seven degrees.

This difference in temperature is what we would expect from the difference in elevation. The mean maximum day temperature also shows a similar condition. I think it is unnecessary to quote
2600 all the figures. The mean maximum night temperature shows a similar variation, it is unnecessary to quote that.

I think it might be well to quote the lowest temperature of record in those growing months: Fort Collins, March, –24; Laramie, March, –21. April, Fort Collins, plus 5; Laramie –10. May, Fort Collins, 23; Laramie, 16; June, Fort Collins, 31; Laramie, 26. July, Fort Collins, 36; Laramie, 33. August, Fort Collins, 38; Laramie, 32. September, Fort Collins, 22; Laramie, 8.

It shows that in all those months, there is a temperature at Laramie below freezing, except in August, when it was at freezing, and in July, when it was one degree above freezing. I am told that frost may be exected in July in some parts of the Laramie Plain. I was told that in Wyoming.

Of course, this gives Laramie a serious frost risk. It also has a comparatively short growing season.

The variations are very great in the precipitation as well as in the temperature. At Laramie in 1872 there was a total rainfall of 17.77 inches. In 1893 the observation showed 3.84 inches. The Fort Collins storms were as follows: Wettest year, 1891, 21.7 inches, and the driest year, 1893, 7.11 inches. The same year that Laramie had a rainfall of 3.84 inches, Fort Collins had a rainfall of 7.11 inches. The annual rainfall for the epoch under discussion is for Fort Collins, 14.81 and for Laramie, 11.11. I may say that this was made before I received Bulletin 100 of the Wyoming Experiment Station and these figures are, of course, not the same as in that, for that includes the Laramie region for a long number of years, but the same conclusions may be drawn.

There are no records that I know of, making the wind phenomena available for these two regions. It is understood the Laramie plateau is rather exposed and subject to strong wind current and the pre-

vailing winds are almost uniformly western, northeast and southwestern. They are usually from a western direction and the areas most exposed are the northwestern region, as I understand it from the maps.

So far as meteorological records are valuable for determining the fitness of these regions for agriculture, one would have no hesitancy in saying that the region measured by the Fort Collins records offers very decided advantages over that measured by the Laramie records.

Comparing the general improvements on the Wyoming lands, I should say they were less expensive and less prominent than on the Colorado lands, though there were some exceptions to that. My recollection is that the best establishments as a whole are in the Colorado district.

I do not know the reason for the excellent roads in the Wyoming district, unless it is due to the natural character of the soil. I was there during a very dry time. The roads over the Sherman Pass in that region, of course are very good roads and are quite ideal. The other roads looked to me to be well taken care of and well made, the main roads. What the surface would be in wet times I could not say.

I did not see any potatoes growing as a commercial crop in Laramie Plains region. My judgment is that there will never be a heavy potato crop commercially. I think they could be raised more cheaply in other regions.

The best crops that I really saw in the Laramie Plains, or
2602 saw the results of, were on the Blackburn Ranch. There are of course crops of native wild hay. To briefly sum up the principal reasons why the Poudre Valley area is in my judgment so much superior to the Laramie Plains areas as an agricultural region, I think I cannot do more than practically repeat the statement I have already made in my testimony. I feel that the development that is in the general Greeley district is one that is destined to produce more value per acre and greater diversity in cropping, will maintain a bigger rural population, and more rural industries founded on agriculture. The general fundamental reasons for these differences I have already indicated; I think chiefly are soil and climate, particularly the latter, for the reason it is difficult to overcome climate, but it is possible to overcome some difficulties of soil conditions. In other words, I should regard the climate to be a more important controlling factor than soil, other things being equal, if the soil is such that crops can grow in it at all.

I saw no reason for doubting that the area included within
the Greeley-Poudre Irrigation District could be developed
2603 as highly as the region about Eaton. Of course, to answer that with great positiveness, would require soil examinations and a careful survey. As far as a reconnoissance is concerned, I saw nothing that would indicate that it could not be developed as well as the other. There is no difference in the physical conditions. The soil is lighter in many cases than in the neighborhood of Greeley. There is much soil in the neighborhood of Eaton that is lighter and it seems to be the same general situation as far as I could determine.

L. H. BAILEY.

Cross-examination by Mr. N. E. Corthell:

The only time I made any investigation upon the ground in the Poudre Valley and the Laramie Plains was between September 16th and 19th, 1913, when I made an automobile trip over the two valleys and held conversations with persons along the road. Four days we spent on the whole trip and about half in each region,
2604 and we also returned through the Poudre Valley on the way back from Laramie City. Aside from my observations during this time my investigation has been confined to the examination of bulletins, reports and printed statements. Reports are those published by the Bureau of Soils of the Department of Agriculture, and in the case of the Poudre Valley the report was published in 1904 from soil survey by J. Garnett Holmes and N. P. Neill, and constitute a part of the sixth annual report of the Department of Agriculture, Bureau of Soils, for 1904. The data concerning the Laramie Plains region is founded on the publication of the Bureau of Soils, entitled Soil Survey of the Laramie Area, Wyoming, by N. P. Neill and party, advance sheet of field operation of the Bureau of Soils, 1893. This latter report covers the land lying within a distance of from two to nine miles west of the river and from one to six miles east of the river. Aside from these reports, maps, and the investigations I have mentioned, I have gained no information
2605 in regard to the soil of these two areas. I do not believe that the change in classification which has been made by the Bureau of Soils since the publication of these reports affects in any way the situation relative to these two valleys, the change not being one in fact, but only in the names of some of the soil types and in the origin of them. I believe that the names used in the reports covering the Greeley area and the Laramie area are comparable. As fas as the maps are concerned the land lying west of the Lara-
2606 mie River is more uniform than that in the Greeley area, but the descriptions will show that there is a considerable variation on the inside classification of the soil type. Little if any of the Greeley-Poudre Irrigation District is shown on the soil map of the Greeley area. The land lying east of the Union Pacific Railroad in the Greeley area differs in quality from that lying west of the railroad. I am not acquainted with the geological formations of either of the areas in question.

2607 From my reconnaissance of these two areas I arrived at certain conclusions in regard to the general characteristics of the soils, and I then asked a man connected with the soil surveys to go over the soil survey maps and to give me any comparison he wished to give of the soil conditions of the two areas as disclosed by the maps and soil surveys, and in my direct testimony I gave the results of his examination and comparisons. He did not know what was involved in the situation. As far as I know he had no personal knowledge of the conditions upon the ground, and his comparisons were based wholly upon the reports. My experience has generally been with

soils in the humid region and I have had no particular ex-
2608 perience with soils in the arid region and have given no special thought to any differences which may exist. I am not a specialist in soils. It is true that soils in the humid region are more likely to be impaired in their formation by acidity rather than by the opposite fault. This is quite a common condition in New York. There has been a great change of opinion in a great many agricultural institutions relative to the value of soil analyses. Some persons hold that chemical analysis is very important and others that it is incidental, and no generally accepted conclusion has been reached. I have given particular attention to horticulture more than to any other branch of agriculture while I was teaching it. I cannot state what the effect of two or three seasons of cultivation has been upon the texture of the soil in these two regions.

2609 I made no particular examination of the soils on the Blackburn ranch nor any comparison between the uncultivated and the cultivated lands upon the ranch nor between the lands on that ranch and the lands in other places upon the Laramie Plains. I observed gravel so frequently, particularly in cuts, as to challenge my attention, but I cannot state any particular place where I did note it. I made no particular examination of the soil in the vicinity of the Lund Orchard. I made no investigation to ascertain the conditions from which the livestock industry of the Laramie Plains grew. I should think that that country was devoted to stock
2610 raising because of its natural adaptability rather than to general farming. I have formed no idea as to how low much of Albany County, Wyoming, is mountainous and how much of it consists of plains. I suppose that the presence of large areas of mountain or dry land to the lands near the streams would promote stock raising. Weld County, Colorado, is altogether a prairie country. The difference between Weld County, Colorado, and Albany County, Wyoming, in this particular would modify the industries of the two areas to some extent, but I would say that the principal cause of the difference in the industries would be due to the general adaptability of the country. Other things being equal, I would expect to find more stock-raising in a country where there are mountainous areas than in a country where there are none. With respect to climate, temperature and rainfall are the principal factors, and where, as in this case, the difference in precipitation in two areas is not great, temperature would be the principal factor. Other factors are so important that I should not say that it is generally true that the higher the temperature during the summer season the greater the value of the land and the productiveness of the soil.

2612 I also based my judgment of the two areas partly upon a comparison of them relative to population and the intensity of cultivation. My testimony was that my judgment was based on the general impressions made upon my mind in this reconnaissance, and when I made an analysis I was conscious that these impressions were founded in the first place upon the facts as I saw them; that is to say, the actual development of the two places and also upon

the physical conditions, chiefly soil and climate. The difference in soil conditions was sufficiently marked for me to notice it. I have made no investigation as to the cause of the early development of farming in Colorado nor the effect upon it of the early development of the mining industry. I have assumed that the development in Colorado and Wyoming was upon equal terms subject to the difference in natural conditions and adaptability of the two regions. I have not assumed that there have been any artificial conditions affecting the development. There always are such artificial conditions but they are usually not controlling.

2613 I have stated it as a general proposition that the naturally productive and fertile regions tend to develop first, so far as they are accessible or can be made accessible. The early development of New England comes within this rule, as it was the accessible part of the country. If the Mississippi valley had been equally accessible, it would have been settled first. In my testimony based upon Census reports I took them for their face value and have not gone back of them to ascertain if they had sufficient basis. They were used to reinforce my general observations. I made no

2614 investigation of the potato industry in the Greeley district since 1910. The Laramie Plains is inclosed at least partially on the east, the south, and south-west and the west. The Poudre Valley is not inclosed, having mountains only on the west side. By the exposed condition of the Laramie Plains I had reference in the first place to the elevation and secondly to its exposure on the north and north-west from which many of the prevailing winds

2615 come. I did not mention the existence of mountain ranges around the Laramie Plains as indicating that they constitute a protection.

2615 Redirect examination by Mr. Fred Farrar:

I stated that there is some controversy as to the value of chemical properties of soil. There is no lack of uniformity of opinion as to the chemical analysis. Chemical analysis is important. The gist of that discussion is this, we have to consider the history of the matter. It was formerly thought that a making of the chemical analysis of the soil is a way to determine its fertility and productivity, and that was the thought a great many years. It has become established in the public mind that one may analyze his plant and analyze the soil and find exactly what to apply to the soil in order to produce the plant. Now we understand that the mechanical, physical and textural conditions of the soil also have a very marked effect and also the biological content has a marked effect, and in places where there is marked deficiency in any of these elements, a chemical analysis is not now considered to be so controlling as in times past.

I was told that the Blackburn Ranch which we visited was the best place in the Laramie Plains. This was the local information given me; that is to say, for a large ranch.

T. J. MONTGOMERY, recalled.

Direct examination by Mr. Fred Farrar:

I located at Fort Collins in 1877. When on stand at my former testimony I stated that Laramie Plains region today was about the same as that of Poudre Valley in 1867 or 1868. I wish to correct that statement. I would like to have the record read in 1877 or 1878, instead of 1867 and 1868. I was not living in Poudre Valley in 1867 or 1868. My comparison of the two areas is intended to be general and not specific.

I referred to the sale of lands in the Laramie Plains by the Laramie Water Company. That is the company which I understand owns Lake Hattie and the distributing system incident to it. The testimony I gave as to their selling lands at $60 per acre was hearsay, absolutely. I do not know of any case in which they
2617 sold their lands at that figure. I have been in real estate business for a good many years. I am familiar with farm values. I would say that the reasonable value of lands of the Laramie Plains for agricultural purposes would be about $15 to $30 per acre for lands under irrigation and cultivation.

T. J. MONTGOMERY.

2617 Cross-examination by Mr. N. E. Corthell:

I made no special inquiry relative to the price for which lands upon the Laramie Plains were selling and I have no knowledge about the sale prices of those lands excepting from hearsay.

Redirect examination by Mr. Fred Farrar:

I have followed testimony given in this case to some extent. I was familiar with survey made in behalf of the State of Colorado by Mr. E. C. McAnelly and his party on the Laramie Plains. If lands of the Laramie Water Company on the Laramie Plains are worth $60 per acre, lands under irrigation in the Cache la Poudre Valley would in my judgment be worth $300 to $500 per acre. I was advised that the Laramie Water Company were endeavoring to sell these lands to people recently from the east, people that they were bringing into the country. They were not attempting to sell the lands to people living in the Laramie Plains.

2619 E. C. MCANELLY, a witness in behalf of defendants.

Direct examination by Mr. Delph E. Carpenter:

Civil engineer, reside at Fort Collins. There for 30 years. Graduate of State Agricultural College at Fort Collins from department of Civil and Irrigation Engineering. My principal instructor during time of attending that institution was Prof. L. G. Carpenter. Engaged in practice of profession 14 years. Duties have been confined particularly to Cache la Poudre Valley. Work has been principally that of ditch and reservoir construction. During years

1913 and part of 1914 was State Deputy Engineer of Colorado. Particular duties assigned to me during that period were the making of surveys in the Big and Little Laramie Valleys. Made plane table survey of most of Big Laramie Valley. Was directed to survey and observe the irrigated portions of these two valleys. Entered
2620 upon performance of these duties in early part of June, 1913. Had full plane table survey party with me in charge of George P. Woodhall.

Made plane table survey of Laramie Valley from range lying on West side of township 76 following down Big Laramie Valley to little below Two Rivers. Also about six miles above Two Rivers on Little Laramie River with exceptions of a few sections in townships 14 and 15, range- 75 and 76 on the table land. I began some few miles north of the interstate line and about four miles from Woods Landing, Wyo. That point is at upper end of Laramie Plains. Laramie River Valley above Woods Landing is narrow. Mountains close in on plains near this point. Jelm and Sheep Mountains close in on valley here.

2621 There are ranches and cultivated lands in this narrow strip along the river between Woods Landing and the point where I commenced our survey. Starting at point of beginning of survey and naming the ranches upstream, they are:—Jacob Lund, Berg Ranch, and one other just below Woods Landing. This is same Lund Ranch concerning which testimony has been introduced by previous witnesses, upon which there are certain orchard trees. We began survey near Johnson Ranch. It is next ranch above Sodergreen's. We used the main road between Laramie and Woods Landing as the northerly boundary of our plane table survey work for a considerable distance down the valley. This is a diag-
2622 onal road. It is just on bench above bottom lands. Ceased to use road as northerly boundary when reached range line between ranges 74 and 75 west. From there on used North Canal, one of outlets of Lake Hattie Reservoir as northerly boundary. This canal marks upper boundary of area under ditch in Big Laramie Valley. Ground above that canal is bluff land used for grazing purposes and is not irrigated. North Canal is above Pioneer Canal. There is narrow strip of land used most for grazing. Used this canal down to point where North Canal swings to West and ends in Big Basin and from that point we took Pioneer Canal as northerly boundary and used that canal on down. North Canal swings to the west on Sec. 17, Tp. 16 N., R. 73, W. From there runs westerly towards Big Basin. I understand it terminates in that basin.

North Canal discharged water into Big Basin during 1913.

The highway which we used as northerly boundary for the western portion of the plane table survey, is indicated by two black parallel lines on topographic sheets for Laramie Quadrangle of the United States Geological Survey, edition July 1908, surveyed by E. M. Douglas, geographer. It runs in southwesterly direction from Laramie past Frazier Ranch, Seven Mile Lake, Nelson's Road Ranch, and Sodergreen's Ranch to Woods Landing.

During survey made reconnaissance of lands under canals lying

north and west of this highway and east of Sheep Mountain and Lake Hattie. This reconnaissance was to determine approximate number of acres in crops under different ditches. Under term crops I include native hay or any irrigated land. In making this reconnaissance where I had any doubt as to whether or not land was irrigated or had been irrigated, I resolved the doubt in favor
2624 of Wyoming. I did not make plat of land thus roughly investigated. Map area began and reconnaissance ceased near range line, between ranges 74 and 75 west.

On Little Laramie River ceased going up stream with plane table survey at point one mile west of Sprague's Lane. This lane is the north and south road on section line between Secs. 34 and 35, North, through Secs. 14 and 15, Township 17 North, Range 75 West. From Sprague Lane up Little Laramie River, survey was made by George P. Woodhall, he went with the plane table. The area above the lane was not mapped.

Plane table survey on Big Laramie River included area in vicinity of Wyoming Experiment Station and suburban residence of N. E. Corthell. My duties were to observe kind and condition of crops, etc. Party was in field from June 7th to September 19, 1913. Consisted of 7 men, engaged continuously during that time. Work was continued after September 19th under George P. Woodhall with one assistant. First camp located at Rickard's Ranch on Sec.
2625 12, Tp. 14, N. R. 75 W. Next camp was located on Solomon Ranch on Sec. 11, Tp. 15, N. R. 75 W. Third camp was located at Two Rivers on Sec. 5, Tp. 17 N., R. 74 W. Party worked from these camps. Plane table survey is method employed by United States Government in making its surveys and especially by U. S. Geological Survey in making its quadrangle sheets. Plane table consists of making picture of area of land in field. Plane table consists of draughting board and an instrument called the Alidade. Map is made in field by geographer in charge of instrument. Distances are obtained by stadia measurement and courses are platted right on map. Observations are taken by instrument. Elevations are taken by same method, although we did not note elevations.

2626 Our instructions on this survey were to include irrigated area along valley, different crops, location of buildings, ditches, and everything that was in valley. Geographer was to classify several crops.

During my observations of community took photographs of valley showing different buildings, different headworks, heads of different canals along both streams, the Big and Little Laramies. Part of photographs taken by myself and part by Mr. Woodhall. I have assembled these photographs in album, which will be introduced in evidence later.

Took measurements of hay stacks in valley to ascertain tonnage obtained from given area.

Have observed beginning of harvest of first cutting of alfalfa. Observed general condition of soil during progress of survey. Noted

that western part of basin was gravelly soil with large gravel. Some gravel probably 5 or 6 inches across. Largest gravel disappears along near range line between ranges 75 and 76, a little east of that.

2627 And from there on soil is more of sandy nature. Small gravel prevails even in the sandy soil. Best soil is west of Laramie in vicinity of Wyoming Experiment Station. In speaking of gravel being prevalent in western portion of basin I refer to Laramie Plains. Large gravel appears in vicinity of Sheep Mountain and continues in soil along Sodergreen High Line, Pioneer, Last Chance, Parker and Fischer Ditches. Gravel is so prevalent throughout this area that it can be observed by casual traveler. Soil on gravel in Sprague Lane on Little Laramie was six inches to a foot thick. On Lake Hattie inlet on Big Laramie gravel

2628 starts right on surface of ground. It is at surface.

Gravel, large or small, exists throughout the soils in Laramie Plains.

The topography of the Big Laramie Valley may be divided into three benches,—the river bottom, what is called the first bench, and the second bench or upland. We didn't cover highest bench with

2629 plane table survey. River bottom is land lying along river. It is flat and a little higher than the stream. A gradual slope from foot of bluff to river. Second bench is higher than river bottom land, with slope from foot of third bench toward river. Second bench on north side of Big Laramie River varies from about 6 miles to 1½ miles. Pioneer Canal irrigates second bench.

In making observations other than those noted on sheets, I observed irrigated lands from section lines. Travelled over lands and around them. Carried on these collateral surveys during entire period.

Direct examination by Mr. Fred Farrar:

Observations referred to were distinct and separate from plane table survey. Took observations of kind and character of crops raised on Laramie Plains during summer 1913.

Native hay is principal crop raised on Laramie Plains. Other crops are alfalfa, oats, some rye and some potatoes.

In making plane table survey platted whole country covered by survey. Have designated various kinds of crops raised. Maps or plats give definite information as to number and kind of crops on Laramie Plains. Acreage shown as devoted to any specific crop is accurate designation of true situation. Acreage is not conjectured but is result of survey. Distances were obtained by stadia measurements. Survey commenced in southwest portion Laramie Plains and progressed northeasterly and northerly to Two Rivers, from which point we surveyed southwesterly up Little Laramie. Started below state line, followed down Little Laramie River and then went up Little Laramie River.

2631 Very little alfalfa grown in whole Laramie Valley. Largest tract of alfalfa on Hart Ranch. Sodergreen has small tract and several small tracts close to Laramie.

First cutting alfalfa began on Laramie Plains July 7, 1913. A second cutting was obtained. Do not know day it started. It was last of August or first of September. Only two cuttings are obtained. I measured first cutting of alfalfa on Hart Ranch. There was one body of 481 acres which I considered all as one ranch. Hart Ranch is southwest of Laramie 7 or 8 miles. Lands lie on both sides of river. It is irrigated by Pioneer and Hutton and Bilderback Ditches. First cutting alfalfa on Hart Ranch measured July 24, 1913 in stack. Had not settled very much. Had been stacked about 7 or 10 days. We measured it and determined number of tons.

320 tons alfalfa hay in first cutting from 481 acres on Hart Ranch in 1913. Used same method measurement generally used for measuring hay in stack. That is same method used for hay which has settled. If there is an error, it would tend to show greater number of tons than actually existed.

Second cutting of hay on that ranch was later measured by Mr. Woodhall, under my direction, latter part of September or
first of October. It measured 252½ tons of alfalfa from
2633 481 acres, making total of 572½ tons of alfalfa hay obtained from that ranch in 1913 in both cuttings. Average production of alfalfa for two cuttings combined about 1.2 tons per acre. Some hay might have been sold before it was stacked. Stacks were not broken into, but some might have been hauled from win-
row. It is largest alfalfa field on Laramie Plains. Always
2634 considered it best piece of alfalfa on Laramie Plains. Formed this opinion from observing all of alfalfa on entire plains.

Measured first cutting alfalfa on Sec. 30, Tp. 14 N., R. 74 W., part of Hoge Ranch. Situate adjacent to Laramie River above Laramie, on southeast side of river, 13 or 14 miles above Laramie. 27.8 acres in field. Total number tons in first cutting, 30. First cutting measured four days after stacking on July 16, 1913. No deduction made for future shrinkage. Allowed same standard measurement which would apply to stack after it had shrunk. Yield of first cutting Hoge Ranch was 1.1 tons per acre.

Measured first cutting alfalfa on Sec. 14, Tp. 15 N., R. 74., part
of Buntin Ranch. 30 acres in alfalfa. Total first cutting
2635 production was 29.8, practically 30 tons. Did not measure second cutting. Ranch southwest from Laramie four miles, under Pioneer Ditch. This was all the alfalfa I measured.

Measured one field native hay on Little Laramie River on Al Bath Estate on Sec. 7, Tp. 16 N. R. 75 W. Mr. John E. Field and Mr. George P. Woodhall and I were present at time of making measurement. Hay was taken from 423 acres of meadow. Measurement made November 16, 1913. Measurement showed 253.2 tons of native hay, giving yield of 6 tons per acre. Do not know when hay was cut. Native hay generally cut middle to latter part of July. Only one crop of native hay obtained each year. The Bath place where this hay was located, I consider a good piece of hay land, one of very best meadows in Laramie Plains region.

2636 Gravelly condition of Laramie Plains extends over considerable area. Have noticed soil in Laramie City. They

were digging ditch for laying steam pipe. Excavation showed fine gravel all the way. Difference between this soil and soil southwest of the city is merely the difference in degree as to size of gravel.

2637 More or less alkali is present throughout Laramie Plains. You find it everywhere. There is considerably more alkali on Laramie Plains than in Poudre Valley. Alkali is evidenced by white deposit on ground surface. You generally find alkali in places where seepage occurs. Fact that alkali does not appear does not indicate that it is not present.

Soil under Lake Hattie Reservoir is similar to soil under Pioneer Canal. It varies from coarse gravel to sandy, gravelly loam up towards Laramie and North.

2638 Made examination of ditches in area. Most of headworks and dams across river are temporary affairs. I do not intend to imply that they are put in with the idea of moving them. Water will do that. They are made out of brush and loose rock. Most of headgates on Big Laramie are made of wood. I think there are two concrete headgates. One is at head of Lake Hattie Inlet at which point there is concrete dam. Other is at head of Fischer Ditch. These are new structures.

All diversion structures on Little Laramie were imperfect. Little Laramie area is devoted mostly to native hay. There are a large number of small ditches in this area. They are noted for the same temporary structures I have mentioned.

2639 Examined King Ditch. Head of that ditch is southwest of Laramie. Takes water from Big Laramie on south side. Examined King High Line Ditch. They both take water or head at the same place on the south side of the Big Laramie River. They have wooden headgates. Ditch is 14 feet wide on bottom and flows in easterly direction crossing Sand Creek over to Hutton Lakes. Concrete has been used for flume across Sand Creek and concrete drop on west side, and concrete check on east side of Sand Creek. Latter not yet completed. Waste gates have never been placed or had not last summer, and on east side gates were not in the check. Old Cunningham Ditch flows from Sand Creek into King High Line Ditch on east side of Sand Creek.

Water flowing into Hutton and Creighton Lakes stays there. King High Line Ditch is new. It is not yet completed. Water has been down ditch part of way but has never been across Sand Creek. Headworks of King Ditch are of wood. They are in fairly good repair at the present time. There was no diversion dam at headgate at the time I was there, June 24, 1913. There was no structure, absolutely, designed to divert water from river into King Ditch. There was no sign of any having ever been there. King

2640 Ditch comes out of King High Line Ditch. Where King Ditch leaves King High Line Ditch there is a drop and check in King High Line Ditch, but there is nothing in river.

Photographs taken by me during survey were intended to show character of headworks on different ditches, buildings, and surroundings in Big Laramie Valley. Phonographs show country covered by plats made in survey. In whole number of 500 to 600 photo-

graphs, about 50 did not turn out well. The photographs of the better structures and buildings came out right. Wherever we had a failure of one of the better buildings, or a better improvement, we took another picture. Any that may be missing are of poor improvements or poor structures.

2641 Plats made from plane table survey have been prepared for introduction into evidence. They are prepared by photographic reproduction and reduction of the original tracings.

(Defendants' Exhibit 114, an album containing photographic reproduction on reduced scale, of plane table survey plates, offered in evidence.)

Exhibit No. 114 is an album of 40 sheets, first sheet labeled index and sheets 1 to 40 showing improvements and vegetation in Laramie River Valley. This is photographic correct reproduction on reduced scale of plane table survey plates. On first or index sheet, scale is designated as one inch to 400 feet. That was scale of original map. That scale does not prevail on these photoghaphic reproductions. Each plat or sheet shows six sections of land. Sections 29, 30, 31, 32, Tp. 14 N., R. 76 W., and Secs. 25 and 36 Tp. 14 N., R. 77 W., are shown on sheet No. 1. From that as starting point, sheets follow down irrigated portion of valley. On index sheet there is plat showing sections numbered in various townships and ranges and there is large number commencing with 1 and running to 39 for each 6 sections. Larger numbers are sheet numbers. That shows

2642 sheets as they apnear in the exhibit.

Have prepared album from photographs of ditches, headgates and diversion dam in Laramie Plains region.

(Defendants' Exhibit 115, an album of photographs, offered in evidence.)

Defendants' Exhibit 115 is the album of which I have spoken The headgates and dams shown in exhibit are located along Big Laramie and Little Laramie Rivers, over area covered by plane table sheets, and also above that point. They include practically all headgates on Big Laramie River and most of them on Little Laramie River. Some of pictures of headgates on Little Laramie River did not turn out well. There was no discrimination in selection of headgates. We tried to obtain pictures of all headgates. Photographs were taken during summer and fall of 1913.

Number on map in front of this album shows location of picture bearing same number in album. Map is merely key to location of headgates geographically. In the legend under each photograph, first appears the number, then date upon which photograph was taken, and then what the picture represents and were located. It also shows stream from which diversion was made.

2643 Prepared album of photographs of improvements on area covered by plane table survey. It includes other buildings besides those shown on plane table survey.

(Defendants' Exhibit 116, an album of photographs, offered in evidence.)

Exhibit 116 is album concerning which I just spoke. Same arrangements have been made on map showing location of improvements. Map in front of album containing numbers in India ink, shows geographical location of areas shown in each respective picture. Each picture contains legend, giving number of picture, date taken, name of owner of place, and description by section and subdivision. Pictures of buildings are arranged according to section and township beginning on west and running from north to south. To make it clear, first township is 15 N., R. 77 W., and first picture is in Sec. 1. From there they run south through that tier of sections. Next series starts on Township 17, N., R. 76 W. and runs south. Runs to Township 13 S., R. 76 W. By taking map and commencing with Township 15 N., R. 77 W., first one, each succeeding range as you pass to eastward is shown in series. I referred to these pictures when I testified a few minutes ago that I had photographs of everything except in cases where there had been failure. Where there were important improvements concerned, and failure occurred, we went back later and took another picture. I have not intended to include anything in this album, showing improvement within city of Laramie.

In Defendants' Exhibit 115, there are 167 pictures showing ditches and headgates. In Defendants' Exhibit 116 there are 245 photographs showing improvements. There was no discrimination as to what improvements we took. Purpose was to try to take all of improvements to show character of country, buildings, and all improvements. Photographs contained in Exhibits 115 and 116 were taken by myself and George P. Woodhall. Laramie Plains area is contained in album Exhibit 116. It shows improvements from upper end of Plains down to point about six miles below Two Rivers. Two Rivers is junction of Big and Little Laramie Rivers. Took photographs of all improvements to point above six miles below.

2645 We only took photographs of improvements within irrigated sections. This does not go down as far as Wheatland Reservoir. From Two Rivers on pictures include buildings on river bottom and not up on bench. Exhibit 116 is complete album giving comprehensive view of improvements on Laramie Plains outside of Laramie City.

Exhibit 114, sheet 1, plane table survey exhibit, shows ranch of J. E. Johnson, part of Oscar Sodergreen's place, and some of A. T. Durand's place. This plat shows location of county road between Laramie and Wood's Landing, Sodergreen High Line Canal, Lake Hattie Inlet Canal, Headgates and portions of these canals, headgates and portion of Popp and Barlow or Last Chance Ditch. Popp and Barlow and Last Chance are same canal. The canal I de-

2646 scribed as Popp and Barlow other witnesses have described as Popp and Pahlow. Portions of other ditches are also shown on this map. Cultivated area is designated by characters, also names, as "oats," "potatoes," "garden," "plowed ground." All are labeled. I have arranged a legend showing how township lines are represented, section lines, subdivision lines, fence lines, barb wire fences, pole fence , telephone lines, grains, alfalfa, potatoes, plowed

ground, meadow l[illegible], pasture lands, grease-wood, bluffs, trees, and roads. Legend is o[illegible] first sheet of album.

Sheet No. 2 of album, Exhibit 114, shows classification of meadow lands into second and third classes. I made classification of meadow lands into first, second and third class. First class meadow is meadow that would cut one-half ton of native hay, or better per acre, and with good stand. Meadow which will cut less than one-half ton of native hay per acre, was classified as second class; and third class meadow is meadow that, while it might be cut in spots, is more useful for pasturage than meadow.

2647 Places that I have labeled as pasture is not what counsel for Wyoming termed irrigated pasturage. That is not irrigated land. Irrigated pasturage, as the term is used by counsel for Wyoming, is designated on these sheets as third class meadow.

For illustration of Exhibits of 114, 115 and 116, I refer to sheet No. 1 of Exhibit 114, album of plane table survey. On that sheet appears canal which heads near center of Sec. 36, Tp. 15, N., R. 77 W., which is labeled Laramie Canal. That is inlet canal to Lake Hattie, owned by Laramie Water Company. That is canal described by Wyoming witnesses as Lake Hattie Inlet, being enlargement of Pioneer Canal at that point. Referring now to Exhibit 115, picture No. 119, shows headgate of this canal. Picture No. 120 shows dam across river at that point. Referring again to Exhibit 114, next canal down river is Parker Ditch, heading near eastern line of same section. Photograph No. 139 Exhibit 115, shows headgate and diversion dam at that canal. Shows structures on Big Laramie River. On Exhibit 114, Popp and Barlow Canal shows as heading near center of N. ½ of Sec. 31, Tp. 14, N., R. 76 W. In Exhibit 115, photograph numbered 126 shows headgate of that canal and photograph No. 125 the dam. Headgate is wooden structure. Dam consists of loose rock and brush. There is wooden measuring weir below headgate in that canal. Headgate is not very permanent wooden structure, poorly constructed. It is not satisfactory device under any modern system of irrigation. The gates are fairly good, it is constructed of planks laid lengthwise. I have seen such headgates diverting water from Poudre River. They are not prevalent down there. They are putting in more permanent structures there now than they used to have, although there are wooden gates yet.

Next canal shown on sheet 1 of Exhibit 114 is Sodergreen Ditch heading in same section as Popp and Barlow. Photograph No. 124 in Exhibit 115 shows headgate of that canal and photograph

2649 125 the dam. Pictures is wooden. Dam consists of dam and headgate. Headgate is wooden. Dam consists of loose rocks, logs, and some concrete. Headgate not in good repair. It is not permanent structure. There is no modern operating device for headgate.

Next canal appearing on sheet 1 Exhibit 114 is Fischer Ditch, heading near north line Sec. 32, Tp. 14 N., R. 76 W. Picture 127 in Exhibit 115 shows headgate and dam of Fischer ditch from Big Laramie River. Diversion dam consists of loose rock and log dam.

Headgate is concrete structure with screw lifting device. This headgate more nearly approaches modern device.

Riverside Canal No. 2, heading in same section as Fischer Ditch, appears next on sheet 1, Exhibit 114. Photograph No. 128 shows the structures at that point of diversion. It shows headgate and dam. Dam consists of loose rock and brush. Headgate is wooden structure made out of poles for top cross piece and with plank sides.

Next canal shown on sheet 1, Exhibit 114 is Olson Ditch, heading immediately below Riverside No. 2. Picture 129 in Exhibit 115 shows character of dam, made of trees, logs, brush, and loose rock. Material just piled in and not laid symmetrically. Headgate wooden structure, consisting of two gates.

Durand Ditch next appears on sheet 1, Exhibit 114. Photograph 130, Exhibit 115, shows diversion works of that canal. Works consist of loose rock dam, headgate is modern structure consisting of two gates.

Hammond Ditch appears next on Exhibit 114. Picture No. 131, Exhibit 115, shows headgate of that canal.

Other than Lake Hattie Inlet Canal, designated on sheet 1, Exhibit 114 as Laramie Canal, headgates of various canals taking water from Big Laramie River are not of generally permanent nature. Ditches themselves are not in good shape and not kept clean. More or less grass or weeds grown along ditches. Willows grow in them. Ditches do not indicate very good farming.

Sheet No. 1, Exhibit 116, Upper plate shows Johnson Ranch. Picture No. 64 shows improvements on that ranch. Improvements numbered previous to No. 64 in Exhibit 116 are on sections to north and west of Johnson place. Picture No. 63 shows improvements on Sodergreen place. Photographs in this album, Exhibit 116, are arranged according to sections, beginning with section 1. Sodergreen place is on Section 29, Johnson buildings on section 30. Sodergreen buildings have the number 63 and Johnson buildings No. 64. Sodergreen Ranch is one of best in point of improvements on Laramie Plains region. Johnson and Sodergreen places are at extreme upper end of Laramie Plains, just below cañon in Laramie River. Sheep Mountain is on north side and Jelm is on south side of these ranches.

Photographs shown in Exhibits 115 and 116 were taken under all conditions. At times light was adverse and also weather conditions were sometimes adverse. That is reason some photographs are clearer than others.

2652 At times names I have used to designate places or ditches are not exactly same as those used by Wyoming witnesses. In these cases, I obtained names as best I could while making survey. This accounts for difference.

Photographs contained in Exhibits 115 and 116 give fair representation of character of improvements. There was no attempt made to take adverse picture. Object was to take photographs of everything. I tried to take fair pictures showing real conditions.

Referring to album, Exhibit 115, containing photographs of headgates and diversion works on Big Laramie River going down stream,

description of each set of diversion works, with number of pictures, are:

First picture, No. 122, at upper end of valley is photograph of structures located at Woods Landing on Sec. 11, Tp. 13 N., R. 77 W. Dam consists of loose rock. Headgate wooden structure; name Berg Ditch. Next ditch is Sodergreen High Line, heading in Sec. 36, Tp. 14, N., R. 77 W. Photographs No. 121 and 141 show headgate and dam. Dam consists of loose rock piled across Laramie
2653 River. Headgate of would in good condition, comparatively new. Headgates of Berg and Sodergreen High Line Ditch are both above point where started plane table survey. They are not shown on plat. King High Line Canal is shown by picture 136. The dam is shown by picture 135. A dam of poles appears in picture. It was not there when I made observation from which I stated that there was no dam in river at head of King High Line Ditch. Picture 132 shows Mansfield Ditch located north side Big Laramie on Sec. 2, Tp. 13 N., R. 76 W. There is no picture of diversion dam. Riverside Canal No. 1 located on north side Big Laramie River on Sec. 2, Tp. 13 N., R. 76 W. Photograph is No. 134. Dam consists of loose rock structure built across river. Headgate of wood. Dam is merely irregular pile across stream. Caldwell Ditch is pic-
2654 ture No. 118. No diversion dam on river. Headgate consists of wood. Structure is not up to date. Picture No. 117 shows next ditch, Cuba ditch, north side of Big Laramie River in Sec. 29, Tp. 14 N., R. 76 W. Gate consists of wood, structure in fairly good condition. Ditch is newly constructed. Was constructed about one year ago and is in fairly good shape. Hoge and Haley Canal is located on south side of Laramie River Sec. 29, Tp. 14, N. R. 75 W. Photograph No. 116. Headgate consists of wooden structure; it is poorly constructed. There is no diversion dam. Nelson Ditch is located north side Big Laramie River, Sec. 21, Tp. 14, N., R. 75 W. Photograph No. 142. Wooden headgate and no diversion dam. Bush and Holliday Canal is located south side Big Laramie River in Sec. 21, Tp. 14, N., R. 75 W. Photograph No. 137. No diversion dam across river and has headgate of wood in poor condition. Dowling Canal located east bank Big Laramie River Sec. 32, Tp. 15 N., R. 74 W. Dam consists rock crib. Headgate wooden structure in good condition. Photographs numbered 149 and 150. Next canal is old Walcott Ditch, located north bank Laramie River, Sec. 22, Tp., 15 N. R. 74 W. Photograph No. 157. No headgate and no dam across river. Ditch has evidently been abandoned.

Remaining photographs in this exhibit were taken by Mr. Woodhall, and not by me.

2655 Referred to album, Exhibit No. 114, containing plane table survey sheets, on each of some of sheets appear small letters referring to another sheet numbering, for illustration, on sheet 9 appears small letters at top of sheet "No. 8." That indicates that if they were spread out in map form sheet No. 8 would simply join sheet No. 9 on north. In each case I indicate reference to another sheet. It indicates No. of sheet joining on proper side.

E. C. McANELLY.

2656 Cross-examination by Mr. N. E. Corthell:

Prior to 1913 my only acquaintance with the Laramie Plains was in passing along the Woods Landing road upon the old stage. Substantially all of my time from June to September, 1913, was spent upon a survey upon the Laramie Plains. I was not with the party all of the time, but it was in my charge. Part of the time I held the rod, sometimes I was up on a hill taking pictures and sometimes I did other work in connection with the actual surveying. The particular pictures I took are those showing the headgates and buildings. I believe I took more than one-half of all of them. I did no personal work upon the maps and did not handle the instruments. We dug no test pits to examine the soil and the only investigations we made were from surface conditions and where excavations had been made. No samples were taken. The gravel continued to some extent all the way from Laramie City to Sheep Mountain. Anywhere along the Woods Landing road, which is a graded road, the gravel can be observed, being finer near Laramie City. I observed a gravel pit about one hundred yards from the river near Laramie City and observed it at other places between that and Sheep Mountain. Any amount of gravel can be seen west of Mr. Grable's ranch, and east of Grable's ranch you will find it by Nelson's place, and east of that it gradually becomes less as you go towards Laramie City. I did notice that last summer fresh gravel had been hauled to the Woods Landing road, but I do not know how far they had hauled it.

2659 The excavation I saw in Laramie City was near the post office where steam pipes were being laid, and where gravel was noticeable. There is a difference between the soil in Laramie City and that on the west side of the river. On the east side of the river the red sandstone and shale formations are found. Coarse cement gravel is also found in Laramie City, but I do not know whether it is found on the east side of the river outside the city. I did not see any excavations of the same depth on the west side of the river, so cannot compare conditions. I do not know how

2660 much alfalfa may have been hauled from the fields upon the Hart ranch and how much of it was stacked. The acreage of 481 acres, including three patches on sections 21, 29 and 31, was, I believe, all cut over for the first cutting. I do not know about the second cutting. I did not measure any alfalfa on the south side of the river on the Hart ranch under the Hutton or Bilderback ditch. The formula I used for calculating the tonnage of hay in the stack was to take the width plus the over and one-fourth of that squared times the length and divided by 512. I think 512 is the

2661 number of cubic feet to a ton of alfalfa hay in the stack as commonly computed on the Laramie Plains. 422 cubic feet is used with native hay but so far as I know not with respect to alfalfa. I have no knowledge as to the method employed in measuring alfalfa on the Laramie Plains, and only know what Mr. Titus testified relative to the measurement of native hay. In measuring the native

hay on the above ranch I used 422 cubic feet instead of 512 in the same formula. The acreage of meadow land on that ranch as I have given was the acerage actually cut over in 1913. I know nothing about the custom of pasturing cattle on these meadows after the hay is taken off. I do not know whether any hay had been hauled away from the Bath meadow, but none of the stacks had been cut.

2662 The only alfala fields on the Hart ranch were as follows: On Section 14, 70 acres; on Section 21, 266.2 acres; on Section 22, 5.3 acres; on Section 27, 12.2 acres; on Section 29, 135 acres; on Section 31, 79.8 acres; on Section 34, 6.1 acres. The 70 acre tract in Section 14 was not entirely cut over, about half not being cut. The 35 acres cut produced approximately 30 tons in the first cutting. The only alfalfa land I found in Section 14 was 70 acres.

2664 In Exhibit 116 the collection of photographs showing, with a few exceptions, all of the buildings and improvements outside of Laramie City upon the Laramie Plains, I did not include the improvements on unirrigated lands. Pictures were taken of all improvements under the constructed ditches. Whether pictures were taken of improvements upon lands to be covered by the Stuart Ditch now under construction I do not know, as Mr. Woodhall took the pictures in that territory. The legend at the beginning of Exhibit 116 was prepared in the State Engineer's office, and not by me. My only purpose in taking the pictures was to secure a fair

2665 representation of the structures, buildings and surroundings, and in each case I attempted to procure the clearest and most representative picture. I did not take pictures Nos. 1, 5, 6 or 25. No. 9 may be a picture of premises belonging to C. W. Weber instead of J. Weber. It shows the first buildings below Woods Landing on the River. All I know about the building shown in No. 32, designated as vacant, is that nobody was there the day we took the

2666 picture, and the same is true with No. 35. Some of the pictures of buildings which we considered unimportant were taken at some little distance. This is true of Nos. 31, 32 and 37. No. 235 was taken from a road I do not believe 1,200 feet distant from the building shown. I do not believe that the building

2667 there shown cost as much as $2,500, but I did not examine the house from any near point. I would say that this picture No. 235 was a fair representation of the premises and improvements even though it was taken at a point which placed the half-acre alkali patch in the foreground and, as assumed by counsel for Wyoming, a highly productive market garden patch of 8 acres and a $2,500 house in the distance. It is true that in some cases, possibly 24 or 25, the pictures were taken at long range with uncultivated land in the foreground and the buildings far removed in the back-

2668 ground. Picture No. 118 showing the ranch of Cyrus Billip was taken from the road, perhaps a quarter of a mile from the house. The improvements consist of a good barn and a small white frame house. Mr. Billip is farming the whole section, and he has good buildings, but I would not consider them the best

2669 buildings in the valley. A better picture might have been taken of the buildings but it is a good picture of the whole place.

The legend (Note hog in the foreground, rarely seen on the Laramie Plains) placed on Picture No. 123 was not gotten up by me. It happened that this was the only picture we got of a hog. The legend relative to pictures 133 and 136 as follows: "Note: The pictures on this page show usual appearance of most of Pioneer and Fischer canal areas," was put on in the State Engineer's
2670 office, and it is true. I would not say that the land shown in these four pictures is fairly representative of the larger part of the irrigated area under the Pioneer Canal, but representative of the area under that canal in that particular vicinity from the Grable ranch through the bluff to the west. The land irrigated from the Fischer ditch is supposed to be shown in one of these pictures, but it is cloudy. All four of these pictures are poor prints. It is not apparent from the pictures that the land is irrigated although such is the fact. I did not take pictures numbered 145, 146, 147, 151, 154, 158, 167, or 176, and know nothing about the legends on them.

2672 I did not take picture No. 177 although I recall the water flowing onto the road as shown in this picture. I did not take picture 181, but I know that the potatoes were frostbitten on the night of July 30. I could not say, however, that they were killed, and do not know anything else about the frost damage at that place. I did not take pictures numbered 186, 191, 192, 193, 194, 195 or 196, and know nothing about the legends attached to them. I took picture No. 201 and the legends should show that the buildings were unoccupied. Somebody may have been using the ranch. I took picture No. 211, but am not responsible for that portion of the notation relative to the freezing of potatoes and the freezing of the ground. I believe Mr. Woodhall made up this notation. I took picture No. 215. By the notation on this picture note that the buildings were vacant, not that the ranch was not in use. I did not take pictures 224, 227, 229, 231 or 243. I did not take any of the pictures of headgates and diversion works upon the Little Laramie River, shown in Exhibit 115.

2674 Where our plane table survey covered only a part of a section we covered the balance of the section by reconnaissance and placed the whole section upon our maps, photographic copies of which are in Exhibit 114. In the plane table survey we used a plane table with a telescope instrument called an alidade, having a magnetic needle. We got our north and south lines from the section lines, sometimes setting up our table between the section lines, however. I do not know whether in any case any effort was made to establish an independent meridian by either solar or siderial observations. The classification of pasture lands where used in connection with the Big Laramie Valley was not intended to segregate unirrigated from irrigated lands, but upon the Little Laramie River
2675 it was. Upon the Big Laramie River irrigated pasture land had been classified as pasture land. The tabulation of acreages which I have made includes all land irrigated in 1913 above Two Rivers on the main stream, together with some on Sand Creek, Soldier Creek, and Willow Creek. I have not checked my descriptions with the plats in order to verify the acreage.

2676 On the Big Laramie River we did not attempt to differentiate between meadow land and irrigated pasture land, but on the Little Laramie River this was done. Ordinarily where a field was partly cut and partly pasture land we classified it as meadow land, but in some cases where the pasture portion consisted of sage brush which could not possibly be cut over, it was classified as pasture land. The sub-classification of meadow land was based upon my judgment and observation from what I saw on the land at the time. I believe that I was able to make this classification properly at the time of year the survey was made.

2677 By permanent diversion structures I mean concrete or masonry structures. Wooden structures are not permanent as they need frequent replacement, but they are as efficient as concrete structures so long as they last. I cannot say that there was any dam at the headgate of the King Ditch at any time during the year. There was none there when I examined it, but water was flowing into the ditch which is practically on a level with the river, so that without any dam water will at all seasons flow into the ditch. The Bush and Holliday Ditch had no dam and got no water in 1913. The result of having no diversion dam is to prevent the securing of water when the river is low, the water flowing down the river to other appropriators. The lack of a dam does not lead to a waste of water. There were not very many ditches upon the Big Laramie River which were unable to get water in 1913 or which were short in their supply, but I paid no particular attention to this latter feature. I at-

2678 tended the taking of evidence in this case at Laramie in August and September, 1913. I believe I was present pretty near all the time evidence was being taken. I was not investigating in the public offices at Cheyenne any time prior to November, 1913, and was not at Wheatland. About the end of August or the first part of September I spent a part of two or three days in the assessor's office at Laramie.

2679 I was in the same neighborhood as the party doing the plane table work practically all the time, and the first month or six weeks I was actually with the party. During this period they made a survey of the upper part of the valley, including the Riverside ranch and the lands as far north as the county road. I

2680 examined the country lying north of the county road myself, but made no survey of it. The field notes were made by Mr. Woodhall, and from them I made practically all of the computations of area. We did not work together in this matter. Each of us made some of the classifications, my classification covering the territory from a point near the east boundary of Range 75 through the Riverside ranch.

2681 I had nothing to do with the actual drawing of the plats from which the photographs were taken, Mr. Woodhall making the rough draft and the draftsman completing this work. Some of the legends upon the photographs were made by me and some about which you have inquired were not. At the time the photographs were taken I made a memorandum of the number, the date, the location, and whether the house or building was vacant. I do

not believe that I could find this memorandum now and I have no copy of it.

2682 With reference to Section 1 shown upon Sheet No. 6 of the plane table survey, the lands lying north of the original King Ditch are designated as pasture land. They are under the ditch, but whether irrigated or not I do not know, and the designation is not intended to show anything with reference to the fact of irrigation. Upon those plats relative to the lands upon the Little Laramie River, however, I believe that where the pasture land is irrigated it is designated as "irrigated pasture." With respect to the lands upon the Big Laramie River, however, the term "pasture" gives no indication of the land relative to whether the same is irrigated.

2683 The 27 acre area south of the King Ditch designated as "old plowed ground" was broken up but was not in crop in 1913. The tract to the south designated "pasture--greasewood" had tall greasewood upon it, and so far as I know neither this tract nor that designated "old plowed ground" were irrigated from the King Highline Ditch in 1913, nor rom any other source. I visited this place only once, in June or the first part of July.

Section 6, shown upon the same sheet No. 6, is all pasture land with more or less greasewood upon it, and is all of the same

2684 general character. Part of the section was under the King Ditch, but I do not know whether any of it was irrigated in 1913. I made but the one visit to this section also. The same statement is true relative to Section 5 shown on the same sheet, which is likewise pasture land covered with greasewood, and I do not know whether any of it was irrigated in 1913.

Section 34 shown upon sheet 3 of the plane table survey consists of about three-quarters of meadow land and about one quarter of pasture land, the meadow land being that which was cut over for hay. Mr. Woodhall can testify better than I relative to

2685 the classification of the land in this section. I cannot state how much if any of the section was irrigated in 1913. Five hundred acres of the land in Section 35 shown on the same sheet No. 3 is meadow land, and the balance is pasture land. The determination of the particular area in each classification was made by Mr. Woodhall. I have been on the land more than once only as I have travelled along the road through it. I do not know how much of it was irrigated in 1913 or any prior year. My knowledge with respect to the classification and character of the lands in the Riverside ranch shown upon the plane table survey sheets is similar to my knowledge of the sections already referred to. The land in Section 22 marked in the name of E. A. Watson and lying north of the county road and shown on Sheet 2 of the plane table survey, was examined by me but not surveyed by the party, and I furnished the information upon which the map was made. I did not

2687 measure or step off the various distances, and had no instrument, but merely estimated the various acreages from the land lines and was only over that part of the land east of the ditch.

The ditch marked "Pioneer Ditch Lateral" crossing the county road three times in Section 28, does not stop on the point indicated on the plat, but runs to the northeast some place. I do not know how far it extends or whether the Watson land is irrigated from it, nor whether it extends down into Section 18 shown on Sheet
2688 No. 4 of the plane table survey, although there is a lateral upon that land. I furnished the data upon which that part of the area shown on Sheet No. 4 lying north of the county road was mapped. I obtained my information relative to Section 18 in this area from Mr. Havenek and Mr. Larsen, the owners of the land, who gave me the acreages. I did not go over the land which
2689 can be seen from the road. In a general way my information relative to all of the land north of the county road which is not included in the plane table survey was gained in the same way as my information relative to the sections already discussed and was intended as an approximation, only. I gave Wyoming the benefit of the doubt and I think my figures are a little higher than those of Mr. Meeker.

Cross-examination by Mr. John D. Clark:

I was able to tell from my examination whether the land had been irrigated for a number of years or had been placed under irrigation within recent years, and found that some areas were brought under irrigation recently. I could see that the area under irrigation was being increased a little, as there is always a gradual extension of irrigation. I am not familiar enough with that area to state whether the increase is more rapid than in other areas or not. There are lands lying under the constructed ditches which have not yet been irrigated, and I believe this is true of all of the ditches examined by me. Most of the bottom land has been irrigated, but there are extensive areas lying under the ditches on the higher benches which have not been irrigated as yet. I would not attempt to estimate how extensive an area of the lands lying under the constructed ditches have not yet been irrigated it is a very considerable amount. There are also lands which may be irrigated from these same ditches through the extension of them, as is true in almost any irrigated country. As is also true in any irrigated country I observed that there had been extensions from time to time of various ditches since their original construction.

Most of the ditches which I examined along the Big Laramie River are river bottom ditches as distinguished from high line ditches. The Pioneer Canal probably carries water to the
2691 most distant point from the river and this is probably six or eight miles, and the water is not carried over any minor watersheds by any of the ditches. Aside from the Pioneer Canal the King High Line, the Fischer, the Last Chance and the Parker ditches, all of the ditches from the river are river bottom ditches and most of them are only a few miles in length. I was never in the Wheatland area and so far as I gnow the State of Colorado has made no survey or reconnaissance of the lands in that district.

2691 Redirect examination by Mr. Fred Farrar:

Whether or not wooden structures are as permanent as those I have described, depends upon conditions and the way they are constructed. Some of wooden structures I found on Laramie river and which are shown in photographs, Exhibit 115, are as efficient as concrete. I refer to those in good repair. Some of them are not in good repair. Photographs show condition fairly well.

Lack of diversion works prompts people to complain of shortage when they could have obtained water simply by putting in diversion dam. Lack of proper diversion works might result in water passing ditch and whether or not it was wasted would depend upon circumstances below.

Photographs contained in Exhibit 116 were designed solely to show improvements and character of country, vegetation or lack of vegetation and verdure or lack of verdure. If in taking a
2693 picture a house is shown in background, it was not intended to slight that house.

In one or two instances, concerning which I was cross-examined, I testified to having made reconnaissance to north of county road running up and down Laramie Valley southwesterly from Laramie. Reason for reconnaissance was that plane table survey ended at the road, so far as particular plats concerning which I was interrogated is concerned. I filled out parts of sections above road by personal reconnaissance. Where section lines are truly defined and also subdivisions, you can make fairly accurate visual survey of the country, and determine matters with fair accuracy. That is the sort of survey Mr. Ralph I. Meeker, witness for Wyoming, made in this case. He made it much faster. He went by automobile. I find that I gave a little higher acreage in crops than he did. I was liberal. I gave Wyoming the benefit of the doubt in every case.

I assumed that officials of Wyoming exercised some care and accuracy in laying out the land and therefore did not determine original solar meridians. If Wyoming surveys are at fault, it may be that some of my surveys are a little bit off. Titles to pictures were made under general information gathered by me. I vouch for titles of these pictures of the originals where I have knowledge of field covered by photographs. I did not take all of photographs. Mr. Woodhall took a few.

There is considerable land under the Pioneer Canal which was not irrigated. Most of land under river bottom ditches has been irrigated. If Pioneer Canal was constructed in 1879, there has been opportunity for irrigation of those lands since that date. When I stated that all the canals except King High Line, Fischer, Parker and Pioneer, and possibly one or two others, are bottom ditcher, I did not include the new ditches now under construction leading from
2695 Lake Hattie and Lake James, and the like, I had in mind ditches to which I had testified that were on river bottom.

Water from Big Laramie River, taken out by Pioneer Ditch or Lake Hattie Inlet, is taken out of Lake Hattie and carried around over intervening divide and dumped into Big Basin on Little Lara-

mie River drainage. I understand Stewart Canal is surveyed and to be constructed for bringing of water from Little Laramie River over intervening divide and into Big Laramie River side. It is not as yet constructed. Am not familiar with Bellamy and Lobac Canals. In referring to the taking of water from Lake Hattie and discharging it into Big Basin, I referred to use of North Canal of Lake Hattie System.

Attention is called to legend on front of album, Exhibit 115, "This album should be considered in connection with testimony of Emmett C. McAnelly and George P. Woodhall". "It contains photographs taken during summer and autumn of 1913, by above named engineers, and contains photographs of most of diversion works used for diversion of water from Big Laramie and Little Laramie Rivers in Wyoming."

2696 "It is intended to illustrate the character of the structures used at heads of canals on above streams, and also their adaptability for purposes constructed, as well as care or lack of care in use."

"Particular attention is called to primitive character of all except the most recent structures.

"Photos appear of all principal diversions works. Only small and insignificant diversions works have been omitted, and particular attention was given to obtaining photographs of best works on streams."

"Owing to the fact that a number of diversions by small ditches (especially on Little Laramie) were concealed by grass and underbrush, it was impossible to obtain photographs showing condition of structures. However, photographs of the structures that are visible, are representative of those that are omitted."

This legend is correct statement so far as it contains the statement of facts.

The following legend appearing at the beginning of album, Defendants' Exhibit 116, containing pictures of ranches and improvements on Laramie Plains region:—

"This album is to be considered in connection with the testimony of Emmett C. McAnnelly, and Geo. C. Woodhall.

"It contains (with but few exceptions) photographs of all of the ranch and other buildings and improvements (exclusive of Laramie) on the Laramie Plains region of both the Big Laramie and Little Laramie Rivers in Wyoming, above their junction at Two Rivers, and all buildings below Two Rivers for six miles."

2697 "The photos also show the general uncultivated conditions of the lands of both valleys, most of which are used for grazing or growing native hay."

"Photos are arranged by government subdivisions, rather than by stream areas, and may be located by referring to annexed map."

"Several photos of the same ranch appear in a number of instances, notably:—Photos No. 193,4-5-6 and 7, the Perigal Ranch, and Nos. 199-203-7 and 8, the Hart Ranch."

"Date on which each photo was taken appears on bottom. Numbers refer to plat and are for better identification."

"The photos were taken by Emmert C. McAnelly, Deputy State

Engineer of Colorado, and George P. Woodhall, Colorado Georgrapher, during progress of their detailed surveys and observations on the Laramie Plains of Wyoming, in summers and autumn of 1913. Attention is particularly called to the character of the soil, vegetation and improvements on each picture, also general absence of trees, unhomelike character of improvements and their similarity to improvements general in stock-raising countries, where little effort is made towards establishing permanent and attractive homes."

"Compare this album with those of conditions under the Larimer County Canal and the Larimer and Weld Canal (Eaton Ditch in Larimer and Weld counties, in Colorado)".

That legend, so far as it purports to be statement of facts, is true.

In response to questions directed to me on cross-examination tending toward inference that I was not in complete touch with survey made by my party, would state that the survey was made
2698 under my direction. The making of investigations and general supervision of all the work was in my charge. Everything was done under my personal direction. At times I had 6 or 7 men in my party. In making plane table survey, one man operates instrument. We had three rod men in field. Rest of men are scattered at various points desired in making the observations. Men may be scattered out over radius of ½ to ¾ of mile. Instrument man sends out rod men. He sends them to different points. He trains instrument and makes his readings on rods at these different points. From these readings and directions, he makes his plat right in field.

Concerning question referring to county road running up and down Laramie Valley as being turn-pike, will say, that I have always understood that turn-pike road was an macadam road. This road is not macadamized. I took counsel to mean a graded road. It was natural material. This road had excavations on each side with materials thrown up in center. This was true for part of way. At other places it was not true. It was crowned at places with nat-
2699 ural material. It is graded for probably 12 or 13 miles west of Laramie and then in patches from there up. My survey covered about 60 linear miles on both streams. There are not many of these graded roads on Laramie Plains, aside from this one. The roads are such they don't need much grading, owing to natural road material. It is a gravel formation.

Houses and improvements represent in album, Defendants' Exhibit 116, except in district immediately adjoining Laramie on the West, are from ½ mile to 3 miles apart in places. These improvements are not close together except in vicinity of Laramie. It is a fact that traveling along main highways in Laramie Plains, with exception of country lying along river above city of Laramie, one may go for miles at times without passing a house. There is none of improved district more than three or four miles from main road, except on high bench land. There are very few houses on that. On the road
2700 from Laramie to Two Rivers, on the west side, it is about three or four miles between houses. These plats, so far as I know, show location of houses correctly. They do on area surveyed. The

map in front of Exhibit 116 shows houses by numbers on map and with reference to number of pictures.

2700 Recross-examination by Mr. N. E. Corthell:

The radius worked over by the rodmen in open country was not to exceed three quarters of a mile from the instrument, and they did not work often to that distance while I was present. I could
2701 not say what the average distance at which they worked was. The wind interfered considerably with our work, but in spite of adverse conditions we succeeded in completing that work shown on the plats. I could not say how much time we lost on that account. In a country where the wind blows almost constantly, and is cold and chilly, it is rather difficult to do this kind of work.

2701 Redirect examination by Mr. Fred Farrar:

Mr. Farrar: I desire to assure counsel for Wyoming that these pictures, so far as could be done, were taken with every degree of fairness. You will understand that cost of this survey and making pictures, all of which was done, as far — field work was concerned, in enemy's country, was quite a task and I was unable to afford expense of sending professional photographer with party. Any imperfections in pictures are due not to any intent but to fact that persons who took them were engineers and not professional photographers.

2702 Witness continuing: Map in Exhibit 116, upon which number of pictures appear, is U. S. Geological Survey Topographical Sheet. On this topographical sheet houses are represented by small dots. Houses as represented on this map, as prepared for U. S. Geological survey, are fairly correct. They are houses that were there at that time, that is, in 1908, when map was made. I found houses there that are not noted on map. I have photographs of them.

GEORGE P. WOODHALL.

2703 Direct examination by Mr. Delph E. Carpenter:

Associated with State Engineer of Colorado at Denver. Civil engineer. Graduate of University of Missouri, department of engineering. Have Bachelor of Science degree and degrees in mining engineering and metallurgy. Engaged in practice of profession continuously from time graduated thirteen years ago. I worked with Edwin E. Baker, an irrigation engineer at Greeley, Colorado, before graduating from school. His specialty is irrigation work. He devotes his time exclusively to that branch. Received part of my education in Greeley, attending school in that city. I was
2704 identified in engineering capacity with Lost River project in Idaho and also with project with the Minidoka and Southwestern Railroad in Idaho. Was assistant engineer with Harriman

lines for five years, having headquarters in Salt Lake City. During that time came constantly in contact with irrigation engineering and construction. Was employed specifically to handle that end of the work, being sent out on investigations on irrigation projects and reported to chief engineer at Salt Lake and my reports to him were transmitted to General Manager Bancroft and to John Krutchnitt, Traffic Manager of all Harriman Lines. Object of reports was to consider advisibility of building feeders or branch lines of railroad and whether or not same were warranted. During that time did a great deal of work in reconnaissance. On all projects on which reports were made, it was necessary to make estimate of cost and the returns that would accrue to road in next 5 or 10 years in matter of freight. Went also into possible passenger traffic. I had occasion to travel over states of Idaho and Montana. This engineering department embraced territory of Nevada, Utah, Idaho, part of Oregon (Cascade Range) also Montana and Wyoming as far east as Green River. In this connection I traveled over country and visited practically every irigation project in that territory.

During 1913 was identified with plane table survey in this case, being in field during entire summer, starting in May and ending in December. Was engaged in Laramie Plains area from Woods Landing down stream along Big Laramie River to point east of Bosler, and on Little Laramie River from Fillmore Station to Two Rivers, Wyoming. It is about 50 miles from Woods Landing down to Bosler. It is about 25 miles from Fillmore to Two Rivers.

2705 Emmet C. McAnelly was my immediate chief. From time to time I took instructions directly from state engineer of Colorado. My instructions were very brief. I was told to go out and get actual conditions as they existed. I was told to map the work by plane table. Mr. McAnelly was with me continuously for a few weeks and after that he was with me from time to time.

2706 I did all plane table work that was done on survey and at same time took notes and observations with regard to crops and various physical characteristics that were evident on the ground. I observed irrigation systems generally as one of physical characteristics. Observed system of diversion and use of water on both Big and Little Laramie Rivers for irrigation. Not all the plane table work done by me was compiled in map form. Work on uper portion of Little Laramie Valley from Alsop ranch upward was platted.

2707 Defendants' Exhibit 114 represents all plane table work on Big Laramie River Valley and on Little Laramie Valley as far as it was mapped. It goes to Alsop ranch and includes the same. This shows all general physical structures that appear in this territory and also nature of crops and grasses grown. Elevations were taken only in connection with Government elevations previously established by United States Geological Survey. In most cases these elevations are noted on sheets. Each table sheet includes 6 sections of land and there are 39 sheets in all.

Survey party consisted of 7 members. There were 3, sometimes 4, rodmen working from instrument. There was a draftsman, a

cook, an instrument man and chief of the party. We kept full camp equipment in field. Established our camps where it was most convenient for work, living in tents. We had team and wagon to go to and from work. Main difficulty encountered in surveying was prevalence of strong winds that sweep over that region. There were several instances where it was necessary to give up work for day on account of strong wind that was blowing. This was true during months of June and July, when wind was stronger than *on* August. June is really spring in that area, especially in upper end of plains; snow is leaving ground; grass is starting to grow. It was noticeable that when days were quiet amount of work accomplished by party was nearly double. Wind prevailed at least three-fourths of time while we were there. Just before going to work on Laramie Plains was engaged in work in vicinity of Denver, and then we went up there and established a camp and the first two weeks cold was very noticeable between the two localities. Wind came from snow fields on Continental Divide of Rocky Mountains, of which Medicine Bow Range is part. Prevailing winds were always from these snow mountains and very chilly.

2710 After plotting Bosler sheet took party and worked on Little Laramie River. Closed full party work middle of September. After that time we ran plane table up valley as far as Fillmore, using one instrument man and one rod man. Did not presume to map this last area. Did make survey of all land included in that valley under irrigation by accurate measurements. None of it was estimated.

Did not attempt to plat town of Laramie on our Sheet No. 22. The only indication appearing on that sheet is circle showing location of town.

On Sheet 3 of Exhibit 114 Caldwell Lake, body of water of approximately 160 acres of water surface, was omitted from the plat. It is on southerly part of Hoge and Haley Ditch area, and should appear in Sec. 27, Tp. 14 N. R. 75 W. It was surveyed with plane table in connection with the rest of survey and simply omitted on transferring from original sheet to tracing. It was error of

2711 draughtsman. In this survey the area covered by ditches, rivers and small ponds was not deducted from the acreage classified but *were* considered as a part of them. Several small ponds do not apear on the sheets, particularly so near the Riverside gate where there were two ponds. There are various other ponds down through entire area similar in extent to those on Riverside ranch which are not shown on the sheets.

2712 Classification of native hay and meadow lands, Exhibit 114, is as follows: First class meadows are those that will cut ½ ton of native hay per acre or better; second class meadows are those that will cut less than ½ ton of hay per acre, and third class meadows are those that show better than natural growth of grass, but not cut for hay.

I have been present during some of the testimony in this case. Have heard counsel for plaintiff and others classify lands as irrigated

pasturage. Third class meadows on my sheets are same as irrigated pasturage.

Little Laramie River has same classification as Big Laramie River, with exception of third class meadow. On Little Laramie third class meadow has been designated as irrigated pasture. This change of designation for this classification of irrigated meadow was due to the fact that Wyoming was so classifying their lands, and Colorado wished to have uniform classification prevail.

2713 Third class meadow on sheets 1 to 39 inclusive of Exhibit 114, is synonomous with irrigated pasture.

We did not detail, survey work of irrigated lands on Sand Creek other than that noted on Sheets 8, 9, 11, 12, 13 and 17 of Exhibit 114. There was no attempt to determine acreage irrigated on Soldier Creek, but on Five Mile Creek there is included certain amount of irrigated land as indicated by Sheet No. 20, covering lower extremity of that stream.

Various crops and native hay growing on land covered by plane table survey are illustrated on sheets of Exhibit 114 by means of symbols. Such is also the case with certain physical structures, such as telephone lines, fences and buildings. Specific symbols used are those for township, section and subdivision lines, barbed wire fences and pole fences, telephone lines, grain, alfalfa, potatoes, plowed ground, meadow land, pasture land, grease-wood, bluffs, trees and roads. Grain is included under one symbol, but individual sheets show kind of grain cultivated. For example, field of oats will be noted by symbol for grain and word "oats." Same is true of other grain. Meadow land is indicated by meadow land symbol and then classification is placed in each tract. Pasture land has a symbol of its own. It is same as grazing land and indicates land with natural growth of grass. In some places pasture land was in fact included in meadows, although not noted on sheets. It occurs largely in the third-class meadows or in irrigated pasturage. What I designate on the sheets as pasture land was unirrigated.

As a matter of additional notation, there appears for example on Sheet No. 5 of Exhibit 114 field wherein grain is not only designated but also the height of the grain, and the date. The oat field designated on Section 31 on Sheet No. 5 of Exhibit 114, designation is "oats 12 inches high on June 26, 1913." For further illustration on Sheet No. 11 of Exhibit 114, the alfalfa notation appearing in the northern portion of Section 31 reads, "Alfalfa—first cutting off, second cutting three inches high on July 23, 1913." Throughout these sheets, similar notations were made from time to time concerning crop conditions ascertained as we were passing along. These observations and details were noted by me.

Names of various owners appearing on sheets on Exhibit 114, were learned during the time of the survey. We were in community of our opponents and before making surveys of any tract we went to house or ranch closest to land and asked permission to run the survey over it, and in connection with that we inquired names and obtained other information from parties at various houses. We were refused permission to enter some premises, for illustration, man in

charge of Riverside Ranch refused permission to enter that property and the survey party was held up some little time on account of refusal. It was finally found necessary to take matter up with company controlling the property and obtain permission from headquarters at Denver before we could make the survey. This was done by long distance phone through State Engineer, Mr. John E. Field, at Denver.

We note topography on these sheets to some degree by our symbol for bluffs. Also by dotted lines for edges of distinct bluffs bordering table lands. For example, on Sheet 4, Exhibit 114, line of short dashes, entitled "edge of bluff" indicates point where in this specific sheet meadow lands end as shown on plat. Rise of land thus indicated on Sheet 4, is the rise of land of the bench along the main travelled road between Laramie City and Woods Landing. On same sheet main traveled road is indicated by double dash line and fence on each side of it. Telephone line is shown on north and west side of road and indicated by symbols explained on index sheet.

Where tract is indicated as covered by grease-wood I refer to a tough, woody plant, a good deal after the order of sage brush, only more fibrous, and tougher. Grease-wood has a greater growth than sage brush. It usually thrives upon alkali soil and is on a clay base. Grease-wood land is not regarded as agricultural land. The largest areas of grease-wood land observed on the survey were on the southwest side of Laramie River in neighborhood of Riverside Home Ranch, above mouth of Sand Creek. Country on which grease-wood grows is all more or less of a pitted character. Winds blow the dirt in the space between the roots of the grease-wood and form hummocks. Grease-wood continually growing out of soil drifted around base forms pits and sometimes as deep as four feet, and five or six feet wide between the hummocks. This was particularly called to my attention in hunting section corners on the southeast side of Laramie River in the neighborhood of Riverside Ranch. These greasewood lands observed on this ranch would not be classified as irrigated lands in any sense of the term. They are not capable of being irrigated without being grubbed and leveled off on account of pits and hummocks that are characteristic of the surface in the locality mentioned. We nevertheless gave plaintiff benefit of many of these grease-wood hummocks occurring in the meadow lands without noting and deducting them on plats. Small areas such as 8 or 10 acres, one piece occurring in a section or quarter section, was not specifically noted but was included in the meadow lands.

These small areas are not in the general grease-wood area.

2718 Places where the grease-wood symbol appears indicates that the predominating feature is grease-wood and is not irrigated land. Sheet 6, Exhibit 114 shows one of the grease-wood areas.

The grease-wood bush or shrub grows as tall as a man. It has tough fibrous growth, similar to the growth of the gooseberry or raspberry or currant bush, but the wood is tougher and stems are thicker. It is not a plant that the mowing machine can cut. It would take a hatchet to cut those grease-wood stems. The greater portion of the area shown on Sheet 6 is designated as grease-wood

land, because this land is entirely covered with grease-wood. This land is pitted with little wind pits between the shrubbery as I have described. It is not agricultural land and could not be used
2720 for agricultural purposes. Throughout Exhibit 114, wherever we have desired to designate an item for which we have no symbol, we used words.

Acreage noted on plats in Exhibit 114 were ascertained by accurate survey. They are the true acreages. Where land is designated as plowed, it means that the ground was turned over in the place designated. It was not in crop. Most of the acreage appearing on the plats of Exhibit 114 is of land that has not been turned over or plowed.

Notation "Fox Tail Meadow" appearing on Sheet 19, containing index to plats of Wyoming Experiment Station, indicates that the meadow was covered with fox tail grass. It resembles barley
2721 its growth is not as high as barley. *Its growth is not as high as barley.* It is not good for hay. Fox tail gets into the jaws of the stock, and if fed continuously will cause ulceration and stock will not eat it. My estimate of the acreage nevertheless gave Wyoming the benefit of fox tail meadows as irrigated agricultural land. It is included as meadow. Unless fox tail was most predominating feature in meadows, it was not mentioned. There are a good many meadows that have fox tail where no notation is made of it on plats.

A number of sheets show lands lying apparently beyond limits of actual plane table survey. For illustration: sheet 24 where Sections 31, 6 and 33 are all designated as "All this section is pasture." I ran over the ground with my instruments. The physical feature was that all of the ground was in pasture on bench lands. Survey was not as accurate as rest of survey next to railroad in this specific sheet. It refers to lands that are grazing and not irrigated
2722 by artificial means. That is not same character of grazing lands prevailing throughout arid region of west: Growth on these bench lands is more sparse than at lower altitude. Grazing land in Weld County, Colorado, has nearly 50% more vegetation than would be case on Laramie Plains region. Lower elevations are generally marked by more luxuriant growth of grass. Where elevation in Weld County, Colorado, is same as Laramie Plains, growth would be practically same. Bench lands above irrigation between Big and Little Laramie Rivers is not shown on sheets. That is arid pasture land, ordinary grazing land. It never has been
2723 irrigated.

The plane table survey extended up to county road on north side of Big Laramie River from point of beginning to range line between ranges 74 and 75, then extending north, covering all irrigated area under ditch from that point down river. Above that point there are irrigated lands north of county road that are not on sheets. Mr. McAnelly checked that land. I did not cover that work. That is the land referred to. That is the land referred to as covered by reconnoissance by McAnelly in his testimony. It was

strip about 2 or 2½ miles wide, parallel to Big Laramie River, above plane table survey, extending from Sodergreens Lake and toe of Sheep Mountain easterly to range line between Ranges 74 and 75 West. About 12 miles. Not much of that area can be considered as irrigated west of Sodergreens Lake. I have been over ground but never made any estimate of average there. Sodergreens Lake is north of county road in Township 14, N. R. 76 W., and is in portion of sections 21 and 28. It is point where Lake Hattie Inlet leaves line of Pioneer Ditch and runs westerly into Lake Hattie. Outside of area described, north of county road, we covered all irrigated lands on Laramie River lying below Sodergreen's and above Two Rivers on west side of stream. Survey extends all over lands that were irrigated from Big Laramie on south and east sides and also included some lands irrigated from Sand Creek. We covered
all lands irrigated by diversions from Big Laramie River,
2725 taking water on the south and east side of stream. From
this survey will be able to give acreage of all irrigated lands under each canal taking water from Big Laramie below Sodergreen's ranch. Acreage of land covered by McAnelly reconnoissance is practically the same acreage as that obtained by Wyoming engineer, and by adding that the total acreage in valley can be ascertained in connection with plane table acreage. I refer to figures already given by Engineer R. I. Meeker as well as those furnished by McAnelly.

Made photographs during survey. Taken during progress of work from day to day, and all conditions, both favorable and adverse. Defendants' Exhibit 115 contains some photographs made by me. I made major portion of pictures taken from Hart ranch down stream on Big Laramie and all the photographs taken on Little Laramie. Little Laramie photographs appearing in fore part of album, represent diversion works in Little Laramie Valley and includes all diversion works of any magnitude and a great part of the smaller ditches but not all of them. The little ditches have no headgates, and many of them are simply gashes in river bank of a narrow width and short length, and observer who did not know these were called ditches would be unable to ascertain whether it was an outlet or an inlet from river, or whether portions were return channels for flood waters from meadows. They were not dignified by headgates. I was unable to tell in many cases where the heads of the smaller ditches were. In connection with taking these pictures on Little Laramie River, I had as a matter of information, a map compiled by the Department of Agriculture at Washington, which purported to show all ditches with water rights from Laramie River and I used this in determining where ditches were located and even with the aid of this map it was hard to tell sometimes. These gashes in river bank were of such a number that it was impossible to tell whether they were to let water into or out of the river, unless water was actually running at the time. I did take photographs of all substantial, visible diversion works on Little Laramie as far as I
could observe them. I obtained photographs of all good
2727 diversion works on that stream. Purpose was to get pictures
of all headgates on Little Laramie River that could be found,

and this purpose was followed in taking these photographs. If any are missing, they are insignificant and those that I did take are better than typical conditions of these poorer diversions.

Majority of pictures I took on Big Laramie were below Hart ranch. I obtained photographs of all diversions works of all ditches taking water from river below Hart ranch. Became familiar with diversion works between Hart Ranch and Sodergreen's Ranch on the Big Laramie during time was making survey. Photographs of these works appear in Album Exhibit 115. I believe every one of diversion works on Big Laramie River is in album because any that did not come out well a special trip was made back to get the picture. At least all better ones appear.

2728 Part of photographs appearing in Exhibit 116 were taken by me; those below Hart Ranch on Big Laramie and those on Little Laramie I took photographs of all of buildings and improvements on Little Laramie area. This album does not contain photographs of every set of buildings and improvements on irrigated area in Little Laramie below Filmore. There are six groups missing. They were taken but the weather was unfavorable, the pictures being taken during snowstorms that lasted between two and three days. Storms in nature of little snow flurries, and photographs that are missing are of same character as those that are shown. Missing photographs are those of Joe Clark Ranch on Bell Estate, and Knudson's place, and the Irwin Ranch. Photographs appear in Exhibit 116 of all buildings and improvements on all property on Big Laramie River below Hart Ranch. I don't know that there are any missing views above Hart Ranch. My understanding is that every picture of improvements on Big Laramie River from time survey was started until it was finished was included in this album. I

2729 heard Mr. McAnelly's statement that he thought some of photographs were missing, but I went back after Mr. McAnelly had been there and took some more pictures. For all practical purposes Album 116 includes pictures of all buildings and improvements on irrigated areas of both Big and Little Laramie Rivers in Laramie Plains Region, down as far as the immediate vicinity of Bosler. Legends on these pictures were from knowledge obtained from actual inquiry while on survey. Made notes of information in engineering field book and saw Mr. McAnelly's notes with relation to pictures he took. Legends written below photographs in Exhibit 116 were written under my personal supervision. Also legend appearing on title page of album and the reading matter thereon. Same is true with relation to Exhibit 115. The lead pencil memorandum made by Mr. McAnelly in connection with these photographs, which was requested by counsel for plaintiff yesterday, was turned over to me in making the legends on various pictures and after I was through with — I put it into the waste basket. I suppose it went down where all waste paper goes. Legends under all

2730 pictures taken by Mr. McAnelly contain all information noted on these lead pencil pages. There was no picking out or curtailing of legends in the original notes. In some instances there appear some special designations in legends in addition to

matter contained in McAnelly notes. I have examined both of these albums after they were completed after legends were copied, and all statements contained within these albums are true to my knowledge. Title pages and legends in albums, Exhibits 115 and 116 were written in white ink under my surpervision by members of State Engineer's office of Colorado.

In taking photographs appearing in Exhibit 116, in addition to photographing mere improvements or buildings, pictures were taken with idea of showing surrounding physical features.
2731 Wherever photographs were taken, notation of date and other data was made.

Maps appearing on Exhibit- 115 and 116 were prepared in same manner as album under my personal direction. I used United States Geological Survey Topographic Sheet for territory embraced in the pictures.

These numbers indicate correctly location of various pictures appearing in each of these exhibits. One looking at photographs in either of these albums, Exhibit 115 or 116, cannot only ascertain location of scenes depicted in photograph by memoranda beneath picture, but also by referring to these maps in front of albums can obtain location by corresponding numbers appearing on map.
2732 Several duplications will be found in Exhibit 116 as noted in legend. Duplications are on better ranches from fact that better ranches have more buildings than poorer ranches, and in order to show them clearly we put on more than one picture. Album 116 conveys to mind a fair illustration of conditions appearing on Big and Little Laramie regions, when taken in conjunction with plane table plats. Everything is there. If there are missing numbers they are insignificant. In album Exhibit 115, number of photographs appear to have been taken when snow was on ground, for reason that last work was done in that locality when ground was covered with snow. Pictures were taken during tour down the river for that purpose. Taking of these photographs was delayed owing
2733 to fact that supply of films for kodak was entirely exhausted at Laramie.

While I was in Laramie Valley making this plane table survey and carrying on observations, noticed methods of irrigation practiced in that locality. Irrigation employed on meadows was by means of flooding Meadows are more or less cut up with sloughs and ground is, to certain extent, filled with small pockets Middle strip of Little Laramie Valley between its channels is full of knolls of quite an elevation. This is true to a lesser extent of all bottoms in both Valleys. There are knolls in meadows that are higher than surrounding ground. Water is turned on meadows in one large body and allowed to spread itself out in fan shape. Water floods all ground wherever it is turned out of ditch and extends possibly a quarter of a mile down stream over meadows where it is again collected by means of some little obstruction and again diverted in same way. This is continued on down valley. Result is that practically all water in whole ditch is utilized as a body of water and flows over ground. It is picked up at stated intervals and goes through same operation.

Little Laramie River is made up of several channels below Fil-
more Station. These channels are utilized in the flooding process
and take place of ditches. It is fact that during irrigation of hay
meadows the water of the Little Laramie is spread out over
2734 the whole valley. They put in manure dams with a few poles
and check flow of stream, flooding each side of obstruction.
The same is true in a measure of the methods of distribution of water
on Big Laramie. There are few men, appparently, engaged in water
distribution. At time I was at Riverside Ranch, which was during
the active irrigation for meadows, they stated that they had two
men on ranch looking after water, and this is a very extensive ranch.
There is no supervision of water after it comes out of ditches and is
spread over meadow. So depressions throughout these large areas
hold the water and it appears like whole valley is filled with water
with connecting necks of land between water surfaces.

Most of ditches on both Big and Little Laramie Rivers
2735 are so constructed that the bottom of the ditch is above the
level of the bottom of the river. The specific example I
have in mind is the Boughton Ditch. Inlet to Lake Hattie and
head works of the Pioneer Canal are so constructed they can divert
all of water in stream. They have dam that raises elevation of river
to elevation of ditch to get water. Is a good structure. Consequence
in times of low water in river, where ditches are of the higher or
two-story construction is that water cannot be taken down through
the ditches because it cannot be diverted. It would not be surprising,
in such a case, if one having land along these canals imagined that
he had a shortage of water. If they build the ditches so they are
above the water in the river they surely can't get water through
them. As another example of these high water ditches, I recall
the Bush and Holliday Ditch, owned entirely by Mr. Rick-
2736 ard. I was camped at his place. The level of the ditch was
above the level of the river, in the neighborhood of four or
five feet, and in 1913, bank was washed away in front of it, and
there was no adequate means in that year to take water down. He
made no effort to remedy ditch during season of 1913 up to time I
left, and that was more than half way through irrigation season.
It would not be surprising Mr. Rickard imagined he had a short-
age of water, under those conditions.

Biddick Canal is a little worse than Bush and Holliday Canal.
It was impossible to see the water above it as you stood below and
down stream. It would not be surprising if Mr. Biddick was unable
to get water in this ditch with such a structure or lack of struc-
ture.

2737 Method of diverting large quantities of water and turning
it loose on meadows is only practice used for meadow lands
in either Big or Little Laramie Valleys. If all water is taken out of
stream by man higher up the stream and turned out over his place,
consequence is that man down near mouth of stream in lower part
of valley has to wait his turn before waters get to him. It is not
surprising if he finds himself short of water under such conditions.
There is a great waste above.

I had conversation with Mr. Grant who was supervising water in 1913. He was Water Commissioner. I had interviews with residents of valley to ascertain what supervision had been maintained over water from these streams by state officials during previous years. There had not been any distribution of water, everybody took what they wanted and that is the case there today. I refer especially to these meadow lands. Every man had a little ditch out of the river, took all the water he wanted out of the ditch, all it would carry, and the rest went down the river.

2738 Water is put on meadows and run continuously until just before time to cut hay, when it is taken off, and after drying cutting progresses. The meadows are in condition of mire prior to time they are dried off. To take specific instance, I attempted to go by horseback over to Sand Creek bottom from Hutton Lake to Rickard's Ranch, where our camp was, and horse got mired and I could not get through. Had to turn around and make a detour of seven miles to point where Sand Creek flows into Laramie River and then go up on bench land to north of Laramie River to camp. A team attempted to cross valley in lower part of Riverside Ranch and they could not get across. Ground was of such consistency that it would not hold up weight of team and wagon. That condition prevailed throughout meadow regions or rivers bottoms. In irrigation of these meadow lands, practice seems to be for every man to take all the water he wants through his canal, run it continuously, and as long as he wants to, and let it take care of itself in the matter of distribution.

2739 Supervision of distribution of water is much closer in Cache la Poudre Valley. In this region there would be large number of men on an area the same size as Riverside to look after water, and to distribute it. In Cache la Poudre Valley they have more laterals and they don't flood whole valley from one end to other. They distribute water from laterals. Men stay with water and aid in its distribution. I have often seen them in Poudre Valley working nights at irrigation. I don't know a single instance in Laramie Plains of their irrigating at night. In Laramie Valley they use the same slovenly method of distribution on table lands above river bottoms where meadow is attempted to be cultivated. The same method prevails under Pioneer Canal. Water wastes and collects in ponds below the ground irrigated on these upper areas. These ponds are not utilized for irrigation. There is no outlet to them. Water stays there and evaporates. These ponds are numerous at the ends of laterals. This is generally true where water is applied to land situate on these table lands.

2740 There are two series of ponds on north side of Laramie River that seem to follow right down a straight line until it arrives at the bench just above river. There is wet land between and around these ponds. There is more or less wet lands around ponds that appear out on the bench. I don't know of a single instance in which means have been provided for utilizing this water thus standing on saturated ground or in these ponds. They have attempted no system of drainage whereby they could make beneficial use of water

thus wasted. Would say that as a whole this practice is pretty prevalent over the entire Pioneer area. This same method of careless handling of water prevails there.

On Little Laramie ditches run into ponds and there is no outlet. Some of these ditches are of considerable size. All large ditches waste into ponds. For example, the Hecht & Farrell. This ditch wastes into the lake on Sec. 17, Tp. 16 N. R. 75 W. There is no outlet ditch for distribution of that water from the pond. There
2741 are several small ponds that continue along there in chain, along low depression; but there is no outlet to them. That water thus discharged into those lakes is not used for irrigation.

Poverty Flat and Parker Ditches both waste into a big alkali lake in Big Basin. There is no outlet to that lake. Water level in this lake, this alkali lake, is about 75 feet below water level of either Big or Little Laramie rivers at the nearest point, and country between is at quite an elevation. The lake of upwards of one-half section area in bottom of Big Basin is fed by these waters thus wasted. Waters at lower end of Poverty Flat and Parker Ditches could be wasted back into rivers by means of other ditches with little effort by construction of waste ditch. There is absolutely no effort there to do so. It seems that main idea in wasting water there is to find convenient place to dump it when there is any waste to be turned away.

Observed so-called domestic use of water on Little Laramie River in December, 1913. There was water flowing in both Poverty Flat and Parker Ditches then. This flow was about three-fourths of the ditch full, and as weather had been cold, ice had been frozen on the ditch and they were carrying this head of water through ditch so as to have water reach lower end of ditch for stock purposes. The water all went down into the Big Basin, into the alkali lake. Absolutely no provision was made for taking this water back to the river from whence it came. That was the kind of domestic use I observed.

Snake Ditch wastes into pond in same manner on north side of Little Laramie river and waste water of Bellamy Ditch goes down into a pond. By Bellamy Ditch, I refer to ditch that runs down past the Mandel post office, sometimes called the Loback Ditch. Those ponds are located along through tier of sections, through ranges 76 and 77 West and Township 17 North.

2743 In none of these ditches thus carrying water for alleged domestic use for watering cattle, where large quantities of water were carried through winter months, are there any waste ditches, or any effort made to have water conveyed back to stream so as not to waste it.

Water running in so-called North Canal or outlet to Lake Hattie Reservoir of Laramie Water Company during 1913 wasted down slope into alkali lake in Big Basin from end of construction, being end of North Canal to Lake Hattie outlet. No effort was apparently made to return that supply of water to stream. This alkali lake is same receptacle that receives water of Poverty Flat and Parker Ditches. It is a mere evaporation basin. Ground between them is

high and there is no likelihood of underground current being
2744 able to seep through. Water in this lake is highly alkaline and that is reason lake is so named. Stock will not drink water from it.

Referring to Defendant's Exhibit 1, map attached to answer of corporate defendants in this case, will state that canal there noted as terminating immediately west of Laramie as North Canal now continues down valley further. It terminates near lake show on map as "Big Basin" and "Alkali Lake." At time map was made the end of canal was properly noted. Construction of this lower end extension is very recent. They have been working on that canal all during 1913 for extending ditch, I should judge from point shown on the map, Defendants' Exhibit 1. This waste of water from this Lake Hattie outlet down into this alkali hole which has no outlet,
2745 was going on summer and fall of 1913. I first noticed it about middle of July and water was running in ditch up to latter part of September. Saw it actually running into lake along middle of August and down until September.

This waste of water by Laramie Water Company could have been prevented by running the water to Big Laramie River by dropping it down in one of laterals that flow into Carroll Ditch, and then by that means into Laramie River. There was no apparent effort to thus save water for use of consumers below. If this waste had not been diverted through month of December, for example through Poverty Flat and Parker and other ditches and had not been run out in large quantities into these waste lakes but had been allowed to flow down stream, or had been allowed to run back to stream from lower ends of ditches, it would have gone into Big Laramie and been available for storage below. All of these diversions of which I have been speaking are above Wheatland Reservoir No. 2. There is no tail ditch at lower end of Pioneer Canal to the river. There is one extended in northerly direction to point west of Maynard ranch on the west side of Laramie Ditch that
2746 has been abandoned. There is drop from present end of Pioneer, locally known as Butler extension of Pioneer, about three or four feet below this tail ditch, where it runs down through gulley to right of way of Union Pacific railroad. Railroad makes provision to take this water from around its embankment, and they have to put pipe underneath their track and water is conveyed to other side. On other side there is alfalfa field of about 26.3 acres and after water irrigates that it flows into river. In this connection, it might be stated, that if tail ditch were used, water would flow into waste pond on southwest quarter Sec. 31, Tp. 17 N., R. 73 W. Outside this Butler Canal or ditch at lower end of Pioneer, I do not know of any other canal in valley that has anything resembling tail ditch, where excess waters are conveyed for any purpose through canal and being unused, returned to stream for benefit of other appropriators. I did not note any during my surveys.

Referring to Defendants' Exhibit 1, map attached to answer of corporate defendants, will state there are soda lakes in the north

end of Township 14, N., R. 75 W., and lake near center of
2747 Tp. 15, N., R. 74 W. These lakes are commonly known as Seven Mile Lakes. These specifically named are large lakes. There are a good many small lakes not shown on this map on account of scale. There is water standing in series of depressions indicated on map extending easterly from Lake Hattie towards Laramie and down to Seven Mile Lakes. They are used as waste lakes. Surface water from irrigation runs into these natural depressions which have no outlet. Soda Lakes are of large area. They are natural lakes. Seven Mile Lakes are natural depressions of considerable size. Other than little canal noted as Episcopal Ditch, leading from one of Seven Mile Lakes, there is no canal or outlet constructed from any of these Seven Mile or Soda Lakes or other depressions extending between Seven Mile Lakes and Lake Hattie. Episcopal Ditch ends in some old plowed ground. Don't remember whether it is in use at present. If in use it would afford an
2748 outlet for one of these lakes. There are number of smaller lakes not noted on maps. You cannot plat much closer than 175 feet on maps like U. S. Topographical Sheet of that region, so that lake has to be of quite a magnitude before it would appear on maps.

There is no liklihood of water discharged from Pioneer and flowing and accumulating in Seven Mile Lakes, ever returning to Big Laramie River. There are ponds on Hart Ranch on Section 1 and on Section 22, also on Section 21. These ponds are noted on my plane table survey, sheet 15. They are natural depressions, so situated that water wastes into them. They have no outlets and are below surrounding elevation.

2749 Caldwell Lake appearing on U. S. Topographic Sheet in Sec. 27, Tp. 14 N., R. 75 W., is waste water lake without any outlet. It covers about 180 acres. The Hoge and Haley and the King High Line Ditches run in that vicinity. These larger illustrations I have given are fair illustrations of process that takes place of accumulation of water in smaller basins all through irrigated land during time water is being allowed to distribute itself in manner indicated. They are fair illustrations of what takes place in smaller scale over area of the two rivers, during months when meadows are not being irrigated, but when there is water being run through canals and into ponds and lakes under claims of domestic use.

James Lake appears on topographic sheet of U. S. Geological Survey as a lake without an outlet. It originally was a waste lake. Recently that has been converted into a reservoir with an outlet whereby waters can be diverted to lands below it.

Condition of valleys of Big and Little Laramies being miry, so it will not hold up horse and rider, indicates that soil is
2750 saturated to such an extent that there is more water there than is needed. The same is true of the area between the line of lakes under Pioneer Canal of which I spoke. I refer to string of lakes from Lake Hattie down to Seven Mile Lakes. Same is true north and east of these lakes. You find these spots and tracts all

along that area. On Little Laramie there is saturated area extending as far down as Puls' Ranch, northeast of Millbrook Ranch. It extends distance of two miles. South of river there are lakes extending through tier of sections from center of Tp. 16 N., R. 76 W., easterly for about three miles.

Observed no attempt to drain any land anywhere.

2751 Obsedved crop conditions, not only on area on which I worked, but to some degree outside of that area wherever there was irrigation. Observed growth of alfalfa plant on fields I visited.

Alfalfa grew about 18 or 20 inches high before it was ready for first cutting and before it began to bloom. Observed patches of alfalfa on Laramie Plains as follows:

On Sodergreen ranch there was some alfalfa, the next patch below I believe was Mansfield's and Mountain View Ranch, (part of Fischer place), and the Hart Place. There was some alfalfa on Experiment Farm and some little on stockyard ranch. That is adjacent to suburban tract right west of Laramie on north.

July 7, 1913, first cutting of alfalfa on Hart Ranch.

2752 First cutting alfalfa on Grable or Mountain View Ranch practically same date.

September 18, 1913, second cutting alfalfa on Hart Ranch. Second cutting alfalfa Grable Ranch approximately same date. There was not much alfalfa on Agricultural College Experiment plate immediately west of Laramie, and I did not make special note of time of cutting. On Section 31 there is notation, alfalfa, second crop, 8 inches high, August 2, 1913. Another, 1.8 acres alfalfa one foot high in bloom August 2, 1913. The latter was evidently left for seeding purposes. Another, alfalfa 10 inches high, second crop, July 2, 1913. Another, August 2, 1913, alfalfa one foot high, second crop; alfalfa, second crop, August 3, 1913, one foot high. Alfalfa one foot high July 26, 1913, Alfalfa 8 inches high, second crop, August 2, 1913. Latter field is one that had been left for seed. It is only 2.3 acres. Another, alfalfa 3 inches high, second crop, July 29, 1913. These specific examples are tracts in Section 31. They indicate second growth at time I was working there.

Don't believe there was any second cutting of alfalfa

2753 on Little Laramie Valley. What I saw was standing there and used for pasture at time I left. One cutting had been taken and balance was used for pasturage. Alfalfa on Little Laramie was in small tracts.

Ascertained tonnage produced first cutting alfalfa. Notes I took were turned over to Mr. McAnelly and were all put in same place for reference and they are in his notes, and his deductions are from the joint labors of both of us. I checked his conclusions to ascertain whether or not my calculation would bring me to same tonnage estimate. We both worked out tonnage separately in order to have check one on another, using data before us.

2754 Observed notation of tonnage on hay stacks on Hart Ranch made by others than myself. Stacks on Hart Ranch were

numbered. Each was indicated by stake driven into ground opposite one end of stack and on some of these stakes were slips of paper with tonnage. I checked these notations with results obtained by Mr. McAnelly and me from measurement. They checked practically same. Variation was not to exceed 1/10 of ton.

Checked tonnage production alfalfa on field on south side of river. I suppose people on Hoge Ranch owned it. That was field given by Mr. McAnelly in his testimony. I checked observations
2755 with Mr. McAnelly as to that field also. He gave correct figures.

Largest field alfalfa in whole Laramie Plains region is on Hart Ranch. Next is Grable field. Made no tonnage checks on Sodergreen or Mansfield tracts.

Native hay tonnage on Little Laramie River at Bath place was measured by party consisting of Mr. John E. Field, State Engineer of Colorado, Mr. McAnelly and myself and owners of the place were asked if they had disposed of any of hay from ranches or whether any of it was in other stacks for season of 1913, and he stated it was all on the ground in the meadow. Statement was made to me by Mr. Bath himself in presence of Mr. John E. Field, State Engineer of Colorado, and Mr. McAnelly. That is same event of which Mr. McAnelly spoke of in his testimony. We measured stacks that
2756 were in field. I heard Mr. McAnelly testify as to tonnage ascertained. We figured that tonnage on ground before we left land. I figured individually and he figured the same way and we both got the same results. The result stated by him yesterday was correct. Six-tenths of a ton per acre.

Oats on Shaw Place in Blackburn Ranch on Little Laramie yielded for 1913 24 bushels per acre. Wheat produced 11 bushels per acre. Flax 8 bushels per acre. There were 19 acres of flax on whole Blackburn Ranch. Observed crops on this display ranch prior to time they were harvested. Crops had received entire attention of people living on place, as they were attempting to farm for a livelihood there. Consequently they devoted more time to raising
2757 their crops while in other places the oats were raised for consumption of animals of home ranch. Crops on this ranch were better than the average, there being considerable difference between crops raised on Blackburn and those raised on Ernest place. Latter place is southeast of Blackburn ranch on Little Laramie River.

On Big Laramie River, during 1913, Grable place produced 2200 bushels of oats. Do not remember acreage.

Average production oats on Blackburn ranch on Little Laramie River for 1913 was 12.6 bushels per acre in field of 63 acres. There were 793 bushels threshed.

2758 Did not see many hogs on Laramie Plains during survey. Did not observe over two or three dozen outside of Wyoming Experiment Station, on both the Big and Little Laramie areas. In almost every instance they were simply around ranch buildings, just two or three hogs for home consumption. 1910 census shows 343 hogs on Laramie River Basin and in whole of Albany County. Referring to picture 123 in Exhibit 116, will state that I placed

notation at bottom "Note hog in foreground, rarely seen in Laramie Plains." That is the fact. That is not hog raising country, they don't raise corn there, and there is no corn on the Wyoming Experiment Station tract. Season is too short for that character of crop. Hog industry necessitates raising corn or feeding of corn. They evidently do not in any way depend upon that industry in Laramie Plains.

Cattle, horses and sheep were live stock observed on Laramie Plains. Main use of horses in that vicinity is for tending cattle, and they all are of light weight and small size compared with those in farming communities where draft animals are required. They are more of broncho type than draft animal.

2759 Cattle raised are mostly for stock. They are not raised for dairy purposes. The dairying stock consists of a few head around Laramie to supply town with milk.

Referring to native hay on Bath place, which I stated we measured, will state that it was raised on a meadow which was some better than the average in the valley. Meadow was very level and there were no hummocks in it. Lands were cleared of sage brush and was practically all clear meadow throughout, which is not the case in a great many other places in the meadow land in the Laramie Valley.

Concerning production native hay 1913 as compared with 1912, will state that while talking with inhabitants of valley located on meadow valley, they advised me they were trying to get all hay they possibly could, because of prevailing good prices for hay sold on market in Kansas City and Denver, there being scarcity of hay crop in other localities. This was incentive for cutting as much hay as possible. They stated that their crop was better than

2760 during 1912.

In measuring native hay lands on Little Laramie Valley, we made plane table survey all way up to Fillmore. It was accurate. United States Government uses plane table on their boundary lines between Canada and the United States. It is generally used on work of the class I was doing. In checking out native hay meadows, was careful to follow meander of meadows and their edges. Margins go in and out and shots were taken at these points. I did not exclude from the meadow lands hummocks or little irregular tracts that were not really meadows. I included these within the meadows. I took outer boundaries and what was included inside was classed as meadow. As the result of these observations, ascertained definitely number of acres of meadow land in Little Laramie Valley. Exhibit 117 is tabulation of irrigated acreage in Little Laramie Valley during year 1913 as ascertained. It includes acreage between Fillmore and two Rivers, Wyoming.

2761 (Defendants' Exhibit 117, a tabulation of irrigated acreage in Little Laramie Valley, offered in evidence.)

Data appearing on Defendants' Exhibit 117 is obtained from figures made from actual measurements of that portion of Little Laramie River Valley between the Alsop Ranch and two Rivers, and also that above Alsop Ranch. Sheets 28, 33, 34, 35, 36, 37, 38

and 39 of Defendants' Exhibit 114, album of plane table survey sheets, were used in compiling portion of this tabulation, Exhibit 117. Those are maps I referred to in my testimony when stating that some of this area in the Little Laramie was mapped. That above part shown in these maps was covered by plane table survey but not mapped. I actually sketched my work on board as I went above that portion shown on these sheets.

2763 Three months of labor was expended in making survey of irrigated land areas in Little Laramie Valley. Had full plane table survey crew about two weeks. Rest of time had help of one assistant.

Defendants' Exhibit 117 contains five sheets. Various classifications appear at head of columns of each set of figures. In meadow classifications, native hay meadows appear on these sheets as first, second and third classes. Later third class meadow sometimes appears as irrigated pasturage. Reason for this change was that at original starting of survey we termed third class meadow what the plaintiffs termed irrigated pasturage; and after plaintiffs had put on an exhibit so classifying this meadow land, we changed our classification to include irrigated pasturage for uniformity. On tabulation, Exhibit 117, third class meadow and irrigated pasturage refer to same class of meadow. There is a portion of irrigated pasture that did not carry foxtail that was designated as third class meadow and was included in third class meadow classification. After changing method of classification, foxtail meadow and irrigated pasture is included under the heading of "irrigated pasture," while meadow that is clear of foxtail is included under the heading "third class meadow." For purpose of this classification, the two columns entitled "third class meadow," and "irrigated pasture" may both be considered as referring to irrigated pasture.

2764 Referring to Defendants' Exhibit 117, being tabulation of irrigated acreage on Little Laramie River for year 1912, following will be noted:

22,081 acres, total irrigated meadow exclusive of irrigated pasture. This figure includes 2,518 acres of third class meadow. Placing that in column with irrigated pasture and deducting if from total meadow, would give the total irrigated meadow on the Little Laramie River Valley in 1913 as 19,563 acres;

5,801 acres of irrigated pasture, and 2,518 acres of third class meadow appear on Exhibit 117. This gives total acreage of irrigated pasture in Little Laramie Valley for 1913 as 8,319 acres;

219 acres of alfalfa on Little Laramie River, or irrigated from canals taking water from that river during 1913;

1,319 acres of land devoted to growing of oats in Little Laramie River Valley;

88 acres devoted to all other crops, including potatoes, other kinds of grain, flax, and turnips;

2765 There are several small patches potatoes. 5 acres on Sec. 1, Tp. 16 N. R. 76 W. One acre on Sec. 23, Tp. 17 N., R. 75 W. One acre on Sec. 26, same Township and range. 2 acres on Sec. 29, same Township. One acre on Sec. 18, Tp. 17 N.,

R. 74 W. This includes all potato patches in Little Laramie River Valley in 1913. These potatoes were not being grown for commercial purposes but for local consumption, at place where planted.

Potato vines on Laramie Plains were destroyed by frost last week in July, 1913. After frost, vines were black through to ground from their tops.

19 acres of flax on Little Laramie River Valley for 1913;

On Sheet 2, Exhibit 117 there are two items designated
2766 "grain". Do not remember kind of grain that was. Was not oats;

Sheet 4, Exhibit 117, shows notation "two acres turnips". That was all turnips found growing in that valley;

31,341 acres, total acreage found irrigated in Little Laramie River Valley, in 1913, as shown by Exhibit 117. This tabulation covers same area as covered by reconnaissance by R. I. Meeker, witness for plaintiff, and shown on Plaintiff's Exhibit E, from Fillmore to Two Rivers and tributary to Little Laramie River. The two surveys cover same area.

All lands designated first and second class meadows in Exhibit 117 were cut over for hay during 1913, or were land that could have been cut over.

12,129 tons of native hay is my estimate of maximum tonnage that would have been produced in Little Laramie River Valley in 1913 if all first and second class meadows had been cut over. In arriving at that figure, I took total area meadow land capable of being cut, and multiplied by .62, obtained from fields that were a little over average on Little Laramie River, and that gave total of 12,129 tons. The figure .62 indicates tonnage per acre
2767 of native hay. For example, the meadow on Bath Place gave that tonnage per acre in 1913. That meadow was above average of these first and second class meadows included in those columns on Exhibit 117, from fact that it was clear meadow without a knoll. The other meadows appearing on Exhibit 117 had strips of knolls through many of them, some had sage brush, and these obstructions were such as to cut down the tonnage average per acre. I feel that the figures I have given are liberal.

Oats were ready for harvest in 1913 on Laramie Plains region about middle of September.

Frost of July 30, 1913, on Laramie Plains killed buckwheat, beans and potatoes on Wyoming Experiment Farm. Potatoes at that time were about size of hen's egg.

2768 I have compiled tabulation of irrigated acreage under several ditches taking water from Big Laramie River as covered by plane table sheets. That tabulation includes all lands irrigated and plowed. In that tabulation have separated the acreage into various crops to which they were tilled at time of survey.

(Defendants' Exhibit 118, marked.)

Defendants' Exhibit 118 is tabulation of irrigated acreage on Big Laramie River under ditches as indicated and determined by

plane table survey. These sheets only include those acreages ascertained by me in plane table survey on Big Laramie, Exhibit 114.

In Defendants' Exhibit 118, have included lands irrigated under Pioneer Ditch, as it existed before construction of new enterprise, the Lake Hattie outlet and Lake Hattie Reservoir, under three heads "Pioneer Lateral, Episcopal and Pioneer." Episcopal Ditch is taken out of Seven Mile Lake and is small ditch running a short distance down below that point. Its acreage is included within Pioneer area. It will be observed on Sheet 15 of Exhibit 114.

2769 The plowed acreage on Section 22 as shown on Sheet 15, Exhibit 114, is irrigated from that ditch.

6,301 acres of land are irrigated as shown under the three headings, "Pioneer Lateral," "Episcopal Ditch" and "Pioneer." Out of the 6,301 acres there were 847.9 acres of land under the Pioneer Canal in 1913 that was not cropped. It was ground that had been plowed, some of it in previous years. This figure of 6,301 acres does not include all of the land irrigated by the Pioneer Canal, owing to fact that the plane table sheets do not include all of the area irrigated by that canal. Assuming for purpose of question, that we were to take reconnaissance of R. I. Meeker, Wyoming engineer, for acreage under Pioneer Canal and not included in plane table sheets, total acreage under canal above the area covered by sheets would be 6,235. Taking the Meeker figure 6,235 acres as the irrigated acreage of Pioneer Canal above plane table survey sheets and my figure of 6,301 acres as the acreage included within the plane table sheets and irrigated by Pioneer Canal, total irrigated acreage under the Pioneer Canal would then be determined to be 12,535.9 acres, which includes plowed ground, after deducting plowed ground.

11,688 acres of land irrigated under Pioneer Canal in 1913. My recollection is that Mr. Meeker did not include plowed ground in his estimate. I accordingly make deduction of plowed ground in order to get irrigated acreage in 1913. Mr. Meeker had assistance of Mr. Titus, the Superintendent of Pioneer Canal, in making his reconnaissance. I did not have assistance of Mr. Titus in my work.

80.8 acres of irrigated lands of all classes from Sodergreen High Line Ditch (Mr. Sodergreen's new canal) appears on plane table sheets. That does not include actual acreage lying to north of plane table sheets between there and Lake Hattie. Some of that land has been irrigated. Mr. McAnally included this acreage in making his reconnaissance in that region. He did not separate acreage irri-

2771 gated by that canal from that irrigated by other canals in that vicinity. Am unable to give actual acreage irrigated by the Sodergreen High Line Canal. Same is true of Parker and Last Chance Ditches. The figures in my table showing portion of irrigated acreage on lands covered by the plane table sheets give, for the Parker Ditch, 157.9 acres and for Last Chance Ditch 174.9 acres.

9.8 acres of irrigated land in 1913 under Sodergreen South Ditch. Acreage was all covered by the survey.

519.9 irrigated acreage under Sodergreen Ditch. Covered all lands irrigated by that canal in plane table survey.

Island Ditch covers 27 acres. It is owned by Mr. Sodergreen. It is a very small ditch and does not carry very much water.

Some of acreage given for Parker Ditch is included in Sodergreen ranch. It is shown on Section 30 in tabulation. It appears as acreage belonging to Sodergreen. There are 14.7 acres. Re-
2772 mainder of land irrigated by Parker Ditch is on Johnson and Watson places. The Watson acreage is in meadow and oats. There are 62.9 acres. That acreage was obtained by plane table. Went over there for section corner.

1700.3 acres irrigated by Riverside Canal No. 1.

3,283.9 acres irrigated under Riverside Canal No. 2. On Tabulation lands irrigated under that canal are described as under the canal and Riverside Lateral No. 2.

724.7 acres irrigated by King Ditch and also Upper King Ditch. Made observations to irrigate acreage under King High Line Ditch. It is a new canal constructed within last 2 or 3 years. It follows same line as King Ditch for part of its course, then it divides and runs over to Sand Creek, and down to Hutton Lakes. King
2773 High Line Ditch and Hutton Lake Reservoir is not a completed enterprise. Found 286.1 acres irrigated from King High Line Ditch on Riverside Ranch.

Olsson Ditch irrigates 356.3 acres. 20.2 acres irrigated by Olsson South Ditch. That includes all acreage irrigated by both of these canals.

125.6 acres irrigated by Durant Ditch.

279 acres irrigated by Hammond Ditch. That is all acreage irrigated by Hammond Ditch.

423.2 acres total acreage irrigated by Mansfield Ditch. It is owned by Mr. Mansfield and irrigates his ranch. His ranch lands are shown on Section 20 in Exhibit 114.

Unable to obtain irrigated acreage under Fischer Ditch because this acreage extended beyond scope of plane table survey. Found 1001.8 acres irrigated by this ditch under plane table area.
2774 This acreage included alfalfa patch on Grable Ranch. There were 88 acres of irrigated alfalfa on the section. That is shown on Sheet 4 of Exhibit 114.

1,560.1 acres are irrigated under Caldwell Ditch.

886.7 acres irrigated under Hoge and Haley Ditch.

372.1 acres irrigated under Bush and Holliday Ditch.

270.3 acres irrigated by Nelson Ditch. On Exhibit 118 the word "Wells" is quoted on map. That refers to fact that he irrigates from wells. In this case there is no diversion from stream. This occurs at Nelson Road Ranch. He irrigates 33.9 acres by this means. It is possible to irrigate lands in this region by pumps.

433.4 acres under Leroy Ditch taking water from Sand Creek.

141.3 acres under the Cook Ditch No. 1.

169.7 acres under Bush Ditch.

146.4 acres from the Garden Ditch.
2775 14.2 acres from the Dwyer Ditch.
101.5 acres from the Pinkerton Ditch.

439 acres from Richards Ditch.
822.7 acres from Red Ditch.
87.2 acres from Cunningham Ditch.
372.5 acres from Hutton Ditch.
These last ten ditches all take water from Sand Creek.
1,885.4 acres of land irrigated from Dowling Ditch taking water from the Big Laramie. That is total irrigated acreage under it.
1,179.5 acres total irrigated acreage under Hutton Ditch, taking water from Big Laramie.
733.6 acres located under Walcott ditch now obtain their water from Pioneer. That acreage is included along with the Pioneer acreage I have already given.
Referring to acreage under Walcott Canal, will state that figures on Exhibit 118 regarding this canal need re-checking. They are now in lead pencil. On examination of ground found that Walcott Ditch was abandoned. Was named Walcott Ditch and not
2776 Walcott Lateral of Pioneer Canal. Total of this Walcott Lateral has been left out in totalling the Pioneer Ditch.
Since previous testimony have checked Exhibit 118 and same is now in correct form for introduction. I now have in my
2777 hand Exhibit 118, Irrigated Acreage on Big Laramie River, Under all Ditches Embraced under Plane Table Survey. This takes place of lead pencil memorandum introduced under Exhibit number last Saturday.

(Defendants' Exhibit 118, tabulation of irrigated acreage of Big Laramie River, offered in evidence.)

At the close of last testimony stated there was an error by exclusion of certain lands under so-called Walcott Canal. That has been corrected on Exhibit 118 so as to place it under the Pioneer Canal acreage. Figures which gave in last testimony relative to irrigated acreage were compiled from imperfect Exhibit 118. In order to correct acreages under Pioneer it will be necessary to correct figures heretofore given.
2778 7,036.9 acres total acreage in plowed ground, crops and meadow, under Pioneer Canal area covered by plane table survey and shown on Exhibit 114. Plowed ground includes plowed lands but not in crop, during season 1913. Without plowed ground there would be total of 5,912.4 acres under Pioneer Canal. 1,124.5 acres of land under Pioneer Canal had been plowed but were not in crop during cropping season of 1913.
Native hay acreage under Pioneer Canal area covered by plane table survey was as follows:
185.7 acres, first class meadow;
2,556.5 acres second class meadow; and 1,524.7 acres third class meadow.
Third class meadow is synonymous with so-called irrigated pasturage.
Alfalfa, 1,187.3 acres; oats, 283.5; other grains, 147.4; potatoes, 17; garden, 10.2; plowed ground, 1,124.5. Total 7,036.9 acres. Acreages include cultivated areas in suburban district immediately

west of Laramie known as West Laramie. Also Wyoming Experiment Station.

10,605.8 total irrigated acreage under Pioneer Canal as ascertained by plane table survey and reconnaissance by Mr. McAnelly.
2779 That does not include plowed ground. There are 1124.5 acres of plowed ground. That should be added to the figures given. 5,912.4 out of the 10,605.8 acres under the canal were covered by plane table survey. Remaining 4,684 acres lie north and west of area covered by plane table survey and noted in Exhibit 114. For that area I have adopted figures of Wyoming engineer, Mr. R. I. Meeker. In ascertaining total irrigated acreage under Pioneer Canal I take the actual acreage on the plane table area and as compiled by me, and the R. I. Meeker figures for the excess area not covered by plane table survey. These two taken together show 10,605.8 acres irrigated under canal in 1913.

I desire these corrected totals to be taken in lieu of former testimony.

Mr. Meeker showed on acreage under Pioneer not covered by plane table survey:

Oats, 1,569 acres; alfalfa, 94 acres; meadow, 2,273 acres; and irrigated pasturage, 748 acres. Total, 4,684 acres. Mr. Meeker testified that total irrigated acreage under Pioneer Canal was 11,486 acres. My figures are computed from plane table work and with assumption that Mr. Meeker's figures for Pioneer area not so covered were correct, give total acreage under Pioneer Canal of 10,605.8. Difference between my figures and Meeker's 880 acres. My figures show this much less. This difference would, of course, be charged against the area covered by the plane table survey. Assuming, for purpose of question, that as great a discrepancy in the area occurred outside of plane table sheets as occurred in area within the sheets, approximate difference in acreage obtained under canal outside of plane table sheets would be 700 acres. Total discrepancy between Meeker's testimony and mine would be 1,580 acres. Meeker's computa-
2781 tion would show that much greater acreage than mine. Discrepancy when expressed in percentage would be 15 per cent. Even assuming acreage given by Meeker, outside of plane table area, to be correct, the 880 acre difference would make a difference of 8 1/3 per cent. That is discrepancy percentage as to whole area, assuming Meeker's acreage to be correct outside of plane table area.

11, 124 acres total irrigated area in Big Laramie River Valley outside of portion covered by plane table survey.

38,241 acres total irrigated area in Big Laramie River Valley including plane table area and that outside of that area located
2782 north and west of same. From this figure are omitted irrigated lands on Sand, Soldier and Five Mile Creek-, and one or other two minor tributaries of the river. These areas are south of area covered by plane table survey. It is small acreage. I have had access to testimony heretofore given by witnesses for state of Wyoming. From this testimony I obtained information that area lying south and east of that portion covered by plane table survey shows:

1185 acres irrigated on Soldier Creek;
300 acres on Five Mile and Willow Creeks.

Irrigated acreages lying under each canal in Big Laramie Valley, covered by plane table survey and shown on Exhibit 114
2783 and 118, exclusive of plowed ground, is as follows:

Sodergreen High Line, 734; Parker, 163.8; Sodergreen South, 9.8; Popp and Barlow, 203.7; Island, 27; Sodergreen, 338.5; Riverside No. 1, 1760; Riverside No. 2, 3,131.5; Mansfield, 446.3; Fischer, 953.3; Oleson, 334.7; Durant, 116.5; Hammond, 259.5; Oleson South, 20.2; Benson South, 11.2; King, 669.5; Caldwell, 1,553.8; King High Line Ditch, 24; Haley and Hoge, 886.7; Bush and Holliday, 370.8; Nelson, 270.3; Wells, 21.6; Leroy, 431.2; Cook No. 1, 141.3; Bush, 169.7; Garden, 93.6; Dwyer, 14.2; Pinkerton, 99; Richards, 439; Red, 822,7; Cunningham, 184.6; Hutton, 372.5; Dowling, 1,855.7; Hutton, 1,205.5; there is a dam in the river that backs up water that covered 130.1 acres. That is in Tp. 14 N., R. 74 W.; it is up stream from Hart Ranch, and shows on plane table sheets 11 and 16 of Exhibit 114. Under Biddick Ditch there
2784 is no land exclusive of plowed ground; under Pioneer Canal there were 5,912.4 acres; Episcopal Ditch, 9.4 acres. This acreage was included under Pioneer acreage as given by me; North Canal from Lake Hattie, 34.2 acres; Grant, 60.1; No Name, 9.9; No Ditch, 94.2; Oasis, 3,334.6; Boughton, none exclusive of plowed ground; total 27,117.2, exclusive of plowed ground.

The term "plowed ground" appearing through totals as given, indicates ground that has been plowed but was not in crop at time of survey. Major portion has been plowed previous to 1913 and had been allowed to lie idle and not put in crop during that year. If I had included all this land which had been plowed but allowed to lie idle without being cropped during 1913, total acreage included within the plane table sheets would be 29,279.3 acres.

In Exhibit 118, that portion designated irrigated acreage under Oasis Canal indicates only that portion surveyed and extending to point opposite Bosler, Wyoming, and not to end of ditch.
2785 Same is true of Boughton Canal. Survey extended to Union Pacific Railroad.

Acreage included under term "no name" indicates that there is no ditch covering acres. Irrigation is by sub-irrigation. Lands are along river. They are in immediate bottom next to river.

29,279.3 acres irrigated in Big Laramie Valley as ascertained by plane table survey, as shown in Exhibit 118, including acreage of plowed land abandoned for use in 1913. This acreage is subdivided into following classes of irrigated land:

First class meadow, 3,104.6; Second class meadow, 14,547.3; Third class meadow, or irrigated pasturage, 6,936.8; alfalfa, 1,440; oats, 831.6; other grain, 211.9; potatoes, 27.4; garden, 17.6; plowed land, 2,162.1; Grand total including plowed land, crops and meadow, 29,279.3.

9,602 tons of native hay would be total production of the 17,651.9 acres of native hay land, assuming that first class meadow would

produce average of ¾ tons per acre per annum, and second class meadow would produce average of ½ ton native hay per acre per annum.

In classifying this meadow land, I stated that we included under second class meadow, all hay that was cut that would make under ½ tons per acre. I included under first class meadow all that was cut and would make over ½ ton per acre. It follows that figures of tonnage I have given are very liberal according to classification.

2,160 tons of alfalfa hay would be annual production from 1440 acres of alfalfa assuming annual production of 1½ tons per acre. This is acreage included in lands covered by plane table sheets including Hart Ranch. Alfalfa on that ranch seemed to receive best care of any alfalfa on Laramie Plains region. That seemed to be main use to which they put that particular bench land. Lateral that ran through there was essentially for this land. I would
2787 say that it was the best alfalfa field there was in Laramie Plains region. The 1440 acres includes the alfalfa on this ranch.

July 7, 1913, date of beginning of first cuttings of alfalfa on Hart Ranch, Laramie Plains. Second cutting was on September 18th. They used the "Go-Devil" outfit to put up hay same as in Poudre Valley.

There is less irrigated land under Oasis Canal outside of than inside and included within survey. Would think there is proportionately less outside. Ditch is pretty long and upper portion of lands under ditch get major portion of water. Plane table
2788 sheets cover this upper portion of canal. These lands are better and more thoroughly irrigated than lands under lower portion of canal outside of survey.

I have checked over testimony of Wyoming witnesses relative to irrigated areas under canals not included in plane table survey, and as well as those included within that survey. 890 acres of irrigated land under Oasis Canal outside of plane table survey as given by Z. E. Sevison. 424.6 acres of irrigated land under Oasis canal as ascertained by my survey and Mr. Sevison's testimony. I made reconnaissance of the land below plane table sheets and east of U. P. Railroad, with one man and a team. I also had, in connection with this, tabulation of Mr. Z. E. Sevison, showing adjudicated water rights as determined by the courts, and notation concerning every quarter section under Oasis Ditch. With these figures to aid me, I made reconnaissance and determined 890 acres of irrigated land under Oasis Ditch outside of and below plane table survey. Did not make reconnaissance of Boughton Ditch. That Ditch and Oasis Ditch are parallel and near to each other and there was certain amount of observation made concerning that ditch. The figure I obtained for Boughton Ditch was taken from testimony of witnesses for plaintiff and showed 1,550 acres irrigated meadow under that canal.

2789 375 acres irrigated meadow land under Cooper Lake Ditch. Witnesses for Wyoming gave 750 acres under that canal, only fifty percent of which, however, was irrigated.

998 acres of irrigated land under Gillespie Ditch, outside of plane table survey.

705 acres under McGill ditches. Last two figures are obtained from testimony of Wyoming witnesses.

2790 3,400 acres of land irrigated by Sodergreen High Line Canal in upper portion of valley. I obtained this information through testimony of Mr. Sodergreen. He stated land he owned and amount of land irrigated on each section, with the exception of one. For this latter section I took Mr. McAnelly's figures and adding the acreage on this section to the total given by Mr. Sodergreen, I obtained total of 3,400 acres.

1,600 acres of land irrigated by Parker Ditch, other than that covered by survey. Obtained this through witnesses' testimony—witnesses for plaintiff.

1,120 acres irrigated land under Popp and Pahlow Ditch. This is acreage outside of that included in plane table survey.

320 acres of land under Fischer Ditch outside of plane table survey.

42,759 acres, total irrigated acreage in Laramie Valley, exclusive of Little Laramie Valley, including portions south and east of plane table survey and irrigated by Sodergreen High Line, Pioneer, Parker, Popp and Pahlow, Fischer, Oasis, Boughton, Copper Lake, Gillespie, McGill ditches, also including total area within plane table sheets, and portion of Sand Creek area.

2791 Have already testified to total irrigated acreage in Little Laramie Valley. (Page 2766, 31,341 acres.) This acreage included that below Fillmore, or locally known as Wright's Ranch.

800 acres irrigated land on Sand Creek, above point where plane table survey reached. Obtained this from other sources of information. This acreage does not appear on Exhibit 118.

90,610 acres total irrigated acreage in State of Wyoming in Laramie Plains region irrigated from Laramie River and its tributaries. This acreage total obtained by me from various sources of information already enumerated. This acreage is located

2792 on Laramie River and tributaries between the interstate — between Colorado and Wyoming and the cañon of Laramie River below Wheatland Reservoir No. 2. It is located exclusively in Laramie Plains area. Not in vicinity of Wheatland, Wyoming. I have not attempted to give any acreage east of Laramie Mountains or Black Hills.

There is not as much land under irrigation at present time throughout Big and Little Laramie Plains region as there was at some prior time. This is true both under Pioneer and Oasis Ditches. The column of plowed land on Exhibit 118 under Pioneer Canal of 1,124.5 is determined by plane table survey. It covers about 5/9's of area under Pioneer. It would indicate that at some previous time this ground had been plowed and seeded, but is not at present under crop.

Under Oasis ditch there is big item of plowed ground that at one time was cultivated and probably sowed to some crop. At present time it is lying idle.

Country general- gives appearance of falling off of cultivated and irrigated areas. That is true of all ditches that have plowed ground below them.

2792 Have observed flow of water in Soldier Creek at its mouth. About Sept. 15, 1913, I had occasion to drive on wagon road just south of river above Laramie River and at point where road crosses Soldier Creek there was water running into river.

2793 Think there were about 2½ cubic feet per second flowing. That water came from spring up at the State Hatchery. It was not result of sudden storm or freshet. It was ordinary flow. I would say that Soldier Creek is a tributary of Big Laramie River from fact that water flows down into that stream from it, notwithstanding testimony that Soldier Creek is not tributary.

Cross-examination by Mr. N. E. Corthell:

2793 When I was employed by the Harriman system in investigation projects in its territory my duty was to examine the various projects from all sides, including the agricultural possibilities, and this involved a careful and complete examination of the respective territories from an agricultural standpoint and

2794 not merely a consideration of the prospective business which might be secured. The value of the territory necessarily depended in some measure upon the agricultural possibilities.

2795 My work in the Laramie Valley in Wyoming was confined to the Laramie Plains and occurred only in the year 1913, when I was there from about the middle of May until about the 5th of December. During this period I was upon the Laramie

2796 Plains continuously with the exception of a day or two at a time when I made trips to Denver, these numbering three or four. After the middle of September I was present four days or so at the hearing in this case at Laramie. Another week

2797 perhaps was used in taking pictures and in reconnaissances. I do not believe that aside from these occasions over a week or ten days was spent in other than actual field work. Three days were lost by reason of stormy weather.

2798 I did all of the plane table work myself, and while I was away the party did nothing. The western boundary line of the plane table work on the Little Laramie River that was mapped at the time was one mile west of Sprague Lane, being the

2799 north and south middle line of Township 17, Range 75. East of this point all of the land irrigated from the Little Laramie River directly was included in the plane table survey, but not the land irrigated from James Lake Reservoir. The northerly limit of the survey on the Big Laramie River was

2800 Bosler, upon the Union Pacific Railroad, being the north line of Section 23, Township 18, Range 74. In that vicinity the survey on the east side of the river covered the Laramie Valley bottom lands, including everything under the Oasis Ditch up to the north line of Section 23, and also the lands on the west side of the river were included. The city of Laramie was not included in the survey. The plane table survey did not cover all of the areas

shown on the sheets but the designations are made from plane table work. Section 25, Township 14, Range 77, shown on Sheet
2801 1 was covered by the plane table survey and also all of the other lands shown on the same sheet and lying north of the county road; also all of the lands shown on the same sheet lying south of the bottom lands on the south side of the river, and all of the designations shown on the sheet are from my plane table survey.

2802 The plane table survey covered all of the land shown upon Sheet 2 of the survey, including that lying north of the county road. The Pioneer Ditch Lateral shown on the sheet is not shown in its entire length because it runs into other lands. Neither is it shown to its full extent upon this land, but marked as we would pick it up on the road. All the main ditches are
2803 shown wherever they run, and any laterals on the side away from the river are shown for their entire length. The Pioneer Ditch Lateral extends in a northeasterly direction, but I cannot say definitely where it goes. It is not shown north
2804 of the county road because that area was pasture land and the lateral was not followed out. I do not know how long it is nor what land it serves to irrigate. The lands irrigated under it beyond the plane table survey area are taken up in the summation of lands irrigated above the survey which has been offered. All of the land which is irrigated in Section 22 upon this sheet is so shown upon the sheet. The base line shown on Sheet 2 of Exhibit 114 was run with a transit, and whether the areas north of the county road were taken by means of the alidade and mapped or by means of the transit with field notes makes no difference, as it is all the same thing. The work was put down on the maps at the time.

2805 The base line which was run upon the land shown upon Sheet No. 2 was in a general east and west direction and stations were marked by means of wooden hubs driven in the ground, and from these hubs the plane table survey was made. There was only one base line on the territories shown upon this sheet, and it was run out with a transit. The area on the sheet designated as Sodergreen Lake was accurately located by means of the plane table survey. As I recall, the water was rather low at the time, and if it were higher it might extend across the section line, but when I was there it did not extend in Section 21. My recollection is that the concrete check gates and division gates near the Sodergreen Lake shown upon this sheet were accurately located, and that they are actually in Section 28, but they may be across the line as some of the quarter corners are not in line with the section corners.

2807 There was no land in the area designated as the Watson place shown on Sheet 2 and lying west of the Parker Ditch which was irrigated in 1913. My recollection is that the land east of the ditch is irrigated from the Parker Ditch, but possibly some other lateral may cover it. I do not believe the Sodergreen Lake

shown on Sheet 2 could be considered as a storage reservoir,
2808 in connection with the Pioneer Canal. It is a low depression which might be used as a small equalizing basin, but it could not be much of a storage reservoir. I was not there during all seasons in 1913, so cannot say whether it was used for that purpose. There was no connection between the Sodergreen Lake and the Pioneer Ditch or the Lake Hattie Canal, although water had run into the lake from the canal and made a way for itself. It is not true that all of the water that runs through the Lake Hattie Ditch or Pioneer Canal is run into Sodergreen Lake and then out again through the gates marked on the map.

We did not show the course of the Pioneer Ditch Lateral beyond the county road with any idea of hiding anything. It was not our purpose to run out every lateral, as such work would have required too long a period. We showed the laterals above the main
2809 canals or on the side away from the river, and in all cases we showed the entire irrigated area covered by the survey. In all cases we show the main canal, whether there is an upper lateral or not. In some instances we have shown laterals lying below the main ditch, our general rule being to show the commencement of all large laterals and follow them a distance and then drop them.

I do not know how much hay is cut upon Section 28 shown on Sheet 2. Mr. Sodergreen informed me that he cuts between three and four hundred tons upon his land, but I do not know how
2810 much of that is on the section. This is not one of the best meadows on the river. My classification of the various tracts is based partly on information I gathered from persons with whom I talked and partly upon my own observation of the land itself. My classification was made with reference to the physical conditions appearing in 1913 and not exactly upon the irrigation of the tract in the year 1913. For instance, areas upon the Caldwell and Rickard farms would be simply pasture if the year 1913 alone were considered, for it has been some two years since water has been used there, but I have classified them as irrigated pasture lands. This is also true of the land in Section 25, Township 14, Range
2811 76, and there are other instances of the same kind where lands are classified as irrigated pasture lands although not irrigated in 1913. The rule used throughout the survey was to show all land as irrigated which was irrigated in 1913 or in previous years. In some instances, as under the abandoned Walcott Ditch, where the land had not been irrigated for a long period and had
2812 gone back to its original condition, it was classified as pasture land and not as irrigated pasture land. Also upon the Riverside Ranch, where there was no increased growth of grass by the use of water, the land was classified as pasture land, and wherever lands upon that ranch are so designated upon the survey there had been no irrigation to increase the growth of grass.

The water from the Lower King Ditch runs down through the greasewood in gullies and natural diversions to land near the river which is irrigated. The intervening area of greasewood land is

full of pits and knolls, and I would not consider it as irri-
2813 gated land. There are no large laterals, and I would doubt there being several miles of laterals, some on each side of the King Ditch, and I doubt if there are any laterals running
2814 south of the King Ditch and irrigating lands which I have marked as pasture lands. The Upper King Ditch is an old ditch practically as old as the Lower King Ditch. I talked
2815 about the irrigation along the King Ditch with Mr. Ware, the foreman of the Riverside Ranch, who has been foreman for two years but has been in the vicinity before. I do not know how long any of the several persons designated as owners of the Riverside Ranch lands have lived in the vicinity. I also
2816 talked with Mr. Sodergreen, who was an old resident, and with Oliver Mansfield, an old resident, but only with Mr. Sodergreen about the King Ditch.

The principal area of meadow land irrigated by the King Ditch along the River is shown upon Sheet No. 5, and all of it
2817 touches the line of the ditch itself. The ditch designated as the King High Line Ditch is a new ditch, and the ditches designated as the Upper and Lower King Ditches are old ditches. The Upper King Ditch runs from Sections 6 and 5 in Sheet 6 into Section 4 in Sheet 9, and its principal use seems to be for
2818 the oat fields shown on Sheet 4, and from that point it drops into Section 33 and wastes into the lakes shown below. The lower mile of the Lower King Ditch shows no evidence of irrigation in 1913 or in the few years preceding. Where it leaves Section 32 and runs through Sections 5, 2 and 33, it seems to fol-
2819 low the natural course, and I do not believe was a constructed ditch. My recollection of this particular area is rather distinct on account of our difficulty in finding section corners. It is difficult to state just where the ditch ceases to be a ditch and becomes a waste-way, but in Section 32 it flows below the lowest land through a series of ponds.

2820 The course of the Popp and Pahlow Ditch shown upon Sheet No. 2 in Exhibit 114 was determined by survey and is correctly shown as running through Section 23. It does not run to any extent through Section 22. The course of the Parker Ditch is also accurately shown through Section 22 as determined from actual plane table survey, including the part lying north of the county road. The Sodergreen High Line Ditch shown on
2821 Sheet 1 is correctly shown as determined from actual survey across Section 30. The rye field shown in Section 30 is irrigated from the Parker Ditch, as shown by the tabulation marked Exhibit 118, which was made up from the data found by the plane table survey and also from other observations. There are two ditches, one above the Sodergreen High Line running through Section 36 shown on this same sheet, the upper one
2822 not being in use and the excavation having been levelled. These two ditches actually exist. The upper ditch is about the same size as the Sodergreen High Line Ditch and is bridged

where it crosses the county road, and the excavation was
2823 not completed so as to have permitted water to run through. I have been at the head-gate of this ditch but cannot state positively where it is located. It is above the survey.
2824 No part of Section 30 shown on this sheet lying north of the county road shows any signs of being irrigated, although the ditch runs through that portion. The meadow shown in the eastern part of Section 29 on Sheet 1 is part of a field belonging to Mr. Sodergreen, who irrigates land from his own ditches and from the Parker Ditch. Whether he irrigates land from the Popp and Pahlow Ditch I do not know, as he is a large land owner and I am not familiar with all of his lands. The slough shown on Section 32 upon this sheet was located by actual plane table survey and is accurately located on the sheet. The 68 acre
2825 tract on Section 36 on Sheet 1 designated "third class meadow" has knolls in it and is more uneven than land further down the river. It is irrigated pasture land and was not mowed in 1913 and contains no alfalfa, there being no alfalfa in Section 36. The land on both sides of the road leading from the county road to the headgate of the Pioneer dam on Section 36 is
2826 of the same character, being all third class meadow. It was not producing half a ton of hay to the acre at the time the survey was made. The land north of this road is irrigated from the Sodergreen High Line Ditch. The road to the
2827 Pioneer dam was located by survey. The land in Section 29 on Sheet 1 marked "pasture land" has no surface irrigation, with the possible exception of a little seepage near the ditch. I would not say that the land in this section designated "second class meadow land" is among the best of the meadow lands on the Laramie River. This tract is full of boulders, and further
2828 down the river the land is more level. None of the land shown in Section 32 on this sheet which is designated as pasture land is irrigated. The Fischer and Riverside ditches pass through this area in a cut, and the land is not irrigated.

2830 Cross-examination by Mr. N. E. Corthell:

I know of no ditch irrigating about 200 acres in the south half of Section 29 on Sheet 1 by the name of the Jones and Norton Ditch. These lands are shown on the plat to be irrigated,
2831 and they are irrigated in part from the Sodergreen Ditch and in part from the Popp and Pahlow Ditch, the former irrigating most of the area. Certain lands are designated on the plat as "third class meadow," "second class if irrigated," this designation being used in certain cases where the lands had once
2832 been irrigated and would become second class meadow land if they were now irrigated for a proper period.
The large triangular area in Sections 34, 35, and 3, on Sheet 3, is designated as pasture land because if it had ever been irrigated it had reverted to its original state. There may have been
2833 laterals across the land but no system of irrigation, and if water was run across the land it was only through depres-

sions and it was not spread so as to increase the growth of
2834 grass. The river does not run into Section 35 shown on this sheet. I meandered the stream at every bend and it does not touch the section as shown by the corners found on the land.

2835 All of the lands upon which symbols appear shown on Sheet 4 were covered by the plane table survey. The corners of Section 13 on this sheet were fixed by survey and no plane table work inside the section was done, as all of it was pasture
2836 land. That part of Section 18 on this sheet showing symbols was mapped by means of the plane table survey. There may be laterals in this section which are not shown on the plat and there may be a lateral irrigating land north and west of the most northerly ditch shown on the plat. I know of no lateral from the Popp and Pahlow ditch entering the section near the northwest corner and extending southerly and easterly in the east half of the section, but there may be such a lateral. There might
2837 also be a lateral from the Pioneer Canal entering the section. I have not attempted to show all the laterals. The Havenek land in this section which is credited to the Fischer Ditch might be irrigated from the Popp and Pahlow Ditch, but
2838 there can be no mistake in the acreage irrigated as that was determined by the survey. There was not as much as 70 acres nor more than 38 acres of oats growing on the land in
2839 Section 18 owned by Harvenek. I did not locate on the map the buildings and improvements of Harvenek, Larson, and Lund, which are on this section.

I have not shown the improvements of Mr. Olsen on Section 24 on this sheet. I do not know whether any land is irrigated in the northeast quarter of Section 24 as that was beyond the extent of the plane table survey, which extended only as far north as the symbols indicate. This is also true of the Chris Olson land in the northwest quarter of Section 24, but any irrigated acreages in Sections 18, 24, or 13 beyond the plane table area are included in our summary of irrigated areas, taking the figures supplied by the plaintiff's witness, Mr. Meeker. This is true of all lands not
2840 covered by the plane table survey. Where the symbols extend clear around the tract it indicates that the whole area is of the character indicated, and where no symbols appear it indicates that the survey did not extend over that part of the land. The improvements of Mr. Grable upon Section 17 of this Sheet 4 are not shown on the plat. The oat field in this section is as good as there is on the Laramie Plains on the Big Laramie River, but I do not know what the yield was, although I endeavored
2841 to get the threshing record. These oats were four inches high on June 16th. There was no land irrigated southwest of the Fischer Ditch on Section 17 to a sufficient extent to increase the growth of grass, and there were no signs of this area having been plowed. I noticed no barley to the northwest of the
2842 county road on the Grable land in the field marked "oats." The balance of the land in Section 17 lying north of the

road is second class meadow, being 195 acres in area. There is no oat field south of the road in Section 17 excepting as shown on the plat.

The location of the Caldwell Ditch in Section 32 on Sheet 5 was determined by stadia measurements. It runs south of the buildings and not north of them, the ditch running north of the buildings being a lateral of the Caldwell Ditch which I followed out from its source. There is a division of the Caldwell Ditch near the buildings and we took the upper line and ran it out, not following out the lower line which runs north of the King buildings. I am certain that there is a physical connection between the Caldwell Ditch and the ditch running south of the buildings on Section 32. None of the land designated as pasture and greasewood in the southern part of Section 32 on Sheet 5 is irrigated, and if it was ever irrigated it shows no signs of such irrigation now. The land in Section 25 on this sheet consisted of knolls and irrigated meadow, about half of it being irrigated, but all of it was included in the tabulation as third class meadow. Some of the land in this section is irrigated from the Mansfield Ditch by means of a lateral which I followed out. Some might be irrigated from Riverside No. 2 Ditch, the water being carried across the Mansfield ditch, but I do not know whether such is the case. The land in Section 31 on Sheet 5, lying south of the King Ditch, is full of greasewood and was not irrigated to any extent in 1913. None of it is heavily sodded land. I do not know whether the land in Section 36 on Sheet 5 lying between the Mansfield Ditch and the Riverside No. 1 Ditch is irrigated from either of those ditches or from the Riverside No. 2 Ditch, but I believe it is irrigated from the Riversjde No. 1 Ditch.

Section 16 shown on Sheet 7 consists of pasture land, excepting the 66.8 acre area in the southeastern part. At one time the major portions of this land were irrigated, but the laterals are in such condition that they are not capable of carrying water. The land has reverted to its original state. No hay was cut on this part of the section unless it might be a very small amount near the edges of the few ponds on the land. I found no irrigated land in Section 9 on Sheet 7. I found no irrigated land in the west half of Section 11 on the sheet on the north side of the river in the river bottom. On the south side I found 39 acres of meadow in the east half of the section. Near the river, some of the land is sub-irrigated. None of the land in the east half of Section 14 on Sheet 7 lying between the Bush and Holliday Ditch and the Haley and Hogue Ditch is now irrigated, if any of it ever was. We took no elevations of this tract to ascertain whether any of it was under the Haley and Hogue Ditch. We depended upon U. S. Geological Survey bench marks for elevations.

The Caldwell Ditch is what I would call a high water ditch, and at the present time the head-works have been damaged by high water in the river so that water cannot be delivered through the ditch. If a dam were put in water could be taken out of the river at all times.

The land in Section 21 on Sheet 8 designated "pasture land" is not irrigated. It lies on the slope from the top of the bluff to the bottom land and not mostly below the bluff, and is not irrigated from the Fischer Ditch. The land on this sheet lying south of the
2854 Caldwell Ditch receives some water flowing south from the Caldwell Ditch, but no great amount of water flows south from the Haley and Hogue Ditch. None of the land in Section 28 lying south of these ditches is classified as irrigated. This is also
2855 true of Sections 27 and 23. This land south of the ditches is higher than the ditches and there is no indication that it is irrigated in former years. The land in Section 22 lying between the Haley and Hogue Ditch and the Bush and Holliday Ditch shows no indications of irrigation, and if there were ever laterals on the land they are obliterated. I do not remember that there are any laterals in Sections 23 and 27 south of the Haley and Hogue Ditch. Only the land designated as "Oat stubble" in Section 4 on Sheet 9 shows signs of having been irrigated.

2856 There was a lateral running south of the Pioneer Lateral in Section 29 on Sheet 10, and there was not sufficient distribution of water to classify that land as irrigated land. There was not sufficient growth of grass to indicate that it had been
2857 irrigated in previous years. Neither is there any irrigated land in that part of Section 29 northwest of the lakes shown on the plat. This lake was not meandered. The portion of the southeast quarter of Section 30 shown on this sheet which is designated as pasture land is not irrigated, and shows no signs of having been irrigated in previous years. The word "pasture" in the central part of Section 25 on this sheet relates only to that portion of the
2859 section covered by the plane table survey as indicated by the symbols and not to the balance of the section. I do not recall whether the balance of the section has any irrigated land in it or not. The same is true of Section 24. Of the land in the east half of Section 19 lying south of the Pioneer Ditch, only the al-
2860 falfa and plowed land is indicated on the plat as irrigated, and the balance showed no indication of sufficient irrigation to be classified as meadow land. There might be a small area of alfalfa in the grain field indicated in the southeast part of
2861 Section 20 on this sheet. In Section 20 as in other cases, lands which are marked as pasture might at one time have been irrigated, but if so no present indication of irrigation appears and the land has reverted to its former condition. All of
2862 Section 1 shown on Sheet 11 is pasture land and also all that portion of Section 36 outside of the area covered by the symbols. The south canal from Lake Hattie is correctly located on Section 6 and is not extended farther to the north because the survey did not go farther. That portion of Section 31 lying east of the Pioneer Lateral is not irrigated but it may possibly have been irrigated in former years as there is a piece of plowed ground in
2863 Section 32 which receives water through Section 31. I could see no indication of irrigation of the land in the enclosure northwest of the river in Section 32, and found no crops upon it. I

found no potato field or wheat field in this area and I do not
2864 recall any lateral from the Pioneer Lateral extending into it. The Hutton Ditch from Sand Creek shown on this sheet does not enter Section 5 again after running into Section 32.

2865 I do not believe I have made a mistake between the Hutton Ditch and the Dowlan Ditch or a lateral from the Dowlan Ditch in this area as the Hutton Ditch is on higher land. There may be a lateral from the Dowlan Ditch entering this tract, however. When a rodman
2866 picked up a ditch he would follow it out to its end so as to avoid the confusion between ditches. The lower end of Hutton Ditch is in very bad state of repair. Antelope Creek
2867 runs through Sections 30 and 19 on Sheet 13 but is not shown because it is a very small stream which I did not recognize as a creek at the time. I do not know of any irrigation from it, but did not follow it up outside the area of the survey.

2868 85.8 acres were irrigated in Section 16 on Sheet 14, the oat field containing 53.3 acres as determined by stadia measurements. The field contains more than 40 acres I am certain,
2869 but if it contains only 40 acres the discrepancy would be more than is allowable in connection with such surveys. There is not as much as 200 acres of pasture and 60 acres of meadow land irrigated in that section. We found two ponds in this section which might possibly become one in case of high water.

2872 The entire area of the untinted land in Section 26 on Sheet 15 is unirrigated pasture land. Whether it produced any hay in former years I can not say.

2874 That part of the southeast portion of Section 30 on Sheet 18 designated "pasture land" is not irrigated pasture land, but alkali land which I believe was thoroughly moist when I was there in August, and was being used as pasture at the time.

2875 The plot shown as alfalfa land in Section 31 on Sheet 19 was alfalfa land and did not have the appearance of having been plowed up and sown to grain in 1913.

The Walcott Ditch is correctly located through Section 14 on Sheet 20 and the two pieces of alfalfa land are correctly located and the sizes accurately shown, and the barn and house are on the northwest quarter of Section as shown. I do not believe that there is any waste ditch from the Pioneer Canal across this section.

2879 I know of no freshly plowed ground in Section 11 owned by Mr. Salmon and seeded to alfalfa in 1913. There was an old plowed piece near the road which I passed a number of times in June and July, but I saw no signs of any alfalfa.

2882 The area in Section 12 on Sheet 20 near the middle of the west side of the Section marked as pasture land was not sufficiently irrigated, if irrigated at all, to be considered as meadow. I do not know whether any of it was cut over in 1913. I do not know what the hay yield was on the portion of the section classified as second class meadow. That portion of the southeast
2883 quarter of the section lying north of the river designated as pasture land was not irrigated to an extent sufficient to classify it as meadow land.

2884 That part of Sections 20 and 29 lying west of the Laramie River shown on Sheet 21 was used for pasture for stock, being held at the stockyard, and was not irrigated to any extent and is classified as pasture. If any water has ever been put on the 2885 section it was not sufficient to increase the growth of grass. I was on this land after the usual irrigation season for meadow lands. Gravel for stock cars is procured from sec- 2886 tion 20 at a point possibly one-third of a mile from the river, approaching to within about one-twelfth of a mile from the river. I do not recall any waste ditch from the end of the Pioneer Canal in Section 18 on Sheet 23 leading to the river. The 2887 method of conducting this plane table survey was to establish stations from base lines, and from these stations take sights to the various rodmen in different directions, these directions being platted on the plane table. As many stations were established 2889 as were necessary in view of the conditions found and as many sights were taken from each station as was practicable. In some instances as many as 40. The maximum length of the sights was about 2800 feet, but the length would depend on the conditions, the average being 800 to 1000 feet. The wind blew perhaps three days out of four, mostly from the west, and I re- 2890 call t' ree days when we had to stop work on account of the wind. I had three or four rodmen in the party the whole time, and they followed my instructions in determining the points at which they would set up their rods. I have not shown all 2894 of the ponds nor all of the large ponds in this area upon the plane table maps. There are a great many small ponds in the country and a number of large ones which I recall but which are not shown. Some of the ponds which are used for the 2897 storage of water are being turned into reservoirs and water is being diverted from some. Practically all the long ditches waste into ponds. I made no effort to estimate the amount of water wasted by being turned into these ponds.

GEORGE P. WOODALL, continued.

Redirect examination by Mr. Fred Farrar:

Plane table survey as shown by plats in Defendant's Ex- 2899 hibit 114, includes main body irrigated land Laramie Plains region from point at or near Woods Landing, up towards Wyoming-Colorado line, extending thence down the course of river to point six miles below Two Rivers, and also up Little Laramie river from Two Rivers to line one mile west of Sprague's Lane. Lands which I mentioned as lying to north of main traveled highway extending up and down river above Laramie City, which are not covered by plane table survey, have been shown by me from transit observations and reconnaissance. These last mentioned lands were not included in plane table survey, owing to fact they were scattered, small areas that would require considerable time and great expense to make survey, and constituted but a small part of the total area of the Big Laramie Valley. Regarding some of these isolated tracts

I will state that I made no attempt whatever to show them on the plane table survey. Others which I have shown, were brought into plats from transit measurements and from reconnaissance. Lands on Little Laramie River above the line one mile west of Sprague's Lane, were covered by plane table survey, but were not platted. Exhibit 114 does not purport to show them all. The last mentioned area does not include James Lake area. That area is not shown on plane table survey. It was taken by Mr. McAnelly.

It was not design or purpose in making plats to show lines of laterals or lateral ditches. I designed to show main body of irrigated land included within those lands which would be brought under irrigation by extension of main ditch through lateral.

It was not my intention to show full length of South Canal of Lake Hattie Outlet on Sheet 11.

Plats appearing on Exhibit 114 were not designed as survey of ditches, except as they were incidental to showing irrigated area.

2901 I was interrogated on cross-examination with reference to specific areas of land which I designated as pasture and which question implied were thoroughly turfed. As matter of fact territory given outside of high lands and aside from greasewood lands, is all covered with a turf. At times turf is heavy. Presence of turf would not render land agricultural or hay land.

S. E. 1/4 of Sec. 30, Tp. 16 N., R. 83 W., a portion of which appears on sheet 18, is heavily alkalied. It is in a condition of seepage.

Different and duplicate corner stakes prevail frequently in Laramie Plains. In several instances I found that condition, especially along Big Laramie River near Hart Ranch. Surveys and line will accordingly vary according to the particular stakes from which they are made, assuming use of a stake. With reference to the question as to whether or not all the sections were not correctly marked with stones by Government Survey will state, that Government Survey in West is generally in poor condition. Very poorly surveyed. Markings in great many instances are obliterated and cannot be found

2902 I have positive assurance that many section corners were located and established by counting revolutions of wheel of wagon under direction of person sitting in wagon with pocket compass, to give directions. I was not attempting to make a land survey for purposes of determining lines and section corners in making plane table survey. It would not be surprising if my lines as shown on plats might vary somewhat from other surveys which may have heretofore been made in Laramie Plains region. I would state that the plane table survey is very much ahead of measurements by tape from standpoint of accuracy.

In plats on Exhibit 114 I have not attempted to note small ponds.

Interrogatories on cross-examination relative to railroad grade on sections 11 and 12, Tp. 15 N., R. 73 W., Sections shown on Sheet 20 or Exhibit 114, was old abandoned railroad grade which formerly ran from Laramie to Alkaline Lakes to southwest. There is no railroad in existence there at this time.

Classification of lands, particularly of meadow lands, into first, second and third classes was made by myself. Of necessity this involves personal judgment. It is possible that what I might classify as poor meadow might, in the judgment of some person from Wyoming, be considered good meadow. In other words, I was
2903 not attempting to assume the Wyoming standard of values in this classification but merely my own. In making the classifications of these meadows I based my conclusions on conditions of Laramie region alone, not taking into consideration any other localities for comparison. It is possible that some of these areas which I have classified as pasture land, some other person, either for purpose of this suit or otherwise, may have seen fit to mow later in the season.

Redirect examination continued by Mr. Delph E. Carpenter:

2904 Acreage which might possibly have been irrigated from James Lake Outlet of James Lake enterprise, was not included in total figure for irrigated acreage given by me in direct examination for the Laramie River above canon below Wheatland Reservoir No. 2. There was practically no irrigated acreage
2905 under James Lake in the year 1913. There had been previous attempts at irrigation and reclamation. In a majority of cases, the people who had previously been attempting to farm that land had left the country and gone to other places. This was evidenced by abandoned ranches.

In total irrigated acreage given, I included acreage watered from Lake Hattie enterprise in 1913 by North Canal. I did not include in that acreage irrigated by that canal any land over which water flowed and wasted from Lake Hattie North Canal during 1913. I did not include any acreage thus irrigated or overflowed by water in area lying east of Big Basin.

Figures for acreage would not be changed even though upon some sheets in Exhibit 114 a particular tract of land is designated as irrigated from some particular ditch, when in fact it is irrigated by some other ditch. The error would be compensating. Acreage under one ditch would become greater and by some amount under other
2905 ditch it would be correspondingly less. In the end, it would neither increase nor decrease the total acreage included within the area covered by plane table survey.

I heard old ditch noted in Sheet 1 of plane table survey, upon which particular stress seems to have been placed by counsel for Wyoming, and by me designated as "ditch not in use" as the Murphy and Collins Ditch. It is line of excavation crossed by road. Road crosses on earth at this place. Whether it was filled in or whether or not original earth was never excavated, I don't remember. Water could not flow through ditch. In any event, so far as irrigated acreage is concerned, it makes no material difference whether there happens to be small acreage at upper end of this canal irrigated by it rather than by Mr. Sodergreen's High Line Ditch. On same sheet on Section 29, land lying north of Mr. Sodergreen's

house and designated "pasture land," is land with water plane very close to surface. It comes from canon between mountains. Water is close to surface. Seepage appears on this land from Pioneer
2906 and Popp and Pahlow and other canals. There is a growth of native grass and some sage. It is close to mouth of canon and there are large boulders all through that country. At any rate it is used for pasture. Same condition would prevail with relation to NE.¼ of Sec. 32 in the part marked "pasture" on the Durant place. This is heavily covered with boulders and is heavily gravelled in that portion of section. It is not covered with a luscious growth of grass.

Referring to Sheet 3, Exhibit 114, Section 35 and particularly lower portion of that section, concerning which counsel interrogated relative to river crossing portion of the section, while on plane table sheets river does not appear to enter section, will state that stream does not enter Section 35 as determined by section corners on that section. Government stone was on southeast corner of that section, although it does not appear to be in line. If United States Topographic Sheet happens to show river in that section, that is no sign that river does in fact enter the section. I was in position to observe the location of the corners in that locality. I made my sur-
2907 vey from those corners. The map accurately shows the conditions. The United States Geological Survey might have taken another corner further south than the one which I took. River goes near to south line of the section.

I stated there was no evidence of any irrigation in vicinity designated as greasewood pasture on Sheets 5, 6, 7 and 8. If water has been turned on any part of that land in years past, there is no evidence by marked increase of growth of grass that would attract an observer at this time. There is no indication of any irrigation having taken place.

I checked over testimony given by Mr. Winkler, a witness for plaintiff, who stated had been in active charge of this ranch for many years. Total acreage as ascertained by me in plane table survey as irrigated on Riverside Ranch, as compared with total acrege as given by Mr. Winkler, showed difference of 674.2 acres. His total was 10,372 acres, including all classes of irrigated land. My total was 9,697.8 acres. Out of this large area of irrigated land that is the only difference between our figures. It is a fact that Mr.
2908 Winklers figures also dealt with that portion of Riverside Ranch covered by areas noted as grease-wood on my sheets.

There are quite a number of ditches on the Riverside Ranch. They cross and commingle one with another from time to time. It is not a matter of easy location to ascertain these ditches, with the numerous laterals that run out from them. It would not be surprising if an observer should designate a ditch by wrong name in some portion of tract.

Mr. Richard obtains his water supply from Hoge and Haily Ditch and Bush and Holliday Ditch. The Hoge and Hailey Ditch diverted water during 1913. Bush and Holliday Ditch did not, for

reason that ditch was not in condition to carry water. Headworks were in such condition that water could not be taken down into ditch. Dam was not in place. Water could not be diverted into ditch. It is what is known as High Water Ditch.

2909 Lands lying west of Laramie River on Sections 20 and 29 as shown on Sheet 21 of Exhibit 114 and designated as "pasture land," are low lands. Their surface is not far above the water plane of the river. They are of gravelly formation, river deposits. There is more or less seepage in that vicinity and especially on bluffs to west. The natural drainage from the fields irrigated by the Pioneer Canal tends towards river and there is a general leaching out of alkali into the lower lands. A strip of that land extends on west side of river up through this region. There is a tile drain constructed to drain these lands by the Agricultural College. I do not know the exact location. That strip of seepage and alkali lands along river bottom runs past Wyoming Experiment Station Farm. Do not remember how far it goes.

Plats designated as "alfalfa" on Sheet 20, Exhibit 114, in Section 14, which seemed to give counsel concern, and also some land designated as "stubble" lying between these two tracts of alfalfa, will state that there was some alfalfa growing in the stubble, but not enough to classify the land as alfalfa. The growth of alfalfa

2910 was very irregular and sparse. In fact, my recollection of alfalfa field there is that it was poorest on whole Laramie region. I refer to tract designated as alfalfa. There was some scattering alfalfa through stubble. It is fact that owing to presence of few scattering alfalfa plants, some observers might classify it as alfalfa lands. The irregularity of the margins or borders of the lands of the various tracts noted on Sheet 20 is due to fact that there is small natural valley that goes down through there and has irregular boundary lines. There is apparent seepage down through that tract. There is a series of ponds through this locality. The seepage land that gave a growth of grass was designated as "meadow." Where grass was too scattered for meadow I designated it as "pasture." If owners of that land were to put more water upon it, it would bring more alkali to the surface at that point. The growth of grass would be less.

In signaling men in plane table survey, when men were close enough to hear my voice, signalling was done by voice, except when wind was against me, or distance too great, in which case signalling was done by individual flag. Rodmen kept a memoranda of their work as we went along. They had loose leaf note books. Books served as check on my reading with instrument. Each day we checked over our readings from instruments with notes made by rodmen. If we found descrepancies we went back and discovered which one was wrong. Throughout my work, notes of my rodmen checked with notes kept by me.

On Little Laramie River I checked over Mr. Ernest's testimony as to acreage in that valley and particularly as to acreage on

2912 his ranch. I found his estimates of acreage to be very high. Remember man by name of Titus testifying in Wyoming

suit relative to production of hay in Little Laramie Valley, in which case he testified he got up upon the hills and made a horizon survey by his eye and then told about the number of tons in the valley. His estimate of the tonnage of hay in that valley was about 35% too high, assuming that all the acreage of the Little Laramie Valley went as high as the Bath hay, .6 tons per acre. I would say that was not a reasonable degree of accuracy of testimony in a case of this magnitude.

GEORGE P. WOODALL.

Recross-examination by Mr. N. E. Corthell:

2912 Most of the places where I failed to find government corners were along the lowlands, but I do not recall how many
2913 I failed to find nor any record of them. I would say that there were as many as ten corners missing. I do not know definitely that any of the original surveys in this region were made with wagon wheel measurements or by pocket compass courses. I have no notes relative to the irrigated lands under the James Lake system, as that was not under my supervision.

Redirect examination by Mr. Delph E. Carpenter:

By river bottom land I mean the low land lying in vicinity of river as compared with high bench land on the higher lands.

(The following admission was then made:—It is admitted by counsel for Wyoming that an appeal or proceeding in error has been perfected from decree of district court in and for Laramie, County, Wyoming, and that the appeal or proceeding in error *were* perfected taries were adjudicated, a copy of which decree was offered in evidence over the objection of defendants as Exhibit N, by State of Wyoming, the appeal being to the Supreme Court of the State of Wyoming, and that the appeal or proceedings in error were perfected on or about January 4, 1914, but that no supersedeas has yet been perfected from the Supreme Court.)

(End of Transcript Vol. 6—Defendants.)

2916 R. M. GARDNER, a witness for Defendants.

Direct examination by Mr. Delph E. Carpenter:

Photographer. Ralph E. Gardner, my brother, was associated with me during year 1913. Was engaged by State of Colorado to perform services in my line during summer of 1913 in making pictures showing agricultural development under Larimer County Canal and Larimer and Weld Canal in Weld and Larimer Counties, Colorado.

We laid out a highway under each canal and took a picture on each 160 acre tract on both sides of the highway. At the same time we obtained data from farmers and tenants on the land by questioning them. We kept memoranda of dates on which each individual photograph was taken.

Defendants' Exhibit 119 is an album of photographs taken under Larimer County Canal by Ralph E. Gardner and myself.

2917 The particular highway along which these photographs were taken is shown with dark green inked line marked on either side by numbers of pictures on government map in front of album. By government I refer to topographic sheet of United States Geological Survey. I took portions of those sheets and mounted them in this album as a map. Each number appearing in red ink on this main line indicating the highway, indicates a picture following in the book with the same number. In other words, one observing any photograph in this album, may ascertain geological location by reference to number as it appears in red ink on map.

In legends beneath each picture the number of the picture is first noted, then the date and the description of the lands by government subdivisions. We carried with us topographic sheet by the United States Geological Survey while making these photo-

2918 graphs. We used these sheets in checking descriptions given us by the farmers.

Highway under Larimer County Canal, as indicated by map in Exhibit 119, was selected to show heart of irrigated district under this canal through its length. Westerly extremity started near Long Pond near Fort Collins and ran from thence in easterly direction under Larimer County Canal to Olive Branch schoolhouse northeast of Ault. Larimer County Ditch is shown in darker ink outline than other on map. In making this line heavier, I traced the original marking of the Larimer County Canal as shown on the topographic sheet. The highway selected is a well-traveled road. This highway does not follow a directly east and west course, but drops to follow line of canal, showing central portion of irrigated district under that canal..

In this photographic survey no attempt was made to obtain photographs of all the farms or particular crops irrigated by this canal. These photographs were limited mostly to the agricultural

2919 development. For this album there were no photographs taken on lands other than those lying immedately adjacent to and along this one particular highway.

The legend appearing in the front of the album reads as follows:

"Agricultural development under Larimer County Canal."

"This album contains photographs taken by R. E. Gardner and R. M. Gardner of Greeley, Colorado, during year 1913."

"It illustrates the agricultural development on each 160 acre tract on both sides of only one highway through the territory irrigated by the Larimer County Canal of the Water Supply and Storage Company, with the exception of the tracts marked 'X' on the annexed map."

"This highway along which these photographs were taken is indicated on the annexed map. Each photograph bears a number corresponding to a like number on the map, which shows its location."

"Only occasional photographs of improvements appear, owing to

the fact that particular attention has been given to crop conditions. For the same reason, street scenes in Ault have been omitted."

"The date of the taking of each photograph is indicated and the crop development at that date may be ascertained accordingly. The data relative to plantings, yields, ownership, etc., was obtained by inquiry from farmers on the land."

"It is intended to display as nearly as possible the crop development along one highway through this area as it would appear to one traveling along the road. In several instances, more than one photograph was taken on the same tract to better indicate the conditions."

2920 That legend tells the truth. It is from my data. It was prepared by others in the State Engineer's office, at Denver, and then approved and checked and corrected by me.

(Defendants' Exhibit 119, album showing agricultural development under Larimer County Canal, offered in evidence.)

Freehand lettering at bottom of pictures was not done by me, but the legend was prepared by me from my data for this purpose. I have checked over the album since the freehand lettering was put on and found that the legends correspond with those given by me and are correct. In each individual instance, these legends state the facts as I ascertained them. These legends tell what I found from farmers and noted on my map.

The purpose of this album was to show crop development and not street scenes or residences of farmers. At times I took
2921 photographs of residences. As a rule I did not.

I also took photographs along highway situate beneath Larimer and Weld Canal or Eaton Ditch, and through lands irrigated by it. I obtained data for that album in same manner as I obtained data for Larimer County Album, concerning which I have just testified. The same plan was followed.

Defendants' Exhibit 120 is an album of photographs taken by R. E. Gardner and myself during year 1913, under Larimer and Weld Canal. There is a map attached of a similar nature and prepared the same as map attached to Exhibit 119. The highway along which these photographs were taken begins under Larimer and Weld Canal east of Fort Collins at what is known as Plummer school-house and beet-dump. This highway, then, extends in easterly direction through towns of Severance and Eaton, Colorado, to a point six miles east of Eaton. That highway is located
2922 through about central portion of land irrigated by Eaton Canal. It includes newly reclaimed lands by that canal east of Eaton; lands irrigated by extension of Eaton Ditch and newly developed.

First five photographs were made at Fort Collins Sugar Factory.

Legend appearing in this album and on front page there reads as follows:

"Agricultural development under Larimer and Weld Canal."

"This album contains photographs taken by R. E. Gardner and myself during year 1913. It illustrate- the agricultural develop-

ment on each 160 acre tract on both sides of only one highway through the territory irrigated by means of the Larimer and Weld Canal, sometimes known a sthe Eaton Canal, with the exception of three 160 acre tracts, which are unbroken sod, and are indicated on map by 'X'."

"The highway along which these photographs were taken is indicated on the map which is on the reverse side of this leaf. It is but one of many highways that could have been selected."

"Each picture bears a number which corresponds with the same number appearing on the map and indicates the location of the scene with relation to the road."

"The photographs begin at the Fort Collins Sugar Factory and continue as indicated on the map to a point east of Eaton, Colorado."

"Only occasional photographs of improvements appear owing to the fact that particular attention was given to crop conditions. For the same reason street scenes in town of Eaton were omitted."

2923 "The date at which each photograph was taken is indicated and shows the development of the particular crop on that date."

"The data relative to plainting, yields, ownership, etc., was obtained by inquiry from the occupants of the lands."

"It is not intended to illustrate any considerable portion of the development under this canal, but only that which would be apparent to one traveling along the highway indicated."

"In several instances more than one picture was taken on the same tract in order to better illustrate the subject in hand."

"The Larimer and Weld Canal is also designated as Eaton Canal in this and the Industrial Album. This canal is commonly termed the Eaton Canal or Eaton Ditch, owing to the fact that it was constructed under the supervision of ex-governor B. H. Eaton, who was also an extensive owner of land reclaimed by this canal."

"In designating the ownership of lands in this album, the name Bruce G. Eaton, son and principal heir of ex-governor Eaton, is given in lieu of the Eaton estate, owing to the fact that the Eaton estate lands, as well as the private holdings of Bruce G. Eaton, are generally spoken of as belonging to him. A. J. Eaton lands are not a part of the Eaton estate, and neither the estate nor Bruce G. Eaton are interested in them, although such lands are, in the main, under the Larimer and Weld Canal."

"Those lands lying east of Eaton and noted as newly reclaimed are irrigated by means of an extension of the Eaton Canal, constructed during the past eight years."

The data given in this legend has been checked and is correct. The facts therein stated are according to information gathered by myself and brother.

2924 Legends appearing beneath various pictures consisting of number of photographs, date when taken, subject and government description, are true according to facts as ascertained while making this photographic survey. Have checked them over with originals and found them to be correct.

Throughout Exhibits 119 and 120, where, for example, beet crops

were given as 14 to 15 tons per acre, to make it more convenient in striking average between 14 and 15 tons, I used the fraction ½. I did this to save space in legend. Where fraction occurs, it indicates that farmer gave me his crop yield as between certain numbers.

(Exhibit 120, album of photographs showing agricultural development under Larimer and Weld Canal, offered in evidence.)

In taking pictures shown in Exhibits 119 and 120, except where otherwise indicated, I took a picture on every 160 acre tract
2925 on both sides of road. I did not select particular tracts over whole area covered by ditch but only along one highway. In Larimer County Canal album, Exhibit 119, there are only two omissions along highway. This covered ground above irrigation on a knoll. I was instructed to go out later and take a picture of these tracts, but weather did not permit it. In Exhibit 120, under Larimer and Weld Canal, there are only three omissions along the highway. These 160 acre tracts were omitted for same reason as given under Larimer County Canal album.

I was directed to compile from photographs taken by my brother and myself during summer in connection with same work, an album showing various agricultural industries in irrigated area in Cache la Poudre Valley, and particularly along Larimer and Weld and Laramie County Canals.

Defendants' Exhibit 121 is an album of photographs known as the "Industrial Album." With exception of six photographs which were taken by F. E. Baker prior to 1913, these photographs are all our own production and taken in 1913. Legend in front of
2926 album on first leaf reads as follows:

"Industrial Album."

"The photographs contained in this album (with the exception of Nos. 160 A-B-C-D-E and F, inclusive) were made by Ralph E. Gardner and Roy M. Gardner of Greeley, Colorado, during 1913. They were taken almost exclusively upon lands under the Greeley Number Two Canal, the Larimer and Weld Canal and the Larimer County Canal, for the purpose of showing the development of each crop from early growth to harvest or market and to illustrate the fattening of live stock during the winter months."

"This album contains a large number of duplications borrowed from the Larimer and Weld and Larimer County Canal albums and used to better illustrate the industry. Photographs Nos. 160 A-B-C-D-E and F were made by F. E. Baker during years prior to 1913."

"Photographs of towns and cities have been avoided wherever possible."

"The pages devoted to farm homes contain photographs giving a general idea of the classes of homes in the valley. Farm buildings occupied by tenants are not given in this line of pic*ut*res."

"No attempt has been made to obtain the photographs of all items of any one industry, for example, photographs of all feeding lots, etc. in the valley, but only of the typical views so as to give an idea of each crop or industry."

That legend was checked by me and approved. The facts
2927 as therein stated are true. The legends appearing beneath pictures were taken from data obtained by me and my brother while taking these photographs. For example, in the Industrial Album the alfalfa crop; it has been shown from first growth where it is protected by some grain crop through different cuttings, harvesting, baling and feeding of the last growth to live stock. Also feeding of hay to stock in corrals. Relating to grain crop, each grain crop is shown separately in its first growth, then through harvesting and threshing, through elevators and mills to the finished product. Fruit has been shown in the harvest season mostly. Garden produce, such as onions, is shown from growing of seed through cultivation of onion and harvesting. Cabbage is shown early in small plants, to medium stage and harvest. Other garden products are shown growing and harvesting. The last of garden products are shown in pictures of canning factory and additional buildings. Potatoes are generally grown on alfalfa ground. I started with photographs of breaking alfalfa ground. Potatoes are then shown growing through their early stages, then in blossom, then deadened vines and at harvest. Then we find potatoes at last being hauled to market and in the potato warehouses.

2928 Sheets containing 160 A to F inclusive, are photographs taken by F. E. Baker. He was a Greeley artist. They illustrate potato as grown in years previous to 1913.

Sugar beet industry is very extensive and we show that in all its aspects. First photograph was taken June 20, 1913, showing beet when it is first cultivated and during cultivation when second weeding and second hoeing was made. We next show irrigation of beet and beet before it is ready to be dug. We then show harvest of beets. I have shown several classes labor employed in harvesting beets, in particular Mexican, Irish, German, Japanese, and German Russians. In harvest of beet crop pictures I show topping of beets by hand labor, hauling, digging, siloing or piling beets until factory is ready for them. Silos are in both field and at the dump. I illustrate various classes of silos particularly on farmers' lands and
2929 at dumps as well. I have shown the sugar factories in this community with beet dumps and conditions surrounding the factory including feed lots and pulp silos.

In sheep feeding industry, I have shown first grazing on last growth of alfalfa, then in corrals where they are fed alfalfa, grain and beet pulp.

In cattle feeding industry I have shown them grazing on stubble of alfalfa and beet tops, then in corrals where they are fed hay and beet pulp covered with molasses and some grain.

Farm homes which are typical of the valley have been shown, some of very modern construction, having electric lights with modern conveniences.

In making this industrial album I have taken pictures from Exhibits 119 and 120 in some instances. The other photographs were taken under the Greeley No. 2 Ditch and surrounding community the Larimer County and the Larimer and Weld Canals.

Potato yields are designated in bushels. Potatoes are dug with machine digger and gathered by hand. They are sorted by machine, either in the field or potato celler later in season. On practically every farm I saw a potato cellar. Each farm would be pro-
2930 vided with a cellar large enough to hold the potatoes raised on it. The interior pictures of warehouses where potatoes were on storage were made by flash light and time exposure.

(Defendants' Exhibit 121, Industrial Album of Cache la Poudre Valley, offered in evidence.)

In making these photographs my brother and I commenced work June 20, 1913, and completed it December 23, 1913. Photographs were mounted by myself. They were printed from our original negatives. I have checked photographs with negative to see that they are correct. I have checked over the legends in Exhibit 121 and they are similar to those compiled by myself from statistics gathered from farmers. They are true according to facts gathered by me.

2931 LOUIS G. CARPENTER recalled.

Direct examination by Mr. Delph E. Carpenter:

During the time I have been engaged as expert in this case, as well as at previous times during my residence in Colorado, I have had occasion to visit Laramie Plains in Wyoming for purpose of comparing that region with Cache la Poudre Valley from standpoint of possible agricultural development. I have, of course, been very well acquainted with Poudre Valley and have been in the Laramie Valley a few times prior to 1909 and since then quite a number of times. Of course in all these cases I have been very much interested in the possibilities and indications of development not only of these valleys, but any valleys I happened to visit. During the years I was Director of Experiment Station at Fort Collins, and for nearly ten years previous, was in constant touch with the station at Laramie. Have been in touch practically from time Laramie station was organized. Chief of Wyoming Station for many years, went to Wyoming from my office and of course I took interest in his plans and work, aside from the fact that it was a station in line of work that related to our own. I refer to Professor B. C. Buffum, who went to Wyoming in 1891 and who had been in my office for a year or more previous and had graduated from my classes before that. I
2932 have kept in fairly close touch with the institution since the establishment of the station at Laramie. Have kept more in touch with it than I have with most of the stations of the United States because of its being near by and for other reasons.

Meteorological observations were carried on at the Colorado Experiment Station under my direction. They were started, some of them, when I came to Colorado, by Professor Mead who had been my predecessor, then I extended them to a much greater length and a wider bearing. Records of Laramie were started by Profssor Buffum who had been my assistant and observer while he was with me, and when he went to Wyoming he organized their records at Laramie.

He followed then the plans that I had enforced in Colorado and a good many of same lines of observations with same methods.

No difference in obtaining air temperature records at two stations. In Colorado Station I have also series of records giving terrestrial radiation temperatures and solar temperatures that I think were not carried on in Wyoming; that is, solar maximum temperatures were not carried on I know and terrestrial radiation I am not sure of. I think they were kept at Laramie part of the time at least but they were not published in their summary. Distinction be-
2933 tween terrestrial radiation and air temperature, as it is commonly termed, is that terrestrial radiation is temperature kept at the surface of the ground, while air temperature record is kept at some distance above ground,—from 6 to 10 or 15 feet as case may be In case of air thermometer, thermometer is protected from loss of heat by radiation and its purpose is more to get temperature of air at that elevation The terrestrial radiation thermometer, being near grass and open to sky, gives the temperature that is partly due to air next to grass and partly due to loss of heat by radiation to sky. This loss of heat is considerable. Thermometer 6 or 8 feet above ground does not go as low as temperature close to ground, so in Colorado we get records of both of these.

There is variation of from 8 to 20 degrees, or more, between air thermometer, 6 or 8 feet above ground, and terrestrial radiation thermometer near surface. The record is given in Table 20 of Bulletin 182 of Colorado Experiment Station, by averages. Average for years run about 5 degrees different, that is, thermometer near ground is on an average that much lower. But that does not give extremes. The extreme difference would run very much higher than that; that is, on clear nights those differences would run up sometimes to as much as 15 or 18 degrees and on cloudy nights the difference would be less. The temperature at the ground is always lower than that temperature in shelter 6 or 8 feet above ground. Hence the attempt at times to determine whether
2934 there is frost by reading of thermometer 6 or 8 feet above ground is very often misleading and it was very often the case that frost might be seen on the grass and shown by the thermometer, when air thermometer 6 or 8 feet above ground would be from 34 to 37 degrees Fahrenheit, or from 3 to 6 degrees above freezing point.

Record of air thermometer 6 or 8 feet above ground and protected by little house in which the thermometer is kept, is not reliable index as to frost conditions at ground surface.

Referring to Bulletin 100 of Agricultural Experiment Station of University of Wyoming at Laramie, entitled "Meteorology for Twenty Years" by Professor Night and Fitterer, the air temperatures would always be given from a thermometer protected by shelter and when they give the temperatures, which they do, those should be from a thermometer so protected. In exposures of different weather stations instruments are probably exposed to air from 6 to 10 feet above ground. That is the accepted exposure, but of course in cities weather bureau is often restricted to places on top of build-

ings. The records in Table 5 on page 41 of Bulletin 100 would not furnish reliable information relative to low temperature during various months throughout each year at surface of ground, assuming table was compiled from records obtained through air thermometer several feet above surface. The records in this table would simply show reduced temperatures at place where instrument was and temperature of ground would be something lower than that.

2935 Information relative to thermometer from which table was compiled has only been obtained from statements and bulletins. They are given air temperatures and such temperatures would necessitate use of thermometer protected by shelter. A thermometer that is not protected would be affected by radiation of different objects, and purpose of shelter is to keep off all influences except air itself as far as they can. My impression is, Professor Buffum did start some observations with terrestrial thermometer but I don't think they kept them up. Those instruments are easily broken and required to be replaced on an average of about once a year, so that it is very easy for the series to be broken.

Assuming Table 5 in Bulletin 100 of Wyoming Experiment Station has been compiled from records kept by air thermometer several feet above ground and not by terrestrial radiation thermometer, and basing my observation on information I have of corresponding records almost everywhere and on controlling conditions as well as on our experience at Colorado Station, would say difference in temperatures recorded between air thermometer and terrestrial radiation thermometer would be rather more than they would be at Fort Collins on the whole. On clear nights they would be large. The reason for this difference is that as we go higher above sea level the layer of air is thinner and radiation is more intense. That is true both in day and night. It is seen in day by greater

2936 liability of burning by sun's rays as we go up on mountain tops and same condition prevails at night. It is also shown by familiar fact that temperature drops very quickly after sunset, which is due to radiation that takes place. So, while I do not know exact difference existing at Wyoming Station, it would not be less than at Fort Collins and tendency would be to be more both by reason of elevation and that air is apt to have less moisture owing to local conditions.

Average temperature as recorded between two classes of instruments, is different from what it might be on a single night, or on certain nights it is varying. For instance, at Fort Collins in July an average of 5.4-10 is given, ranging in some years from as low as 3.4-10 degrees in 1911 to a difference of 9 degrees in 1890. The difference at Laramie would be at least as much and I would suppose 1 or 2 degrees greater on an average. On a single night or on certain nights in a month it would be a great deal more. I have observed a difference of 12 to 15 degrees at Fort Collins at times.

In order to obtain low temperatures at the ground surface during any month, it would be perfectly safe to deduct 5 degrees from low temperatures appearing in Table 5 of Bulletin 100 of Wyoming experiment station. It would probably be safe to deduct more than

that for some nights, because of this reason, that during summer months the nights of low temperature are usually clear and of in-
tense radiation, and on those nights differences in air tem-
2937 perature and air close to ground is greater.

For purpose of comparisons of air temperatures and climatic conditions generally, records of air thermometers in two different localities would be sufficient, with a limitation. The person who is making a critical comparison of records of two places would want to know quite a good deal. He would want to know where records were taken and how instruments were located; that is, assuming that instruments themselves were correct. If two sets of instruments are in corresponding exposure and the same height above the ground, then they give a pretty good means of comparison. The air instruments at Wyoming and Colorado are much more comparable than most stations. I have noticed particularly Wyoming instruments but once and I assume that they have been maintained at about same way and instruments have been under much the same conditions.

Relative to physical conditions between Laramie Plains area and Poudre Valley region, I would state soil in Poudre Valley is much better from an agricultural standpoint than that on Laramie Plains.
The Poudre Valley soil is more open more capable of drain-
2938 age and has less alkali. The general climatic condition is of very great importance even where the soil is equally good. The Poudre Valley varies in elevation from 5000 feet at Fort Collins to 4700 feet at Greeley. It is really a little less, about 50 feet in both cases. At highest ditch it is probably 5500 feet or less at the headgate. The irrigated area in Poudre Valley is practically 5000 feet without much difference either way. Laramie Plains has elevation of about 7000 feet at Laramie, so there is a difference in elevation of about 2000 feet.

There is about 2000 feet difference in elevation between the head of the Pioneer Canal on the Laramie Plains and the uppermost canal of the Poudre Valley. Pioneer Canal, as indicated on Map Exhibit 1 is 7431 feet and the canal of The Water Supply and Storage Company has an elevation of about 5500 feet, so that the difference is just about 2000 feet.

Effect of difference of 2000 feet in elevation is to give the higher place the colder climate on an average through the year and especially during the summer. In some places it might affect the winter climate and in some places winter climate may be moderated by an increase in elevation. The marked difference when it takes place is due to what meteorologists speak of as an inversion of temperature partly due to the inrush of cold air along flanks of mountains and raising warmer air up, and also partly due to direction of
winds. Thus, for instance, on Pike's Peak during many
2939 days of winter temperature at top of peak is warmer than at Colorado Springs, and on east edge of Long's Peak, where I have had observations for 20 years kept by Mr. Lamb and Mr. Enos Mills, winter months from December to April average warmer there than down on edge of plains. However, during summer months

there is a decided difference in cooling, so that at elevation of 9000 feet maximum temperature we have ever had recorded is 77 degrees I think. That is at the flank of Long's Peak. At Fort Collins, with elevation of 5000 feet it has gone up to 99 degrees. On whole the summer temperatures are lower on the higher elevations.

This statement is true of all these places. The higher up you go the cooler is the summer. Now in case of Laramie Plains, I doubt if same cause would operate in winter there as I mentioned at Estes Park on flank of Long's Peak, so that winter temperature and summer temperatures both tend to be cooler and certainly, the summer.

Elevation has much the same effect on temperature as is observed in moving further north. So that, for instance, those who describe plant life of elevations speak of the zones of plant growth. You may start with a temperature zone of vegetation at the base of a mountain and you go to the boreal, sub-Arctic and Arctic zones of vegetation by simply going up in elevation; so that we get, for instance, on these high mountains a vegetation that is practically Arctic; Alpine, they then term a portion of it. Hence, elevation has a decided effect upon local climate. You have practically the same effect as though you were going farther north. The two effects are very similar but not absolutely alike.

2940 Ascending from foot of mountain to summit, in some respects, has greater effect on climatic conditions than going north. The effect is shown in summer vegetation. As you go north and increase your latitude, summer vegetation pushes forward with greater rapidity than it would at an increased elevation that we might compare with the difference in latitude. Reason for that is largely due to fact that length of days are affected by latitude; as you go north your days become longer. Twilight is of very great importance from standpoint of plant growth. Light available for plant life increases very rapidly as you go north during summer season; hence well known fact that vegetation pushes forward with greater rapidity during summer and is very luxuriant and crops may be grown very successfully even when ground beneath may be practically frozen. For example, in northern Canada, portions of Alaska and all countries that approach Arctic Circles. You may go up into the air and you will have effect of going north; upon the other hand, length of your days will not be increased; your twilights will be short. It is well known that twilight in tropics is very short, even by our standard. As you go to 55 and 60 degrees, twilight in summer becomes one, two or three hours, because as sun circles it does not get very far below horizon. For instance, I have read common news-

2941 paper print at Edmonton, Alberta, as late as half past nine in the evening,—near ten o'clock.

2000 feet difference in altitude between Cache la Poudre Valley and Laramie Plains region, if converted into latitude, would be in neighborhood of 6 degrees difference in latitude; so that Laramie Plains as compared with Fort Collins, for example, would be equivalent to being 6 degrees further north. Now, basis of that deduction is this, that in taking plants, for instance, trees, the timber line at different latitudes under nearly same conditions, a difference of a

degree in latitude is equivalent to about 300 feet in elevation. It seems to be between 300 and 400 feet in elevation, but on average it would probably be between 300 and 350 feet along the east borders of the Rocky Mounutains.

This would be modified by length of days if question of effectiveness of crop growth is considered. That is, crops would grow more rapidly and better in summer in north latitude than at these elevations further south where temperatures would be somewhat the same.

Conditions of plant growth on Laramie Plains would be not very far different from conditions as we find them at Edmonton, Alberta, eliminating from consideration the difference in length of days. The difference would be rather in favor of Edmonton, as far as crop growing is concerned. That is based in first place, upon
2942 observations as to what they are doing at Edmonton as compared with Laramie Plains. That is, they are growing oats, for instance, on a very great scale at Edmonton and very successfully. There are great many elevators and mills for grinding oats, purchase of oats, etc. On one of my trips over there, I made quite a journey with a man who owned a string of elevators and his purchases were very largely of oats.

On Laramie Plains the country can scarcely be said to have made a success of raising oats, although there have been crops of it. As a whole, the valley has not found it profitable to go into that kind of agriculture or at least it has not done so, except to very small extent. I cannot state yield of oats near Edmonton, Canada, but I know they are raising that crop on large scale, were doing it as a matter of farming and a matter of profit and it justified their agriculture and taking up lands for that purpose. I saw the crops and know they were excellent.

I have seen but very few crops of oats on Laramie Plains. Compared with those I saw at Edmonton, for instance, those at latter place, judging from their appearance, were much more promising and had a general appearance of a successful crop. The vegetation at Edmonton was more luxuriant and the crop yield more
2943 uniform, as a whole.

Comparing agriculturally Laramie Wyoming, and Alaska, I will state, that Alaska is a country of very diverse conditions. Portion along Pacific coast is very different climatically and agriculturally from that of Laramie Plains and very much more favorable. Inner Plateau of Alaska has been doing some very excellent work in that line and tests that have been made in the Fairbanks Station by U. S. Department of Agriculture at Rampart Station are certainly as good as on Laramie Plains and general prospects look very much more favorable. These tests in Alaska have been only for few years back. They have benefit of longer days and longer twilights. Hardier grains and rowed crops are doing remarkably well. The United States Department of Agriculture is on record as stating that the inner plateau is of great area and is likely to be an agricultural country.

As compared with Alaska and northern Canada, exposure of Laramie Plains region is unfavorable from climatic standpoint. It is

valley protected by mountains on south and west and of comparatively easy access for wind movements from north, so that it is not only exposed to very heavy winds lasting nearly all year
2944 through, but it is also exposed to cold waves coming from North and west.

Wind movement on Laramie Plains is about twice that of Cache la Poudre Valley, that is, while in Poudre Valley average wind movement is 5000 miles per month, in Laramie Plains, according to my recollection, it runs about 10,000 miles per month. That is rate at Cheyenne and from comparison made some years ago, my recollection is it was nearly same at Laramie. Wind movement doesn't seem to be recorded in this last Bulletin 100 of Wyoming Experiment Station. Wind movement is an agricultural condition at least to be considered.

Other agricultural obstacles, outside of greater exposure and shorter growing days during summer months on Laramie Plains region, as compared with equivalent projections in more northerly regions of Canada or Alaska, are the soil conditions on Laramie Plains. The great quantity of alkaline soil and of soil that is very difficult to manage is an additional difficulty.

During summer 1913 I went through both Cache la Poudre Valley and Laramie Plains region to study opportunities of both valleys in their agricultural conditions. I went with Professor L. H. Bailey. We visited portions of Laramie Plains region that were stated to be the very choicest spots of that valley, agriculturally. On the
2945 same trip, there was no particular spot selected in Cache la Poudre Valley. Attempt was to show general conditions of the valley and regions showing periods of development and zones of development under different ditches. We then went through those regions for many miles. There was no occasion to single out any particular portion in the Poudre Valley, for it was all good. On one ranch visited on Laramie Plains, the Blackburn Ranch, some oats were growing and some oats were still uncut. This was, however, practically the only bit of cropping growing to any extent, so far as we saw. It was described by the people well acquainted with the valley, as the very best farm in whole Laramie Plains region, and I think has also been mentioned by various Wyoming witnesses.

Blackburn Ranch seemed to be a special case, rather than an illustration of the business of the valley. The ranch lies rather favorably, somewhat sheltered and it also has rather unusually porous soil, and seems to be situated so that water conditions are unusually good. So that, the reasons why that has been doing so well looked to me to be special reasons and not reasons pertaining to whole valley. It had given some straw, yield of grain I did not learn.

Relative to conditions of Poudre Valley, we must have traveled more than 100 miles and throughout whole distance there was a mass of farms, grain, sugar beets and potatoes and whole distance was a succession of houses and crops in high state of excellence. All roads were in good condition. Houses showed considerable prosperity, electric lights, frequent school houses and a general high condition

showing country that was highly developed and very prosperous.

2946 Poudre Valley is a country which will respond to even greater agricultural development than present limits already irrigated. That is my very positive conclusion from my observation of the valley extending over 25 years and seeing its development and studying the conditions that affect it. There has been a constant increase of fertility, population and yield of crops and also evidence of extension of cultivation. There is every reason to expect that same condition will continue and with increased crops there will of course be increased population and wealth. When I first knew valley 25 years ago, a great many were struggling to obtain financial foothold. During that time they have succeeded and it has become an example of an independent agricultural community.

In Laramie Plains region, especially that region pointed out in this case as an agricultural section, for example under Pioneer Canal and along Little Laramie Valley, there was practically no settlement, taking it from standpoint of settlement. There were quite a number of vacant houses that I observed. The houses that are there are almost all simply excuses for houses; shacks. They appeared as though the people were having a hard time to get along. In a few cases stock ranches along the river had more comfortable houses. I do not recall but two or three that were depending

2947 on agriculture to any great extent. I am not even sure that the Blackburn Ranch depends as much upon its crops as it does on the attempts to sell its lands. That ranch seemed to have more comfortable buildings.

They have few farm buildings in Laramie Plains region as compared with Poudre Valley. They are widely scattered.

In Cache la Poudre Valley in 100 miles of inspection I should think we must have passed three houses per mile. It may be rather more than that. In counting up, in some cases as we went along and in other places that I knew, I reached conclusion that there must be about 7 or 8 houses to section. That is an estimate. These were homesteads or family homes. Mostly two story houses, many of them of brick, I should judge of 7 or 8 rooms as a rule, showing in almost every case telephone wires going to houses and a great many house showing electric service wires for electric lights in houses. They were homes of very best country type. Be-

2948 sides these homes, on many places there were houses occupied by laborers, about like those on Laramie Plains. Most farm homes have, in first place, quarters for their men, single men, and now with introduction of beet culture, there have been great many people especially Russians and Japanese, come in and quarters are furnished for such families. These are more or less temporary, that is they are cheap houses of probably two rooms so constructed that these families can occupy them. This Russian, German and other labor has also been used by farmers in other work about farms in addition to beet culture. They were brought in primarily for beets but have been found very useful both before and after beet crop is harvested. It has given a general source of labor. Prior

to introduction of this foreign labor, farm laborers were mostly single men and men of passage as it were, who worked here and there a day as they were going across the country, or, in many cases, they were single men who were getting a start, some of them later becoming renters and owners of land. The labor problem was becoming more and more difficult from year to year, in proportion to agricultural development, because development of more intensified agriculture constantly called for more help. When the raising of sugar beets was taken up the most serious consideration was that of obtaining labor and this retarded development of sugar beet industry in Colorado for probably two or three years until they could get some means of meeting labor demands. These Russians, as they are termed, or Germans who had settled in Russia originally, have come here with their entire families with intention of making their homes and they are forming a permanent element in the community. In many cases they are getting small tracts of land and are progressing just as fast as their savings permit. They are a very valuable foreign element, as a rule.

Laramie Plains region has had all conditions of transportation and access of people that Poudre Valley has had, and, in fact, to a greater degree. The only difference has been that they could not make a success of settlement. Opportunity for development from standpoint of water supply for irrigation has been fully as good and has been less subject to difficulties than has Poudre Valley. Laramie Valley has had water in greater quantities. They have had to do less struggling over it and have had less expense and all those conditions have been favorable to that valley.

Laramie Plains has failed to develop simply because that region is not adapted to agricultural crops. I do not think it ever will be. It is primarily a grazing and stock raising valley. The unfavorable climate is principal cause for its remaining such. It is a sub-Artic region.

From standpoint of opportunity for development, region near Greeley is perhaps nearest comparable with Laramie Plains region under Pioneer Canal in matter of accessibility, transportation, etc., that is, railroad came to Greeley in 1869 or 1870 and railroad went into Laramie in 1868 or 1869. Laramie and Weld Canal was constructed and its lands were made subject to irrigation about same time as Pioneer Canal in Laramie Plains. Laramie and
2951 Weld Canal had great scarcity of water for a number of years, for 8 or 10 years at least, principally because lands had not become saturated and farmers had not become used to getting along with less water. At any rate they felt the need of water. That provoked many suits and a great deal of litigation partly because of situation and partly because irrigation jurisprudence was being developed and certain principles had not been determined. Larimer and Weld Canal has borne brunt of litigation of Cache la Poudre Valley during period of its development, more than any other one company. As a matter of fact that canal, throughout its history has had one continuous struggle in order to obtain water for its lands. It is a large ditch and that perhaps has intensified the struggle.

Have heard all testimony relative to history of Pioneer
2952 Canal from standpoint of water supply. I have gathered impression that there has been no particular struggle for water under that canal, at least not as compared with conditions in Poudre Valley. It has not been necessary for them to be very careful about getting all the water they could at headgate, and they have not had an organization for regulation of water from main stream similar to Poudre River administration in Colorado. Notwithstanding fact that Pioneer Canal, taken as a whole, has had unlimited water supply and Larimer and Weld Canal has had one continuous struggle to obtain sufficient water for its consumers, Pioneer Canal shows scarcely any development and Larimer and Weld Canal has been constantly developing, both in acreage, wealth, population and crops and has become a very rich and fertile country of homes.

Development under Larimer and Weld Canal is very similar to development under other canals in Cache la Poudre Valley. Only difference is, in times past some canals have possibly been a little ahead of Larimer and Weld and some have been a little behind. At present time they are all practically on same general plane of development. They have much money invested in their canals, reservoirs, ditches and lands. An investment that they consider justified by the returns.

2953 There is very little comparative development under Pioneer Canal in Wyoming. The development under these two canals is more a matter of a contrast than comparison. They are so different in degree that they are hardly in same class.

I think history of past 30 years of these two canals is absolutely indicative of general future conditions, because present state is consequent of physical conditions as they have existed in past and will continue in future. In other words, you cannot change physical conditions under these two canals.

If Pioneer Canal area should show an increasing population and cultivation during future years, the growth and increase of population and cultivation under Larimer and Weld Canal would be very much greater and to as great a relative extent as it has taken place in the years past and probably even to a greater relative extent.

Lands under Pioneer Canal are not and will never be of the character that will support dense population or respond to intensive cultivation.

Defendants' Exhibit 116, containing photographs of buildings and improvements designated as appearing under Pioneer Canal, illustrates nearly all the buildings. These photographs do not exaggerate the general appearance and lack of cultivation
2954 throughout the Pioneer area. If anything, they rather tone it down, because in photographs they sometimes give impression of cultivated land when in fact ground is not cultivated. In photograph it is not always easy to distinguish. Photograph No. 127 is perhaps about average, rather better if anything. Photograph No. 119 is one illustrative of general conditions under that

canal. Photograph No. 109 is another. In speaking of general Pioneer Canal area, I do not include the suburban area immediately west of Laramie City, known as "West Laramie" area. It appears that that area does not depend upon the development of its land — its support. I speak of greater body or larger acreage under canal, when considering general class of improvements.

Defendants' Exhibit 120 illustrates with fair degree of accuracy, agricultural development under Larimer and Weld Canal in Colorado. These photographs do justice to general appearance of the fields. As to buildings, my recollection of area is that buildings are rather better than shown in album. I have the impression, on going through the tract, that the buildings are rather better than the impression I get from looking over the pages of this album. That may be due somewhat to the path that was followed or it may be that I was unduly impressed with the better buildings.

2955 None of photographs in Defendants' Exhibit 116 show harvest views under Pioneer Canal. I did not observe any fields in harvest while there in 1913. I saw some fields that had been cut on Blackburn Ranch and otherwise all I observed was hay. There were a few cases of grain stubble but not many. The field of oats on Blackburn Ranch had mostly been cut and stacked. There was a small portion left uncut. Straw was high and partly green.

Grain is not a principal crop under Larimer and Weld Canal.

2956 There are other crops that are more valuable. Grain is largely grown. Do not recall just how acreage compares with other crops. Under system of agriculture prevailing, they grow grain, alfalfa, beets and potatoes over part of tracts at any rate. Alfalfa has greater acreage than grain. Potatoes and beets excel grain from monetary yield.

Outside of hay obtained from alfalfa, its principal use is as a fertilizing crop. It enriches the soil both by storing nitrogen and by decaying of roots. It serves as good green manuring crop and good fertilizer. Alfalfa fields are being constantly broken and planted to some other crop. It would be almost impossible to grow sugar beets successfully and profitably without alfalfa in rotation. Same is true of potatoes and as a matter of fact, is largely true of grain, as yield of wheat has increased in last few years. Prior to introduction of alfalfa, yield of grain was decreasing. System of rotation includes these crops. Alfalfa is given longest time in rotation. Alfalfa generally seeded with grain as nurse crop. Alfalfa follows grain and by seeding together they save some time as they cut the grain in summer and alfalfa well get a start in fall.

2957 There are no towns or villages in Pioneer Canal area in Wyoming, except Laramie. Under Larimer and Weld Canal in Colorado, town of Eaton and several other towns are largely supported by that canal. Windsor is below Larimer and Weld area but principally supported by farms served by that canal. Town of Severance I think is under Larimer and Weld. Lucerne is just on border of area and Timnath and Ault and several others are partly supported from the area. This area contributes in large measure to support of cities of Fort Collins and Greeley, especially the latter.

Eaton, more than any other of these towns, indicates development of Larimer and Weld area. It is more especially a town dependent entirely upon that area and is a reflection of its growth. Growth of this area is reflected to greater or less degree in cities of Greeley and Fort Collins.

2958 Development of Larimer County Canal is of exactly same character as development of Larimer and Weld canal area. Only difference has been that Larimer County Canal area was few years later in starting.

Defendants' Exhibit 119, an album containing photographs taken under Larimer County Canal is fairly illustrative of agricultural development of that area. This canal derives a large portion of its water supply from Laramie River by diversions through Sky Line Canal and Laramie Lake and Lost Lakes. This album is indicative of response of lands under that canal through application of Laramie River and other waters. Prior to that diversion and building of Chambers Lake Dam and the Sky Line Ditch, this land had not reached a very great stage of development.

Development under the two canals in the two different localities up to the present time is indicative of future development. It is typical one I think.

2959 Poudre Valley has not reached its height of development under canals. Have been over land included within Greeley-Poudre Irrigation District. It is of much the same character from standpoint of soil and of probable agricultural value, as land under Larimer County or Larimer and Weld canals. Land in Greeley-Poudre District is contiguous to lands under Larimer County Ditch and is nowhere more than few miles from lands under Larimer and Weld Canal.

Agricultural development under Larimer County Canal and Larimer and Weld Canal may be taken as absolutely indicative of future development under Greeley-Poudre system and of land included within Greeley Poudre District, when waters of Laramie River and other streams have been applied. It is very rarely one has land under similar conditions so close to area to be irrigated and thus forms such a complete illustration of what will happen in the future as in this case.

I stated Blackhorn Ranch on Laramie Plains was pointed out to us, at time of making our special trip in 1913, as the show ranch or best ranch on which farming was attempted in Laramie plains region. I had heard repeatedly before that it was an excellent

2960 ranch, but this time we had gone to Agricultural College Experiment Station and we asked officers there as to what was best ranch in valley from their knowledge of the area. We wanted to visit best samples and they stated that Blackhorn Ranch was the best. I do not recall that they mentioned any other in same class. As matter of fact, we visited or went along road from Laramie up the river above Sodergreen's and across country under Pioneer and ranches along ridge and saw a number of those in bottoms of Little Laramie on the way, but there was really not any that we saw or

that was indicated to us, that compared with the Blackhorn Ranch. We visited the Lund Ranch, where a small orchard exists.

Apple orchard on Lund Ranch is right on bank of Laramie River, just at the mouth of cañon, a few miles above Sodergreen's in a well known locality. It was a small orchard. I think 30 or 40 trees as I remember it. They were not in good condition. They had few apples on them. Apples were small. Location of orchard was in a sheltered place, so that it was rather an interesting trial which they were making at the place and was possible because of its location in shelter. Orchard was just an experimental tract, raised more as a matter of gratification or curiosity probably than for
2961 the fruit to be obtained. In the Poudre Valley, by comparison, there are, especially in upper end, some extensive orchards for commercial purposes. Lund's orchard is not commercial and I do not think there is any possibility of such orchards on Laramie Plains. Apples in Lund orchard were little fellows. Trees were gnarled and crooked from winds and were protected by quite a clump of cottonwood and brush just above them, but still the trees were all bending down valley. To the person having the
2962 orchard it would undoubtedly be a matter of a great deal of pride, as it would be to anyone who had accomplished something under great difficulties. Even if the orchard had produced apples for market and they had been sold to people in that community, that would not be taken as index of its becoming a commercial industry in that region.

Observed location of grounds of Agricultural College Experiment Station at Laramie. I was impressed with fact that location was rather favorable example, if anything, of lands under Pioneer Canal. Of course it is close to town and soil struck me as being much more open and porous than most of soil under Pioneer Canal. In addition to that, exposure is to south and southeast. There is a ridge behind it which gives it a little advantage in way of receiving sun's rays. There is also some protection from winds. I was struck by the fact that there was enough gravel to give apparently good drainage over quite a part of the area.

Relative to crop developments indicated by little experimental patches as compared with agricultural development of community from commercial standpoint, I will state that all experimenters know that plat tests, as they call them, are to be taken with a very great allowance as regards yields especially, and to some extent as regards possibilities of growth. At any rate, returns they get from small plats are not apt to be borne out in large fields, so experimenters take these with great deal of caution. At experiment stations crops are grown not for commercial purposes and therefore question of cost is entirely a secondary matter, and labor and care and all other items that go into expense are entirely secondary and could not be taken up in field of practice. That is, they are grown primarily for experimental purposes and not for commercial purposes. Values on experimental grounds can be taken as merely an index of agricultural possibilities rather than probabilities. They give pointers and of course within certain limitations are of great value. Yields obtained from these

experimental plats at any of the experiment stations are not to be taken as indicative of probable yield of like crops under ordinary conditions of farming. They are very misleading in that regard. Misleading in giving an idea that the results they get in yield will be borne out in field conditions. Of course in reporting their experiments of this kind, they report facts as they are, that is, yield they get from size of their tract, very often from 1/100 of an acre, and after determining yield from that 1/100 acre they multiply it by 100 to get rate per acre which is perfectly correct for a deduction but after all is not a very sound basis to estimate yield of a field.

2964 Small tracts shown in Section 31, in what is commonly termed "West Laramie" in Sheet 19 of Exhibit 114 are, generally speaking, similarly situated as to favorable agricultural conditions as the lands in Section 1, shown on same sheet with agricultural experiment station.

Speaking of projection northerly into Canada for similar conditions, climatically, with Laramie Plains, Edmonton, Canada, is more than 6 degrees north of Laramie and Poudre Valley. Comparison I made was in feet and degrees was effect of reducing Laramie by 2000 feet and I also stated that general conditions of Laramie made it comparable with conditions at Edmonton, Canada. Comparison I made was perhaps not quite clear. I stated: 1000 feet in elevation is equivalent to about 3 degrees difference in latitude. There would be a difference of about 330 feet for each degree of latitude. That is not perfectly exact necessarily. If we compare Edmonton, Canada, to Laramie, Wyoming, for instance, Edmonton is at an elevation of 2200 feet and Laramie is at elevation of
2965 7000 feet, practically speaking, so that Edmonton is at 4800 feet less than Laramie. If each thousand feet is equivalent to a difference of 3 degrees in latitude, then 4800 feet would be equivalent to about 14.4 degrees in latitude. So then, if Laramie could be reduced to 2200 feet lower elevation, it could be put 14 degrees further north and have, in effect, same climate as it now has. Its latitude is 41½ degrees, approximately, so that if transported north by 14 degrees it would be up to about 55½ or 56 degrees north latitude. If it then had an elevation same as Edmonton, Canada, it would be at 55 or 56 degrees north latitude and have same climate. Edmonton is at 53½ degrees, so that on that basis Laramie would have a climate of a region 1000 miles north of Edmonton, Canada. The basis of 3 degrees for each thousand feet in altitude is based on comparing elevations of timber line at considerable differences of latitude and is somewhere near correct. If it be considered that difference is 400 feet per degree, that would make it compare almost exactly with Edmonton, Canada, but so far as my observation goes, I would consider that the difference is nearer 350 than it is 400 feet, and that also agrees with observations that I have made at Edmonton, as I have mentioned before. Farming at Edmonton, I think is of better character than I have seen on Laramie Plains and is carried on with far greater success.

2966 Crops raised at Laramie are those that can be grown in a cold climate and that is primarily native hay of some kind. That is true in all parts of the world where similar conditions are encountered. It is true at high elevations. Such regions develop into a hay country or stock country of some kind, of course other local conditions may affect details very materially. With pressure of population, lands will be brought under cultivation that did not pay to farm with population less dense, but even in those cases there are large tracts of land that it will not pay to farm. That is true even in India, that with all their pressure of population there are large areas that are not farmed. It is true in Italy, in France, in England and even, I understand, in China. It is true in eastern part of United States and so, as matter of fact, there is large part of area of United States and in particular states that is really waste land. While there is that pressure towards developing and utilizing lands that have not been utilized before, still it is affected and limited by intrinsic value of lands. It is finally reduced to question of whether land will pay for farming.

2967 General tendency is that of increasing population and cultivation upon already proven good lands rather than settlement of waste lands. That has been the history of the civilized world and especially of irrigated areas. Of course, a few years ago when there were such enormous areas of fine land not taken up, there was a spreading of population into those lands but now the best tracts are largely taken and population spreads into communities that show possibility of development and in most cases those possibilities have already been demonstrated. Their intrinsic value has been ascertained.

Under ideal conditions it would not take quite as much water to produce an acre of alfalfa in Laramie valley as it would in Cache la Poudre valley. Under actual conditions it probably takes more. Poudre Valley produces more alfalfa hay per acre. Net return is more per acre. Cost is very much the same and yield is greater, consequently net return is likely to be greater.

If native hay pays expenses it is, or may be lucrative. If amount that it pays over expenses is small then it means there must be larger acreage for one man or owner to cultivate in order to make it an object. Returns from native hay per acre are much less than in case of alfalfa, but it undoubtedly does more than pay
2968 expenses under fair conditions, and in that sense, may be lucrative.

Have heard irrigated pasturage spoken of by witnesses for Wyoming. This pasturage is raised on land in its native rough condtiion. I have previously mentioned that amount of water actually used was not very much in correspondence with needs of plant. Smoothness of ground, preparation for flow of water so as not to stagnate and stand in pools, physical problem of making distribution even, or as near as may be possible, are matters that control quantity great deal more than need of crop. In cheap land it does not pay to smooth ground. In Poudre Valley they get land fairly smooth and have no depressions. While yield of alfalfa in Poudre

Valley would call for more water than small yield of native hay in Laramie Valley, yet other sources of loss would mean or cause more water to be used per acre in Laramie Valley than in Poudre Valley. Considerable water is required to irrigate this pasturage and there is a great deal of waste. Water is wastefully applied. Re-
2969 turn is small compared with amount of water used.

Several times as much water is used in Laramie Valley on average as is used in Poudre Valley per acre. This I should judge from observations I have made in Laramie Valley as compared with measurements we have in Poudre Valley. Several times as much water is required to produce an acre of irrigated pasturage in Laramie Valley as is required to produce acre of potatoes, sugar beets, cabbage or onions in Cache la Poudre Valley.

As live stock country, Laramie Plains is best adapted to pasturage and developing stock during summer and fall and letting other localities finish the stock. It is a country that does not seem adapted to produce forage to any great extent and winters are cold. It is largely true that Laramie Plains has been devoted chiefly to producing the animal and that it has been finished and fattened
2970 ready for market in the Cache la Poudre Valley. The large amount of hay in Poudre Valley has made that a place of winter feding of lambs especially, and to some extent, cattle. In Larimer and Weld Counties in Poudre Valley, there are vast areas of land equally capable of producing live stock in summer months as are lands on Laramie Plains. This is unirrigated land. The alfalfa raised under irrigation will finish much greater number of animals than can be produced in region immediately tributary to valley, so that for past 20 years Poudre Valley has been importing sheep especially from New Mexico, Arizona, Montana and Wyoming, and fattening them during winter, feeding them alfalfa and corn which is purchased from Nebraska and Kansas, and finishing several hundred thousand lambs for market.

Sugar beets and other similar tender crops will never be produced commercially on Laramie Plains. They may be produced in small tracts occasionally. Turnips and rutabagas are a
2971 hardier crop. They are grown in Poudre Valley to very small extent. They are grown as matter of stock feeding and kind of a side issue. Very small acreage is ever devoted to them. They have not entered into general agriculture of valley but have been cultivated in small tracts from time to time.

Potatoes of early variety will have to be raised on Laramie Plains area in order that they may mature before frost. I would not consider that potato raising is apt to be very much of a commercial proposition in that region. There will be tracts where they may grow successfully and produce quite a crop during some years, but one year with another, I would hardly look for much of a production of potatoes in that area.

In number of times I have visited Laramie Valley I have not seen any extensive market gardens, where vegetables, cabbage, onions, lettuce, etc. were raised for consumption of residents of Laramie

or vicinity, and not very much that could even be denominated as small gardens.

Cache la Poudre Valley is exporter of agricultural crops and produce. It exports wheat, potatoes, it produces sugar beets and exports sugar, it exports alfalfa to some extent and mostly in form of fattened cattle and sheep. It exports by-products of sugar industry through same channel of stock feeding, pulp is fed to animals and serves to fatten them. Beet tops are also fed to animals and the syrup to some extent. Most of syrup is re-treated but final residue is fed to animals. They also export fruit, apples and cherries. They export market garden produce, raspberries and at times celery by car-load lots. They export cabbage and onions and a number of similar crops.

Garden products raised near Fort Collins are hauled in wagons to Laramie. There were some gardeners that made regular business of it. Fruits are exported from Fort Collins region to Laramie Plains. There is market there for such material that can-
2973 not be grown in that vicinity.

The canning industry is carried on in Poudre Valley by Empson Canning & Packing Company. There are plants at Greeley, Loveland, Longmont and several other places. Principally peas are canned for export in Greeley factory. Sauerkraut is also manufactured, also tomatoes and cucumbers for export.

As matter of fact there is not one of numerous variety of crops that cannot be grown in Poudre Valley. Longmont community, for instance, early took up peas. Loveland took up raspberries. The same could be done at Fort Collins, Greeley or Longmont but the local nurserymen developed a raspberry that stood up under shipment. Cantaloupe industry developed at Rocky Ford. Same industry could have gone from one community to another.
2974 Onions started at La Porte. Many instances of that kind could be mentioned. Specialty started in each of these communities simply from fact that some man had particular knowledge along one line and gave that his attention.

Laramie Plains region is importer of agricultural products. There is mill at Laramie but apparently supplied by grain raised elsewhere. Grain is milled in transit.

Flour Milling industry is well developed throughout Poudre Valley. There are number of mills and have been from very early days. There are two at Fort Collins and one or more at each of other railroad stations.

L. G. CARPENTER.

Cross-examination by Mr. N. E. Corthell:

2975 I have observed rather than investigated the agricultural conditions of the Laramie Valley, and because of my interest in agricultural investigations, I have made inquiries and watched reports, etc. I have been across the valley on the railroad almost every year since 1890, but made no other trip in that terri-

tory until 1903, when I went over a small part of it paralleling the railroad, and then in 1909 I went from Laramie up Sand
2976 Creek to Sand Creek Pass, and in 1912 I made a number of trips up and down the valley and to the various lakes and reservoirs on the Laramie Plains. In that year I made at least half a dozen trips to different parts of the Laramie Plains requiring perhaps two or three weeks altogether, with an automobile. I traveled over the valley and Laramie Plains at least once
2977 in 1913, and I believe one or two other times also. In 1912 I was instituting some water supply measurements, but was giving attention to all of the general conditions. In a windy
2978 country the surface temperature and the air temperature tend to become more nearly equal than where there is little or no wind. Six or eight years ago I examined the wind records kept at Laramie, but have not reviewed them. My recollection is that the wind movement averages about 10,000 miles a month or twice the movement at Fort Collins, and I would say that the general direction is westerly, judging from the latitude and not from any observation of the actual direction of the wind. I have
2979 made no particular examination of the soil in the Laramie Valley excepting as I have passed over the country and as I have examined the soil survey reports. I would say that
2980 the Blackburn ranch is sheltered somewhat from the north and west, and the slope of part of it to the south and east further modified the climatic conditions. The soil appeared to me to be very excellent, being open and porous and gravelly although not having any large amount of boulders.

2981 I would not say that the rural population of the United States generally has been increasing during the past 25 years. Within the past ten years there has been a decrease in some portions only. There is hardly a place on the Laramie Plains that does not indicate that the farmer has been having a hard time to get along. There is hardly any particular locality which I
2982 would except from this statement, but I do not know the names of any of the places I noted. I recall quite a number of places of this character north of the Little Laramie River under the Lake James Project, and also some abandoned shacks east of Lake Hattie. Excepting places near Laramie City, I recall only one of all of the houses which was painted and I recall none having trees growing around them.

2983 I do not think that the fact that the range land is comparatively scarce in the Poudre Valley accounts for the difference between the industry carried on there and in the Laramie Valley. I do not think that fact has any particular effect on it. It is simply the general conditions. In the Poudre Valley, they have the surplus alfalfa which they raise under the ditches and they bring the stock in and use the alfalfa in the winter. Usually it is the desire of everybody to get as large returns from their resources as they can. If stock is the best way of doing it, they will use stock. It is the economical method to utilize the open range to the fullest extent in raising stock and if there was a larger area of range with re-

spect to the agricultural area in Weld County, you would expect to find more stock raised in that part of the country.

Cross-examination by Mr. John D. Clark.

2984 In my opinion hay is the economical crop raised upon the Laramie Plains, this being due to the soil and climatic conditions and not to any lack of enterprise on the part of the inhabitants. I presume that the raising of hay produces some net return, but the large size of ranches would indicate that the return is not very great. While some farmers favorably located
2985 and favored with some exceptional season might procure a net return and perhaps a large net return from some special crop, on the whole no other crop would now pay or could be looked to in the future as a paying crop. I do not believe that the returns from the growth of hay would justify any greater investment than the present investment, and I should say that the present investment is now larger than the hay return would warrant. The only practical method of irrigating hay land in that region is through flood irrigation, and taking present conditions as a whole, the methods of irrigation now in use on the Laramie Plains are the natural methods. It would require careful investigation to determine whether the return which can be secured from the hay crop would justify the additional expense of preparing the ground so as to economize in the distribution of water. If they were pressed to save water there would be some effort to prepare the ground, as the present method of distribution is very wasteful. I do not
2986 know whether, if they were to go to the additional expense suggested in the distribution of the water, they could secure a net return upon their crop, but it does appear to me that the land could be prepared at small cost so as to improve conditions at least. By preparing the land I mean to reduce the hills and hummocks. Assuming a net return of from one to five dollars per acre, which is a pretty high estimate, or from one to three dollars per acre, the irrigation investment could not be very large if a net return is to be secured. From the evidence which I have heard in this case I would assume that the gross return from the average hay crop upon the Laramie Plains would be from $5 to $6 an acre. The question of economy of water has never arisen in that valley, and hence the value of water has been very small. I cannot, however, find even to my own satisfaction the answer to the question whether the
2987 net return from the hay crop would justify the expense of reservoirs. It might be justifiable to construct reservoirs of
2988 relatively low cost. There are lots of basins in the region which could be used for reservoirs, but I have no data from which I could estimate the expense. Where a reservoir is to be used for a part of the season only, a larger expense is justified than where it is the only source of supply for the land, as in the
2989 latter case the reservoir safeguards a larger acreage of the crop which depends early in the season upon another source of supply. Of course if the crop is one which requires water only

during a comparatively short period of time, this will be an important condition to take into consideration. The conditions on the Laramie Plains will not justify any large expense per acre. The expense per acre which is justifiable for the construction of reservoirs depends very largely upon a consideration of the value of the
2990 crops and I do not know these conditions sufficiently to make an estimate. One of the objects of my numerous trips to the Laramie Plains was to determine the value of the country from an agricultural standpoint.

2990 Redirect examination by Mr. Delph E. Carpenter:

Weld and Larimer Counties not only raise and develop live stock on their pasture lands, but also finish and fatten sheep and cattle for market, while Laramie Plains regions are devoted primarily to mere growing of animals. If sufficient live stock were raised on the immense areas in Larimer and Weld Counties not under irrigation there would be no physical necessity of going elsewhere for animals, but there might be some economic reason. We have coal close to Denver but we go hundreds of miles for some of it. Other conditions being equal, home product would be used for finishing in preference to going abroad. It would be supposed that difference in transportation would make some difference in favor of local product.

2991 Major portion of acreage in both Larimer and Weld Counties, Colorado, is still in the raw arid state and is pasture lands. I do not recall the total aggregate area of the two counties. Proportion irrigated is relatively small. In addition to the 500 square miles of irrigated land in the counties in Poudre Valley, there is quite an area in Big Thompson Valley that is irrigated.

Fact remains that an acre foot of water in Laramie River when applied in Cache la Poudre Valley will produce greater crop return and help to support greater population than when applied on Laramie Plains region, no matter what the cost of smoothing land in Laramie Plains may be in order that it may be better irrigated.

L. G. CARPENTER continued.

2992 Direct examination by Mr. Fred Farrar:

With reference to water-sheds of Colorado, Colorado practically occupies what is sometimes described as summit of continent. It is situated on Continental Divide so that streams flow from it in all directions for it is not only on the Divide but at the summit of the Divide and its streams run north and south as well as east and west. Wyoming is the only other state that occupies a similar position. There are what might be described as four main stream systems, each with a number of important subdivisions. There are the Platte and Arkansas systems flowing finally into Mississippi River, the Rio Grande flowing into Gulf of Mexico, and Grand flowing into Gulf of California. The Grand and Green and their tributaries and San Juan all contribute to Gulf of California. Prin-

cipal tributary of San Juan in Colorado is Las Animas, with number of smaller ones.

Starting from Continental Divide on north border and going easterly more in detail, we have North Platte and Laramie heading in Colorado and flowing to north. Laramie is branch of
2993 North Platte joining it in Wyoming, near Fort Laramie.

Fort Laramie and Laramie City are very different geographically. Fort Laramie is old post of fur hunting days, while Laramie City is community of recent date.

Starting at almost same place as Laramie and North Platte, is branch of South Platte, the Poudre, and there are other forks of South Platte starting from east side of Continental Divide and running east, all finally forming South Platte in Colorado.

South Platte and North Platte join in Nebraska and finally enter Missouri River. Therefore, North Platte and South Platte are parts of the same stream, the Platte. This stream drains practically all of northeastern Colorado, that is, it drains down to short distance north of Colorado Springs on eastern slope and thence all northeasterly from that to state line. On east side Continental Divide is North Park, which is east of Continental Divide but also west of quite an important range of mountains. There are quite a number of tributaries of South Platte, that is, there are Poudre, Big Thompson, Saint Vrain, Clear Creek, and Bear Creek, as well as South Platte itself and various important tributaries of those streams. It drains large part of eastern mountain slope. South Platte in Colorado, from its initial point to southwest of Denver, flows generally in northerly direction, through City of Denver, until its junction with Poudre River near City of Greeley. From this point it has general easterly direction. In other words, from point
2994 from 12 to 15 miles south of Denver, where stream debouches from hills, down to point near Greeley, stream flows generally northerly and parallel to mountain range. Those tributary streams, Poudre, Thompson, Saint Vrain, Clear Creek, Bear Creek and other smaller ones join it in distance from Denver to Greeley at right angles. Their courses are almost due east. This area constitutes what is generally known as "Northern Colorado Agricultural Area" and is sometimes known as Platte Valley, though more commonly that is kept separate. Courses of these streams are consequence of general geological conditions. South Platte is about 20 to 30 miles from foothills and these tributary streams coming down mountain slope after they leave mountains proper, have quite a fall and thus Platte is very well situated for ease of irrigation and distribution and that tract adjacent to South Platte is practically all under irrigation.

South of South Platte to east border of state are Republican and Arickaree Rivers, also forming part of another stream
2995 system. They are what are described as plains streams, that is, for large part of their course they are dry. They do not run much water except at heavy storms, in which case they have floods. As a whole, they are small streams. They become perennial streams for distance after they cut through layer of water

bearing rock in one place and both after and before reaching that point they are not perennial streams. These two streams finally join in Kansas. Republican River is one of streams which form Kaw River near Junction City, Kansas. It is long but of small importance. Republican and Arickaree in Colorado are streams of practically little importance and quantity of water they carry is very indefinite. They are minor streams. Their heads are on plains low down and thus they do not have advantage of mountain water sheds. They therefore flow in aggregate a moderate amount of water but run-off of plains area is much smaller comparatively speaking than run-off of mountain areas. Rainfall in eastern Colorado is not so very great. As you go east into Kansas and Nebraska rainfall increases. They do not have more rainfall than in mountains, but more rainfall than on plains near mountains. There is very little agriculture by irrigation from Republican and Arickaree Rivers. There are a few ditches and a little irrigation but it is insignificant.

Arkansas River watershed comes south of Republican and Arickaree. That includes practically all of remaining portion of Colorado east of main range. That is not Continental Divide. It lies west of San Luis Valley. Both Arkansas and Rio Grande watersheds are east of Continental Divide.

2996 Arkansas River starts near Leadville, passes out of mountains at Cañon City and then crosses plains to state line total distance of about 350 miles in Colorado. It drains very narrow watershed in mountains. It widens out on plains and includes practically all of southeastern Colorado. Headwaters of Arkansas in mountains are very close to headwaters of South Platte, that is, they practically start at same point, one flowing to northeast and one flowing almost south.

The Sangre de Cristo range of mountains constitutes divide between Arkansas and Rio Grande watersheds. It is one of highest mountain ranges in state although not a part of Continental Divide.

There are no important tributaries of Arkansas River in mountains. There are several draining small areas near Leadville and a few small ones between there and exit from mountains, but, as a whole, its watershed is narrow, only 18 or 20 miles wide in mountain region. Area drained by Arkansas on plains is very large, extending from Divide near Palmer Lake north of Colorado Springs, almost east to state line and south of Arkansas River nearly to interstate line in Las Animas County. Extreme southeastern

2997 corner of state is drained by Canadian River.

Pueblo, an important Colorado city, is located on Arkansas River. There are number of smaller cities. Colorado Springs is on its watershed, so are Leadville, Salida, La Junta and various others. Headwaters of this stream and South Platte are little west of center of state.

Cities of Fort Collins, Boulder, Denver, Colorado Springs, Pueblo and Trinidad are all near eastern foot of mountain range. Fort Collins is about six miles from foothills. Denver is a little further. Colorado Springs is a little closer. Pueblo is perhaps a little further

from what we ordinarily call foothills, so as a whole, they are at junction of mountains and plains, or nearly so. This line of cities running north and south very closely defines in an uncertain sort of way boundary between plains area and mountain area. Plains start a little east of these places.

Rio Grande River drains San Luis Valley and flows south from Colorado into New Mexico. Principal source of Rio Grande, however, is New Mexico. Nearly all water coming from that region instead of Colorado, that is Conchas River. Rio Grande in Colorado was known to Spaniards as Rio Del Norte. The area
2998 which Rio Grande drains below is about 2000 miles and stream flows thereafter in Gulf of Mexico. San Luis Valley in Colorado is very large flat, an ancient lake bed, covering about 4000 square miles. In addition to that, there is considerable drainage area to west, running up into mountain areas. They are of different character from mountainous areas to north.

San Luis Valley is surrounded on all sides by mountains. Rio Grande leaves San Luis Valley through deep cañon in basaltic sheet rock several hundred feet deep. Average altitude of valley about 7500 feet.

2999 San Luis Valley cannot be compared topographically with Laramie Plains region, except in one way. It is valley surrounded by mountains. San Luis Valley is very smooth without irregularities on surface. It is flat and does not have elevations or variations and almost no drainage channels so that it is not cut up. As to altitude and being surrounded by mountains it is similar to Laramie Plains. San Luis Valley is protected on north and open to south, while Laramie Valley is protected on south and open to north. Laramie Plains is about 300 miles north of San Luis Valley. That distance is equivalent to considerable difference in elevation which comes of difference of latitude. Laramie Valley would have to be lowered about 1200 to 1500 feet to make up for difference in latitude and to give it similar climatic condition.

Rio Grande River in Colorado runs in generally southern direction and that prevails until river reaches El Paso, when its general direction is southeast.

3000 Streams thus far mentioned are in eastern part of state and east of Continental Divide and flow into Gulf of Mexico.

Rest of state drains into Pacific watersheds, that is, into Colorado River and its tributaries and thence into Gulf of California. West of San Luis Valley comes San Juan River system and tributaries and draining southern part of Colorado, Archuleta County, La Plata, San Juan and a portion of Hinsdale and Mineral Counties. Principal tributary stream is Las Animas and there are number of secondary streams parallel with Las Animas and joining San Juan in New Mexico. General course of these streams is influenced by topographic and geological condition of that portion of state. Streams flow south passing across state in rather long narrow valleys and then joining San Juan short distance within New Mexico, where general course of stream is nearly west. That country, as a whole, is rather

open mesa or plateau country. Valleys are narrow as distinguished from those on eastern slope.

Dolores and Mancos Rivers lie west of the San Juan River and tributaries, and are large tributaries of the Colorado. The Mancos and its tributaries run nearly northwest and the Dolores runs more nearly north and paralleling state line for distance of about 80 to 100 miles.

3001 That mining region generally known as San Juan District is at beginning of this group of rivers, that is, of Las Animas and Dolores Rivers and also of Uncompahgre River which runs into Gunnison and then into Grand. There is a group of high mountains at head waters of these streams which include many silver mining camps.

There is on that watershed in southwest a condition which has led to taking water across divides. I refer to irrigation of Montezuma Valley near Mancos, where water is taken from Dolores River. General conditions there are such as have been described sometime before in the examination, where there is fertile valley without much water supply and another stream nearby which could be diverted by a tunnel. Two tunnels have been taken through the intervening ridge.

Grand River and tributaries lie to north of the Dolores. Grand is principal river running west and joins Green in Utah to form Colorado River. Headwaters of one branch of this stream are near Leadville, Colorado, and another fork heads just across mountain range from North Park and some of its tributaries interlace with those of Poudre which runs into Platte and all of various tributaries interlace with tributaries of all other streams running easterly including Arkansas River, Rio Grande and

3002 other various tributaries of South Platte, so there are quite good many places where water is taken across divide from one side to another, according to local needs and conditions.

Water is taken across divides above Montrose north of Ouray and also at headwaters of Arkansas River and at headwaters of Platte and of almost all of these streams.

Grand River drains country which is largely mountainous, though Rocky Mountains proper perhaps could be considered as terminating not far from Glenwood Springs. Range is granite mass of mountains, while to west it is stratified formation and largely mesa country of high plateaus with narrow valleys. Outlying land is flat with wide table lands and very difficult ascents and ranging from several hundred to several thousand feet above general valley of stream. There is complete absence of flat plains country you find on eastern slope. Available land on western slope for irrigation is confined to narrow strips along these streams. In order to go outside pumping is required and areas that are available are small. There is considerable pumping started from streams but as great deal of land runs up to several thousand feet above stream, most of pumping is out of question for irrigation.

Territory west of Glenwood Springs is mountainous so far as topographical conditions are concerned, but is broken up

3003 with flat topped mesas. Formation is stratified rather than granitic. It has been formed of deep layers of strata and these

have been broken through and washed out. As these strata are very largely shale, it makes very precipitous slopes which are difficult of ascent. Capping is of harder rock.

Principal tributary of Grand River in Colorado is Gunnison River which in turn has Uncompahgre as a tributary. These are streams I mentioned sometime since in my testimony relative to inter-watershed diversions under United States Reclamation Project. Waters are taken from Gunnison River into Uncompahgre and there are also some private diversions from some branches of Gunnison and Cimmarron, which is one of its tributaries, into tributaries of Uncompahgre.

North of Grand River are various tributaries of Green River. It is in extreme northwestern part of state and starts in Wyoming. It crosses state line several times and finally passes through western Colorado for a short distance. Yampa and White Rivers are two important tributaries of the Green and drain most of northwestern part of Colorado, counties of Rio Blanco, Moffatt and Routt. Some tributaries of Yampa start in Wyoming and flow southward and some start
in Colorado and run across into Wyoming and come back
3004 again. Interstate line is not very far from divide.

We have streams starting from Colorado and running in all directions. Streams descending to north such as branches of Platte, North Platte and Laramie. Streams descending east like South Platte, Republican, Arickaree and Arkansas. Streams running south like Rio Grande, San Juan and tributaries. Streams running west like Dolores, Grand, White and Yampa.

Colorado occupies such a position that water runs in all directions from it and no other state except Wyoming is similarly situate. While these streams run north from Colorado into Wyoming, there is another elevation of general mountain range further north in Wyoming in Big Horn Mountains and near Yellowstone National Park, so that streams from Wyoming likewise run to north, east, south, southwest and west, running from Wyoming into Montana in case of Yellowstone, Big Horn and Tongue Rivers; running east into South Dakota in Belle Fourche River; running east into Nebraska in North Platte and several other streams and running south into Colorado in case of Crow Creek, Lone Creek and various tributaries of South Platte. These latter streams are small but they supply considerable water at their headwaters. They are used for irrigation in Wyoming and also for ditches in Colorado and run into South Platte River. There is also Dale Creek and Fish Creek that interlace with headwaters of some tributaries of the Laramie. These lat-
ter streams join Poudre. On the west and southwest of
3005 Wyoming are Snake River and Green River and their tributaries, running from Wyoming into Colorado and into Utah and Bear River on the west which runs into Idaho, so that situation of Wyoming is very analogous to situation in Colorado as regards relation to adjoining states.

Streams coming from Wyoming into Colorado do not compare in size with North Platte and Laramie Rivers running from Colorado into Wyoming. None of them are of any size except Little

Snake and Green Rivers. The Green River runs from Wyoming into Utah, then into Colorado.

There is decided difference between eastern and western slopes of Continental Divide from the stream standpoint. East of mountains are Great Plains. These have general slope to east and while there is depression or kind of trough next to foot of mountains, yet as a whole slope is to east. Plains are rolling with long smooth ridges almost free from rocks so that it is all an arable country and capable of agriculture if water supply is sufficient. At foot of mountains we have narrow valleys and that prevails in all the mountainous region from Glenwood Springs east to near Denver and north of San Luis Valley. In southwestern portion of state and west of Glenwood Springs is general mesa country with flat top mountains and narrow valleys.

The western portion of Colorado has relatively abundant water supply with small area of land for irrigation, while eastern part of state has very large area of land capable of irrigation as com-
3006 pared with its water supply.

Our plains streams are of a very different type from streams in eastern states. With stream running through humid country, at least in eastern United States and most humid countries, streams steadily increase. Country through which it runs is contributing to stream. That is not case of our plains streams—after they leave mountains. We cannot say that these plains streams are
3007 actually draining the country in sense of deriving supply of water from the country most of time. These streams are naturally decreasing instead of increasing as they go away from the mountains. They have always done so from earliest period of discovery and, inasmuch as these conditions have existed for a long period, undoubtedly it has always been the case. Same general fact is observed with all rivers under similar conditions, for instance, in Asia, Algeria, Egypt, China, Turkestan and in some parts of Russia, in some parts of France and Spain and elsewhere, where there is considerable supply of water from mountains at the source of streams and then where stream passes tract or region where rainfall is small. In a humid country rain fall is larger than ordinary evaporation from ground. Ground is more or less saturated, marshes may exist and at any rate there are springs to great extent, and these continually contribute accretions to the stream.

In country like Colorado, as has already been described, water has been long distance from surface of ground. Rainfall has been little more than sufficient to supply evaporation and hence surface of soil has been dry and free from water and instead of contributing water to stream it has absorbed water from stream and supply of water in streams has steadily decreased and sometimes disappeared entirely as in case of Arkansas and South Platte Rivers in early days and which is still true of Republican and many other like streams.

Effect of irrigation is to fill soil so that it leads gradually to change of conditions and bringing about of condition that is much like eastern country. This naturally exists in the mountains,
3008 where rainfall runs from 16 25/100 inches and over, and streams there increase in size from starting point down to

point of leaving mountains. After leaving mountains they have decreased in size as water has been taken up by sands and stream has contributed to ground water.

As we pass further east we get more rainfall, as in Kansas and Nebraska and even in eastern Colorado, and there these streams again begin to increase. That is shown to be the fact in the Arkansas River and was described in testimony and exhibits shown in the case of Kansas versus Colorado.

Effect of irrigation is to produce an artificial condition, in a measure and to a limited extent, similar to natural conditions in humid country. Soil has an excess of water as compared with evaporation, and that excess is constantly draining off and forming a stream in the irrigated country. The excess is applied to irrigation and it leads to almost same condition, so as matter of fact, it has followed that these streams near mountains have become perennial streams. A great many of these dry gulches or draws that were formerly dry, except for rain storm, have become running streams at all seasons of year, and in many cases, streams of considerable size, and have become sources of water supply in irrigation season and ditches have been constructed from them to utilize that water in a great many cases.

3009 South Platte and Arkansas Rivers, before beginning of irrigation, became practically dry down at and near east line of state of Colorado during low flow, because of fact that there were no accretions from any source to the arid soil through which they flow and evaporation rapidly diminishes the quantity of water as it passed down. That as irrigation has been practiced on upper reaches of stream, soil becomes saturated and there is constant return of water from soil under irrigated districts back to stream. This has had very marked effect in gradually extending flow of water in stream. There has been very noticeable change, all within memory of our older citizens. That is, Poudre River, for instance 30 years ago, had practically no increase from mountains to Greeley. When I first measured it about 25 years ago, there was less than 100 cubic feet per second coming in from other than surface channels, and that has in meantime more than doubled. South Platte likewise from Denver to state line, has general increase of from 1000 to 1500 cubic feet per second. It used to be dry at times before irrigation was practiced, somewhere in vicinity of Fort Morgan. There are records of that kind. Fort Morgan is about midway between eastern edge of mountains and east line of State of Colorado. Stream is known to have gone dry at Fort Morgan in early days. Now, in non-irrigation season, instead of drying up, it has become stream of considerable size running 800 to 1500 cubic feet per second during winter months, where even within my knowledge, it was insignificant. As matter of fact, there is substantial flow of water even during

3010 dry summer months, not only at Fort Morgan, but at Julesburg and Sterling. During summer months they take out good deal of water and a good deal enters stream again within short distance. Possibilities of irrigation at Fort Morgan and lower down stream, have developed by these conditions and by this return water.

First time I was at Fort Morgan some 25 years ago, there was very little water for area then under irrigation. In the meantime that area has been very largely increased, large areas have been brought under irrigation near Sterling and Julesburg and now there is in winter months, a good deal of excess water going to waste. That has been brought about largely through storage and application of Platte waters near the mountains. This has extended the fringe of the irrigated area, gradually and constantly.

Same rule prevails on Arkansas River. Records were found that river had been known to be dry as far west as Rocky Ford before irrigation was begun and repeatedly in sections between there and Lamar and practically to state line. Application of water for irrigation has made that pretty constant region. River has never become dry of recent years, unless it be just at vicinity of some headgate. It is then found to run a large stream of water lower down. It is true that application of water in Colorado, particularly from conservation of flood waters in reservoirs and its later application, will in time make possible irrigation on lower reaches of South Platte and Arkansas in States of Nebraska and Kansas, which, without irrigation above could not be irrigated. There is constantly working
tendency, a condition that gradually develops and within my
3011 own knowledge has been quite marked.

This condition is to those who have made a scientific study of it, an absolutely well established fact. It is known in all regions where irrigation is practiced. That has been true in India, France and Spain and it does not require much consideration to see that these conditions are universal. Even 35 years ago, Major Powell, who had a remarkable grasp of conditions in general, and remarkable foresight, called attention to benefits of intercepting and storing water and using it on Upper Platte in order to make Lower Platte a perennial stream and to obtain greatest use from that stream.

The use of water on the upper reaches of the stream, soil and climate being favorable, is absolutely necessary in order to get fullest use of water and from standpoint of ultimate development, that is only way it can really be obtained. I have always considered that it had been fortunate in development, especially locally, that so much irrigation had taken place near mountains.

3012 Have made scientific measurements of return seepage water from irrigated lands. I have carried on for many years measurements of this character and I presume, roughly speaking, have probably covered what might be termed some 8000 or 10,000 miles. It has required that distance of traveling along stream to make measurements as we went. These have included South Platte and all of its tributaries, Arkansas, Rio Grande, Uncompahgre and some other minor streams. Longest series of these measurements have been on Cache la Poudre River.

First seepage measurement was made in 1885 by Mr. R. S. Nettleton and Mr. B. F. La Grande. At that time they had commenced to notice fact that water in stream was increasing and that dry arroyos were running water. This measurement in October, 1885, was first measurement of kind to ascertain that fact. Total increase

from cañon to Greeley was 48 cubic feet per second. Another measurement of similar kind was made in 1889. From 1890 I took up measurements. A detailed summary is given in Bulletin 180 of the Colorado Experiment Station, No. 2, for Cache la Poudre and there is detailed total of series of 36 different measurements con-
3013 tinuing each year from 1890 to 1910. During later years there is quite marked increase over those of early years. Increase very frequently exceeded 200 cubic feet per second from cañon to mouth of stream. This same increase has been noticed outside. Increase that is recorded is that which came into stream and does not include seepage water intercepted by ditches and reservoirs, which was quite a considerable amount, and if it had been measured and counted it would have increased this sum in later years a good deal, so that represents change from about 50 cubic feet per second in 1885 to 200 or 220 about 1910, and indicates corresponding increase in actual water that is coming from saturated soils in valley, due to application of water in valley. It is really less than real increase, because later years good deal is taken into reservoirs and ditches that does not show up in this summary.

These measurements were made by measuring flow of stream at mouth cañon and deducting all diversions from stream, deducting accretions to stream from any other stream and then taking balance representing increase from return or seepage water. It is substantially increased from percolating sources. In some cases draws were supplying water that could not be identified as seepage, whether or not such was case was determined by temperature. Difference in temperature between natural and seepage water was quite easy to determine.

3014 Return or seepage waters do not appear immediately upon application of water to given tract of land. It takes quite long time, depending upon distance of land from stream, character of sub-soil, opportunities it has for returning, water applied and other factors. It may take number of years as has already been testified in this case; considerable time may be taken in addition to velocity, to filling up sub-soil. If sub-soil is filled, it takes quite long time for water to pass any distance; One mile per year is fair statement but would be modified by character of gravel and other conditions.

Flow of seepage water shows some response to high precipitation or high application of water in any one year, but variations are smoothed out and reduced, so that constant increase in rain fall or water might be shown in long continuous slow increase in seepage flow.

Increase of return flow of water in Poudre River was 500 per cent from years 1885 to 1910 inclusive. If there be some allowance made for fact that first measurement was preliminary, when conditions were not well understood, it is still safe to say that gain has been something like three times.

Made comparison of percentage of water diverted from Poudre River and used for irrigation which finds its way back to stream, some years since, at a time when seepage was not so great as it is

now and result of that will be applicable to present time with
3015 slight modification. In an investigation published in 1896 and known as Bulletin No. 33, I made comparison between water that came back as seepage and water that had been applied, and reached conclusion at that time that 30 percent. of water applied returned to river. This conclusion is given in Conclusion 15 on page 62 of Bulletin. At that time, water that was being applied to outer areas was not showing up at stream as much as it was later and returned from seepage as shown in tabulation in Bulletin 180 has been increased since that time as a whole. Taking conditions together, I think it is safe to say, that amount that comes into river is something more than 30 percent. It was constantly increasing, so that it is something above that, but I have not made comparison recently. It is above 40 percent. and may be even more. At that time practically all the seepage water came into Poudre River above its junction with South Platte. There was some seepage beginning to appear below that point. At present time there is considerable seepage entering South Platte below mouth of Poudre, and in making such comparison this amount should also be included as the return from application of Poudre water. Main body of irrigated land on South Platte in portion known as Lower Platte, is practically disconected several miles from main body of irrigated land in Cache la Poudre Valley. There is no continuity of irrigated area
3016 running right down Poudre Valley and thence down Platte River. There is quite a strip of barren land on both sides of South Platte below mouth of Poudre. On other hand body irrigated land in Poudre Valley is contiguous to body of irrigated land above mouth of Poudre, though perhaps land on south side of South Platte near Poudre is an extension of Big Thompson area.

Speaking of Upper Platte and tributaries, you have general body of land more or less irrigated, extending up and down Platte River from above Denver to mouth of Poudre and this area is increased by irrigation of Valleys along streams coming in from west, Cache la Poudre, Thompson, Saint Vrain, Clear Creek and some of smaller streams. That body is disconnected from irrigated section of what we term Lower Platte commencing down in Fort Morgan region and running thence to state line.

Similar set of measurements were made in South Platte River for quite a number of years. Return and seepage water is in-
3017 creasing there more rapidly, if anything, than on Cache la Poudre, for while in 1890 quantity at Iliff, just beyond Sterling, amounted to about 150 cubic feet per second to that point from mouth of Poudre, in fifteen measurements in 1903 it amounted to 720 cubic feet per second. This measurement was taken at Iliff. I took that because in 1890 Iliff was last point of observation. In 1902 it was 760 cubic feet per second. Iliff is in Logan County some 10 or 12 miles down stream from Sterling. It is about 50 miles up stream from point where river crosses interstate line.

Measurements of South Platte show definitely loss in stream of this character,—that is, stream like the Platte or Arkansas, and change

in conditions with subsequent irrigation. In first 5 or 6 series of measurements, made from 1890 to 1894, South Platte River gained from mouth of Cache la Poudre down to Iliff; from Iliff down to state line a decrease shown by series of measurements, with flow stationary at Fort Morgan. Last measurements show an increase down to state line. Since first measurements were made, there has been considerable increase in vicinity of Sterling as well as Fort Morgan and quite an area has been brought under irrigation from Iliff to state line, especially adjacent to Julesburg, so that return water from these sections begins to show and river is increasing all way down to state line, while years ago it was decreasing part of that distance. I might say that percentage of return on Platte River was probably more than on Poudre.

3018 Similar series of measurements was made on Arkansas River, something like 12 or 15 series of measurements from Canon City to state line that shows increase in series of years, starting in with something like 150 cubic feet per second in earlier measurements and becoming near 400 cubic feet per second in last few years. Greater irrigation is permissible in Lower Platte district owing to application of water during past years in Cache la Poudre Valley. This is particularly true in Fort Morgan area. That application in turn may make permissible an increased irrigation as you pass down river. It has already had that effect. I should say that this measurement I spoke of on Platte is simply from mouth of Poudre down to state line. It does not include increases that have come from irrigation above mouth of Poudre either from Platte itself or from tributaries, Big Thompson, Saint Vrain, Boulder Creek and other streams. A similar rule applies to that, so that as a matter of fact, water is more than used over. If, for instance, one half of 40 per cent returns and is used again, then 40 per cent. of that second water would be repeated and so on till it is used. Everyone acquainted with Platte Valley for past twenty years has seen effect of this increase and those who have had occasion to know valley in anything more than purely limited sense, know effect that has come from this seepage water. Stream therefore that used to be low in fall and winter now is high in winter at times when ditches are not taking it out and then reservoirs get abundant supply of water in winter. In fact are getting more than they can use. Some change is taking place not only down at state line, but beyond, and these streams are becoming perennial, where formerly they were dry.

3019 Familiar with valley of Laramie River in Colorado. Same general laws of return water prevail there. Water applied to land would return, or portion of it, quickly to stream, as gravel is large and distance small, so that as valley is narrow and material mostly coarse, water that returns could be expected to return in rather short time. Hence effect of irrigation in Colorado would probably be to retard fall of stream but not to keep stream so uniform as in case of Platte or Poudre, where water is applied so much further from stream. Water in Laramie valley in Colorado must all be applied within very short distance from stream. This

3020 narrow valley would hasten the return. Coarseness of gravel would probably increase amount of return. Water

would flow faster and easier and come back quicker and in probably greater quantity. A large part of that valley is of coarse gravel.

On Laramie Plains same laws of return prevail, but conditions are somewhat different and thus consequences are to some extent different. Some of that soil is fine, adobe clay, with fine deposit that is almost impervious to flow of water, or, at least, soil is penetrated slowly. I think this applies to both subsoil and top soil. Along bottoms there is coarser deposit. Water goes through fine material very slowly and instead of flowing one mile per year as it might in ordinary soil, it will not flow near that distance. That means that soil becomes saturated with water, greatly supersaturated and becomes seeped and that kind of soil becomes alkaline and gradually gets into bad condition. Some water will get back into stream in course of time, but unless there should be layers of gravel under neath surface it would mean that surface would be water-
3021 logged with water on surface, forming pools and evaporating. On Laramie Plains in course of time they will either have heavy returns of seepage water to stream or land will become supersaturated, marshy and the soil will become almost impassable. In some places it may be drained. So far as conditions can be foreseen, they will either have heavy return flow or drainage will be necessary.

In clay soil of any character, water goes through much more slowly than through sand and gravel; through gravel faster than through sand; through sand faster than fine sand and then with mixture of clay or finer particles to fill up interstices, or presence of fine clay or sedimentary deposit, soil will be practically impervious to water. Water will go through any soil, but instead of going through at rate of 10 or 30 feet per day, it may at times not go more than one inch per day. This makes condition of almost water tightness. Very slight stream will therefore furnish more water than soil can transmit and that must of necessity be forced to surface.

Soils of that kind, wherever located so that water comes down upon them, nearly always becomes swampy, water-logged, perhaps impassible and generally show patches of alkali. These soils also generally contain large percentage of alkali. Have observed
3022 seepage lakes on Laramie Plains lying under Pioneer Canal and extending up river in general direction from Laramie. They indicate that basin was pretty nearly water tight; that amount of water that is coming into those basins from rainfall and seepage from above is more than evaporation has taken care of. Indications are that water level has been rising in many of them.

My designation of soil on Laramie Plains differs from other witnesses simply from places to which attention is directed. There are places where soil is coarse, largely along river bottom. On some of uplands surface soil is coarse but soil beneath seems to be very tight and almost impervious, and, as far as seepage is concerned, sub-soil cuts more figure as a rule than surface soil. I was rather thinking of it from that point of view. There is large strip of land running west and southwest from Laramie, for instance, along road, that has fine deposit and it is shown in case of even slight rain that

it becomes very difficult to travel. It is slippery. The soil
3023 I have in mind is extremely impervious. You will find great many other tracts of same character of soil all over valley. Much of that soil has been deposit- probably from ancient lake and is very fine. Coarser soil has come from streamdeposit.

Regardless of seepage or return flow, drainage is almost necessary in any irrigated area. In many places there is natural drainage. Drainage must be either natural or artificial. If drainage is done directly, the water becomes then available for use.

Intercepting drainage water by building ditches for using this water in irrigation has been prevalent in Poudre Valley for 25 years. There are great many ditches that are called "seepage ditches," that is, they depend for their supply entirely upon water that is received from seepage. I made attempts some years ago to ascertain number and I know there were then a great many. Number has been increasing since. In some cases these ditches were constructed more for purpose of getting water for use in irrigation than for drainage of lands. In a few cases the water was incidental and in many cases water and drainage was a combined object.

Dividing Colorado into two classes,—plains and mountain lands, and assuming mountain valleys to be mountain land, the mountain area exceeds the plains area in Colorado. Mountain area is about 2/3 of state. Even if high mountain tracts, such as North Park, Middle Park, South Park and San Luis Valley, were included as plains lands, greater area of state would still be mountainous. Proportion would not change much. Plains area would increase from about 1/3 to 2/5.

In the bulletin from the census of 1910, which I have before me, area of Colorado is given as 66,341,120 acres.

Irrigated acreage in Colorado is 2,792,032 acres as given by census of 1910.

4.2 per cent. of state is irrigated, practically one part in twenty-five.

Colorado exports a good many products and has done so
3025 for a number of years. It has been importing other products. I have not had occasion to look at those figures for some years and would have to give very general statement. Exports are wheat, potatoes, sugar from sugar beets, alfalfa, alfalfa seed, peas, cattle, sheep, fruit, apples and peaches, cantelopes and melons. During portion of year state imports peaches, apples, cantalopes and melons. It imports dairy products to considerable extent, and poultry, although it produces them to considerable extent. It has been increasing its production of hogs and hog products. Same is true of dairy products. Think it imports more than it exports of dairy products. When I spoke of exporting sheep, I referred to finished product. It brings lambs in and exports practically same number, but very much increased in size and weight. It also produces large number of lambs on its own grazing ground.

Colorado leads other states in production of beet sugar. It is foremost state in United States in number of factories and in production of both beets and beet sugar.

3026 Beet sugar is produced in the South Platte Valley east of the Poudre as well as in the Poudre Valley. In South Platte Valley there are three factories. Arkansas Valley has six factories. There is one factory in San Luis Valley at Monte Vista and one factory at Grand Junction. Outside of Poudre Valley in northern Colorado, there is one at Loveland and one at Longmont. There are 17 sugar factories in the state.

Colorado exports agricultural products of much greater value than it imports. Fruit section of Colorado is on Western Slope. There is also fruit section at Cañon City and a great many areas along foot of mountains, but not so well known.

Poudre Valley area is ahead of other irrigated sections of Colorado in point of development. It was settled as a whole earlier than most other irrigated sections of state and it has been 5 to 10 years in advance of irrigation developments of other areas.

L. G. CARPENTER.

Cross-examination by Mr. N. E. Corthell:

3027 Alamosa, in the San Luis Valley in Colorado, about 280 miles south of Laramie, has an elevation of 7550 feet as against an elevation at Laramie of 7100 feet. There has been extensive irrigation development in the San Luis Valley, the 3028 irrigated area now amounting to about 300,000 or 400,000 acres. The irrigation development commenced about 1850, but the principal part has been in the last 30 years, being more rapid in the first part of this period than in the last part, a great deal of the land that was settled in the early days having been abandoned. How this abandoned area compares with the annual reclaimed areas I do not know. The census reports a total area 3029 of 361,840 acres irrigated in the San Luis Valley in 1909, and the geological survey report gives a total irrigated area of 298,650 for the same region in 1899, and 143,801 acres in 1889. The irrigated land which has been abandoned is valley land, abandoned on account of seepage. Some of the seeped land in the San Luis Valley is of an impervious character, as is true with respect to some land in the Laramie Valley in Wyoming, although this is not the predominating character of that soil which for 3030 the most part is porous and gravelly. The principal crops in the San Luis Valley are wheat, oats, and in recent years field peas. Efforts have been made to grow sugar beets and potatoes, and there is a beet sugar factory which was operated in 1912 3031 and for a few days in 1913. It was constructed about 1910, and has experienced considerable difficulty. Field peas were first planted about 1895, on account of the poor success with alfalfa, and they are now grown quite extensively. In some years potatoes have been grown to quite an extent, at least enough to ship 3032 out. The complete result of this crop I do not know, but it has not been a very great success in some of the recent years, and I do not know whether the area given to potatoes has

been increasing or decreasing. As to whether farming in the San Luis Valley is generally considered successful, you can get reports of all kinds.

While the seepage and return flow of water in the Poudre Valley constantly varies, the constant tendency is to increase from one period to another. In the first two or three years following the commencement of the work, there was no great degree of accuracy in the measurements, but after that and commencing about 1885 we were more careful, and attempted to have all ditches in the section measured shut down. Commencing in 1891 this was not done, but the ditches were kept at a uniform flow which was measured and taken into account. The amount of return flow throughout the irrigation section of the Poudre River at the date of the measurement nearest to October which was covered in each year measured, in cubic feet per second was as follows: October, 1885, 48.02; October, 1889, 98.97; October, 1890, 100.79; October, 1891, 79.53; October 1892, 96.28; November 1893, 98.68; August, 1894, 118.17; October, 1885, 162.47; November, 1896, 65.27 (one section of the river omitted); October, 1897, 120.79 (one section omitted); August, 1898, 125.18; September, 1899, 134.12; September, 1900, 110.02; July-August, 1901, 167.50; July, 1902, 119.43; August, 1905, 186.37; September, 1904, 173.49; September, 1905, 180.83; September, 1906, 216.13; September-October, 1907, 203.15; September, 1908, 225.32; October, 1909, 208.54; October, 1910, 159.72.

Our method of measurement was to divide the stream into sections of such length as could be covered within one day, making allowances for the inflow and outflow and then measuring the stream itself. At one time I thought that the return flow and seepage was increased during the summer months, and that may have been the case at that time, but it is not true now, as the return flow has been very largely equalized as the irrigation has extended several miles from the river, over which distance it would take two or three years for the water to travel.

The measurements of the return flow into the South Platte River were made from the mouth of the Poudre to Iliff, fifty miles west of the state line, or to the state line. For the years 1891, 1894 and 1895, it appeared that there was a loss from Iliff east, and it is a fair assumption that this was a constant loss existing in former years. In 1889 the gain between the mouth of the Poudre and Iliff due to return and seepage flow was 217 second feet. In October, 1890, it was 165.5 feet; in October, 1891, 285 feet with a loss of 10 feet from Iliff to the state line; in October, 1893, 254.7 feet; October, 1894, 335.2 feet; October, 1895, 591.1 feet; November, 1900, 861.50 feet; October, 1901, 515.08 feet; October-November, 1902, 762.44 feet; October-November, 1903, 384.22 feet. These measurements were in cubic feet per second. This covered a section of the South Platte River about 100 miles in length running through a district which has been extensively developed during the

past ten or fifteen years, and which has been irrigated to some extent for 25 years.

3041 While seepage conditions are universal in that seepage will always occur and water will return underground to a river wherever irrigation is practiced, the extent of the return flow varies very greatly with the particular conditions. After irrigation has become well settled in the Laramie Valley, I believe the seepage conditions will be substantially similar to those in the Poudre Valley, but the return flow from the uplands in the Laramie Valley will probably be slower than from the uplands in the Platte Valley, as the soil in the Platte Valley is sandier and the return through a gravelly

3042 soil is much more rapid than through a clay soil. In 1896 I reached the conclusion that land in the Platte Valley was furnishing more return water per unit of area than the land in the Poudre Valley.

3042 Redirect examination by Mr. Fred Farrar:

All of San Luis Valley, except river channel and relatively narrow strip close to it, slopes practically toward Alamosa. Sugar beet industry in San Luis Valley has not proven successful.

3042 Climate in San Luis Valley is such that frost may be expected during summer months. They are cultivating field peas in San Luis Valley because they needed a forage crop and also for crop to enrich land, that is, nitrogenous crop. Alfalfa was deep rooted, perennial plant, so that it was not success, principally on account of climate, alfalfa being a lover of warm climates, and because water was near surface. Peas were taken as nitrogenous annual crop. It is small rooted plant and it has improved and helped agriculture there very much.

Production of potatoes in Poudre Valley area has fallen off greatly during last two or three years on account of blight affecting crop. Blight is not limited to the Poudre Valley but extends all over United States. It affects different areas at different times. Celebrated famine of Ireland in 40's was probably due to blight of same character. It is fact that the trouble has been obliterated and that they're securing good crop during 1913. Blight or something similar to it, Rhizoctonia, has affected potato yield in different places or in individual communities from time to time for years, and in Rhode Island especially. Local condition will probably recover and has done so to large degree.

3045 Prof. Fitch, who wrote Bulletin No. 175, to which Mr. Corthell has referred, published in 1910, has admitted that the theories he then advanced were subsequently shown to be erroneous.

3046 DENVER, COLORADO, Feb. 28, 1914.

By Mr. Delph E. Carpenter:

Blueprint map of Wheatland project showing cultivated lands November, 1911, by C. C. Washington, being same Exhibit as Exhibit No. 2 heretofore considered in connection with testimony of

witnesses M. R. Johnson and J. A. Elliott and identified at time of taking of testimony of said witnesses, marked Defendants' Exhibit 2.

(Defendants' Exhibit 2, blueprint map, offered in evidence.)

JOHN E. FIELD, recalled.

Direct examination by Mr. Fred Farrar:

(Panorama album marked Defendants' Exhibit 122, offered in evidence.)

Defendants' Exhibit 122 contains photographs of Wheatland, Laramie Plains and Cache la Poudre districts. These photographs were made in form of panorama so that we could get comprehensive view of district as whole. Panorama camera was used in taking these pictures. It is instrument by which camera revolves around an axis and takes, if required, the entire horizon. It can cover 360 degrees or complete circle and is thus frequently used to give comprehensive view of districts, rather than individual scenes. With these photographs one can imagine himself looking towards any part of the compass. To get really correct idea, unless one is used to looking at this kind of photograph, picture should be turned in form
3047 of circle. Observer should stand at opposite side of circle looking across it. Observer then looks in direction in which camera was pointed while picture was being taken.

In panorama Photograph No. 1 in Exhibit 122, picture should be turned in form of circle and two fence posts at either end of picture made to coincide, then observer standing opposite road shown in panel No. 2, looking across diameter of circle formed by picture, would be looking north. Observer could then move to right, looking across picture, he would be looking west, and moving still further to right and looking across picture he would look down second road due south. In this way person can realize direction and get himself properly orientated to view the photograph.

These panorama photographs were taken on a continuous sheet. Negative was continuous. For purpose of easier handling, prints were subsequently divided into panels and mounted.

Photographs vary from arc of 120 degrees to a complete circle. Panels are numbered beginning at left. Figures at top of picture indicate number of panel. These figures are put on for ready reference in describing pictures and what they were intended to illustrate.

Fourteen panorama photographs in Defendants' Album
3048 Exhibit 122, numbered 1 to 14, with a legend preceding each picture. Photographs in Wyoming are numbered from 1 to 5 and those in Colorado from 6 to 14.

Photographs were taken to present to the court as clearly as possible, general appearance of districts under discussion. For that purpose Exhibit 122 should be taken in connection with photographs shown in Exhibits 115 and 116, 119, 120 and 121.

Exhibits 115, 116, 119, 120 and 121 give individual views, while these panorama views, Exhibit 122, connect up these views, as it were. Details could be studied from exhibits mentioned, while gen-

eral idea of country can be better obtained by examination of panoramas.

First photograph in album, Defendants' Exhibit 122, is panorama taken about 2 miles southwest of Town of Wheatland. It covers 360 degrees or complete circle. Entire horizon is covered and embraced within boundaries of picture. It was taken near east quarter corner of Section 24, Tp. 24, N., R. 68 W. It is almost in heart of older developed district of Wheatland tract, showing farms which have been, generally speaking, longest cultivated. An examination will show area covered by panorama to be that portion lying between Colorado & Southern Railroad tracks and Chugwater Creek. This appears by Exhibit 2. Panel No. 1 is looking in northwest-
3049 erly direction from point where picture was taken. Extreme left of panel covering portion of town of Wheatland, in background. Road shown on Panel 2 is running in due northerly direction. This panel, as well as Panel 1 is looking north across Laramie River, and highlands in background are on north side of Laramie River. Panel No. 3 is taken looking almost due east. Highlands on east side of Chugwater Creek are shown. Panel No. 4 swings more to south. Panel No. 5 is looking almost due south as shown by road, which is same road, except looking in oposite direction as that shown on Panel No. 2. Panel No. 6 is looking in westerly and southwesterly direction and Panel No. 7 completes circle. Portion of town of Wheatland being again shown on extreme right end of panorama.

Picture taken August 7, 1913. It shows that alfalfa was largely in stack. First cutting having been made sometime previous and part of second cutting is in stack, as will be shown by close examination of photographs. Stacks close to each other being of different color, showing more age on one than other. Alfalfa is also shown in bloom in near foreground, second growth. Improvements are shown on nearly all panels, farm buildings, trees and other improvements surrounding them. This is a good district. While it
3050 *it* is further north than Poudre Valley, it has about the same elevation. Season is of course shorter than in Poudre Valley. Though it does not compare very favorably with Poudre district, it compares most favorably with any district in State of Wyoming and is truly agricultural country. This picture, if placed in form of circle, indicates just what man would see if he stood at point where camera was placed, without changing his location, merely turning completely around. This panorama is of same size as original negative. It has not been enlarged or changed. The same is true of all of these panorama photographs.

Panorama No. 2 is another portion of Wheatland area and lies south and west of town. It was taken near south quarter corner of Section 28, Tp. 24 N., R. 68 W. August 7, 1913. This panorama also covers complete circle or 360 degrees. Panel No. 1 is looking little southwest and shows Laramie Mountains in background. Rise of ground west of Sybille Creek. Elevated ground under words "Laramie Mountains," not mountains themselves, but elevated ground between mountains in territory covered by Sybille Project on west

side of Sybille Creek. Panel No. 2 looks little north of west
3051 and shows farms and improvements and cultivated areas in Sections 28 and 29, Tp. 24 N. R. 68 W. On Panel 2 considerable good development is shown. Alfalfa is in stack and residence and improvements are also shown. In extreme background of picture in Panel 2, appears Laramie Peak. It is so labeled. This is one of landmarks in that district. It is a high mountain and North Laramie River heads in that vicinity. Laramie Peak is about 30 miles in air line from point where picture was taken. Panel No. 3 shows one of laterals serving land of Wheatland District. It will be observed from waves shown on water that it is running at very great velocity. This great velocity is possible by reason of considerable amount of gravel in soil which remains in bottom of ditch and prevents further erosion. This condition is common to ditches in this district. Velocity keeps bottom and sides of ditch scoured from silt and seepage from them is very great. Waste from them in consequence of such condition is excessive. Road shown on Panel 2 and also its continuations on Panels 3 and 4, is almost in east and west direction and practically follows section line between Sections
3052 21 and 22 on north and 27 and 28 on south. Land in immediate foreground in this picture is not under cultivation. Picture was taken near edge of cultivated area and in newer portions of district. Larger part of land in this district is not cultivated. Cultivated land may be seen in distance on several panels, improvements and hay stacks on horizon being on land lying almost due south of town of Wheatland. Panel No. 5 shows character of native vegetation and uncultivated character of part of land. Panel No. 7, looking to south and west, shows no cultivated land whatever.

Area in newer tracts in Wheatland district, that is, Bordeaux and Sybille or Cooney Hill tracts, is not as good as that shown on Panel No. 2 of this picture. There is greater amount of waste land. It is more difficult to get water to it. Sybille tract lies somewhat higher and is more remote from railroad. It is not as good as Wheatland tract but might be called fair. Bordeaux tract on other hand, I would classify as very poor land on account of great expense of providing ditches and laterals. Land is cut by draws, arroyos and swails. Bench lands are flat but of small area. On this tract, development will be in small areas along draws and in scattered tracts on bench. It will never be cultivated in anything like contiguous body. I, from my experience, would judge that from 50 to 60 per cent of land embraced in Bordeaux tract is not available for cultivation under present economic conditions. The arroyos and ravines
3053 are quite deep. Ground is very rolling. Gulches have cut through mesa and time has smoothed down roughness and it is not exactly an arroyo country but steep and hilly.

Panorama No. 3 was taken August 8, 1913. It covers something over 180 degrees of arc and was taken from edge of highest bench lands just above north canal of Lake Hattie outlet. It is south and west of Laramie and approximate location of camera was near west quarter corner of Section 17, Tp. 15 N. E. 74 W. Panel 1 is looking almost due east and does not reach quite far enough north to take

in locality of Laramie. It does show hills or mountains to east of Laramie. Road in Panel No. 2 is leading due south going practically toward Laramie River. Panel No. 2 shows canals, North Canal of Lake Hattie outlet and also Pioneer canal. Panel No. 3 is looking south and west towards Jelm and Sheep Mountains. Panel No. 4 is looking practically west. Northerly end of Sheep mountain is shown, which is point where Little Laramie River enters Laramie Plains proper. On all of these panels, the canals, Pioneer and North Canal and Lake Hattie outlet are shown, except on Panal 4 Pioneer Canal is not shown. Photograph shows that soil in vicinity is gravelly as do also all excavations for
3054. Lake Hattie outlet in new canal. Canal below it is Pioneer. It is old canal said to have been constructed in 1879.

Series of lakes or ponds are shown lying under these two canals and running in line along center of picture. These are natural depressions in surface of ground where water has collected and in case of areas where no water is shown they are commonly called alkali bogs. It is wet ground where soluble salts have been left on surface after water has evaporated. Lakes are principally fed by waste and seepage water from various canals traversing district, particularly from Pioneer Canal. Effect of North Canal of Lake Hattie outlet has not been felt as yet, but after it has been operated for awhile one can predict with reasonable certainty that very large area lying under it and near foot of slope from which picture was taken, will be practically one continuous alkali lake or bog.

Small clumps of trees, five on Panel 1, four on Panel 2 and none on other panels, are, without exception, on Big Laramie River. Group of trees on line between Panels 1 and 2 being Hutton Grove on Big Laramie River.

3055 Absence of farming is shown by this view. Note absence of characteristics which are always found in agricultural communities in those portions of United States where rectangular system of survey has been made. One expects, in looking over farming community, to see checkerboard system, to see cultivated areas in rectanguar shapes, which are distinctly and plainly outlined by different colors of different crops. Grain and alfalfa and hay crops forming contrasts which show plainly, but there is an absence of any such appearance on this picture. Such farming as is done, is in such irregular manner that it does not show. In fact there is no continuous farming in this district and it is well illustrated by that absence of checkerboard appearance which one always expects to see in a farming country.

Picture was taken August 8. Having been informed that Pioneer Canal was constructed in 1879, 35 years ago, it seemed incomprehensible that with an abundant water supply, with ditch already constructed, so little progress along farming lines had been made, except, of course, when we stop to consider climatic conditions and soil. In my experience, I think I have never seen district other than this where water had been provided for even ten years, much less 35 years, without development being practically complete.

3056 Panorama No. 4 was taken from knoll in Section 25, Tp. 15 N. R. 76 W. and Section 30, Tp. 15 N. R. 75 W., It was

necessary in order to get anything at all, to get on some elevated point, and it was for that reason that I took these pictures from edge of highest ground. Picture taken August 8, 1913. Panorama covers about 240 degrees of arc and shows area between Pioneer Canal and Laramie River, and area north of Pioneer Canal and south of Lake Hattie inlet and Big Hollow. It also covers territory which lies east of Lake Hattie inlet from Big Laramie River. Panel No. 1 is looking almost due east and little south. Right edge of Panel No. 2 is looking almost due south towards Boulder Ridge. Panel No. 3 Jelm Mountain is shown and I have indicated on Panel 3 approximate location of mouth of Big Laramie Canon. This is in vicinity of Woods Landing, Wyoming. In Panel 4, Sheep Mountain, Lake Hattie and mouth of Little Laramie Canon are shown, also on Panel 4 one can observe Lake Hattie Dam and water in lake itself. This picture also shows prevalence of waste lakes where seepage and waste water accumulates and shows generally character of country. Body of water shown in foreground in Panels
3057 2 and 3 is waste lake.

The four photographs, two of Wheatland area and two of Laramie area, were taken by same operator and camera on succeeding days.

Photograph No. 5 is view of Little Laramie Valley. It covers about 240 degrees of arc and was taken from north end of Sprague Lane. Road shown on panel 2 in which word "South" is written, is Sprague Lane, which is part of Lincoln Highway, a transcontinental automobile road. On Panel No. 3 location of Jelm Mountain, Sheep Mountain and Little Laramie Canon and Filmore, Wyoming, are indicated by arrows. On short Panel No. 4, Centennial Mountains are indicated. Panel No. 1 is looking down Little Laramie River towards Two Rivers, which is junction of Little and Big Laramies. Immediate foreground shows ditch. Further down in bottom land or to south there appears meandering channel, it is one of channels of Little Laramie River. Looking
3058 closely, further across picture, there are other channels which are parts of Little Laramie. One is called Brown Creek, but it is merely a channel of Little Laramie River. There is practically no difference between this creek and river itself. Sprague Ranch appears in foreground. Pole corrals joining large log barn indicate that it is stock ranch.

Taking view of valley shown in Panels 1, 2 and 3, it is evident that agriculture is entirely native hay. At time picture was taken, greater part of hay had been put up. There were some tracts that had not been cut. Road called Sprague Lane appears to be graded. This is what Mr. Corthell in his cross-examination of Mr. McAnelly termed a turn pike.

Roads of Laramie Plains are naturally fair, but there are not many of them. They run diagonally generally across country and in general direction in which one wishes to travel and in that respect they differ from Poudre Valley where section lines are followed almost entirely. Roads generally speaking follow natural topography

of country in Laramie Plains, almost without reference to section lines.

3059 Measured two fields of native hay, which we considered quite a little better than average. Made measurements with Mr. Woodhall and Mr. McAnelly on Little Laramie River valley. Mr. Bath, owner of these meadows, informed us at time we made measurements, that no hay had been hauled off place, which was another reason for selecting these places for measurements. .6 of a ton of native hay per acre crop production was demonstrated by these measurements. He probably fed some during time he was cutting hay, but he did not haul away any. From that measurement in an estimate, I judge, in fact I am quite positive, that average production of native hay in Laramie region along both Big and Little Laramie Rivers, will not average over one half ton of native hay per acre per annum.

Panorama Photographs 3 and 4 in particular show considerable portion of Pioneer Canal and area under it. The Eaton or Larimer and Weld Canal in Cache la Poudre Valley is of about same date of construction as Pioneer Canal. Also Evans No. 2 which takes water from South Platte River between Denver and Greeley.

3060 Also Northern Colorado Irrigation Company's canal, known as High Line, taking water out of South Platte south of Denver with date of priority January, 1879.

There is no comparison between development agriculturally under any of these Colorado canals and the Pioneer Canal. Under any canal in northern Colorado of such a date, where there is bare sufficiency of water, lands are practically all cultivated and well developed. Under Pioneer Canal, as I stated, there is comparatively small percentage of land under cultivation.

Wheatland area which is shown in part in pictures Nos. 1 and 2 in this album, is later than the Pioneer Canal but the country is much better developed than under the latter canal principally on account of difference in climate. Soil is in my opinion, somewhat better on Wheatland tract, but, particularly on account of climate at Wheatland, they can grow crops and make a profit. It is due to climate that there is such a lack of development on Laramie Plains. These two districts are both watered by same stream. In air line they are not very far apart. Wheatland area is something over 2000 feet lower. I think there is no comparison be-

3061 tween the development of the two districts, Wheatland district looks like farming country, Laramie plains area does not.

Panorama Photograph No. 6 of Exhibit 122 was taken in Poudre Valley, in Colorado. It is panorama of 300 degrees arc, taken from point about two miles west of Ault, showing lands under Larimer County Canal. District shown in this photograph is one of rather recent development. Photograph taken August 5, 1913. Panel No. 1 is looking west and northwest towards Larimer County Canal, which is situated in vicinity of trees in background. Lands appearing above line of trees and beyond trees are portions of Greeley-Poudre Irrigation District. Panel No. 2 is looking in northerly

direction as indicated by arrow on road. Panel No. 3 is taken looking in northerly and easterly direction and on right edge towards town of Ault. Panel No. 4, was taken looking in southerly direction. Panel No. 5 is in southerly direction. Road indicated on Panel No. 5 being southerly continuation of same road indicated on Panel No. 2. Districts are illustrative of what I meant by term "checkerboard" appearance of country. Fields of different crops are shown in rectangular shape. Different crops indicated by difference in color, grain, potatoes, beets, etc. and alfalfa, giv-
3062 ing appearance of neatness and of systematic development. Trees in background are some of them along laterals but groups of trees are generally speaking surrounding farm buildings and improvements.

Panorama Photograph No. 7 covers about 120 degrees of arc and shows cabbage and sugar beet fields and also town of Ault in background. This area is irrigated from water from Larimer County Canal. Picture taken August 5, 1913. Crop of cabbage in immediate foreground. Little further back, crop of different color is sugar beets. Also in reference to this picture, panorama No. 8, which follows, was taken from square white building shown in Panel No. 2 of this photograph. Next picture was taken from building shown in this picture.

Panorama Photograph No. 8, taken August 5, 1913, covering about 240 degrees of arc, shows part of residence section of town of Ault, Colorado, and view would partly lie to southwest and northwest of town and along Larimer County Canal. Panel No. 1 is looking in southeasterly direction towards town of Eaton, approximate location of town being indicated by arrow. Eaton is about four miles. Panels 2 and 3 are taken in southwest and westerly direction and cabbage and sugar beet crops shown on Panels 2 and 3 are same shown in Panorama Photograph No. 7. Crop in near fore-
3063 ground on Panel 2 is onions, this was not visible from other direction in Panorama Photograph No. 7. Highway on Panel No. 4 is looking in northerly direction towards Pierce. Panel No. 4 also shows number of residences of town. Area shown in this photograph is one of later developments under this canal.

Panorama Photograph No. 9 taken August 5, 1913, covers something like 250 degrees arc. Was taken from point about one mile southwest of Pierce, Colorado, and shows land brought under cultivation quite recently. This land under Pierce Lateral of Larimer County Canal, constructed during last four or five years. This land was of desert character prior to being brought under ditch. It was regular plains country characteristic of eastern Colorado and poor grazing land. On Panel No. 1 in background is shown buildings of Pierce and road in Panel 2 is running in due easterly direction. On Panel 3 location of town of Ault is shown by arrow. Panel No. 4 is looking in southwesterly direction. Lands of Greeley-Poudre
3064 Irrigation District lie just north and east of lands shown in this picture and immediately joining. This photograph illustrates very well response of land under irrigation, except that it would give better idea had we been able to get further back and show

contrasts between uncultivated territory and this cultivated land. This well illustrates what can be done in course of three or four years, where conditions are favorable for farming under irrigation. Year 1911 was one of comparatively short water supply and scarcity, 1912 was about normal in supply and 1913 was excessively dry. This shows what was done in the very dry year of 1913.

Pierce Lateral was constructed to irrigate land above old land of Larimer County Canal. Land in this district has developed towards north. One traveling back and forth between Cheyenne and Denver, if he passed over that district about two years since, would notice that every time he made a trip the irrigated and cultivated lands had been extending further north each year. Pierce Lateral merely extends area under Larimer County Canal little further north. Town of Pierce, as shown in picture, is in extreme southerly edge of the Greeley-Poudre Irrigation District.

Picture can be said to fairly illustrate probable result of application of water for irrigation of lands in Greeley-Poudre Irrigation District. The areas are identical, but we might expect even better results. It is hardly likely that in beginning they will meet in Greeley-Poudre District same adverse conditions of shortage of water that they have in district shown in photograph. This photograph is not designed to show typical lands of Poudre Valley, but lands that have just been brought under cultivation and which are immediately joining lands of the Greeley-Poudre Irrigation District. It is typical of development of new lands.

Photograph No. 10 is panorama covering complete circle taken August 5, 1913, from roof of Eaton Sugar Factory at Eaton, Colorado, and shows portion of lands in that vicinity. Land shown is irrigated by Larimer and Weld Canal. Panel No. 1 is looking in westerly direction and residences of town are shown in picture. Panel No. 2 is looking in northerly direction and shows line of Union Pacific Railroad running in direction toward Ault, Pierce and Cheyenne. Panel No. 3 looks in northeasterly direction; structure in foreground is beet pulp silo near sugar factory. Sugar factory was not in operation at time picture was taken. Campaign had not opened yet. Panel No. 4 is taken in an easterly direction and shows feed yards of Bruce G. Eaton. In immediate foreground is field of beets close to factory. Object in immediate foreground is chimney of factory. Panel No. 5 is looking in southerly direction and again shows line of Union Pacific Railroad looking toward Lucerne, Greeley and Denver. South point is indicated by arrow put on panel. Panels 6 and 7 are looking in southwesterly and westerly direction. Small rectangular yards or fields shown on Panels 2 and 3 to left of pulp silo are feed yards. These are yards where beet pulp is fed to cattle. Picture as whole shows number of trees, some along ditches and laterals. They were set out artificially. Where trees are grouped, rather more dense, they, generally speaking, surround farm buildings. Residence portion of town of Eaton is concealed by trees in panel No. 1. "Checkerboard" appearance is quite plain on
3067 this picture, excluding feed lots, etc. It is especially apparent in Panels 4, 5, and 6. Reason it does not show so

plainly on Panels 1, 2 and 3, is because it is looking diagonally across country.

Area under Larimer and Weld Canal, Eaton Ditch, is same from standpoint of time of beginning of development as that under Pioneer Canal. Canals are practically same age and opportunities for cultivation, as far as point of time is concerned, are about the same. Development under this canal was hampered by litigation relative to water rights for considerable time.

Panoramic Photograph No. 11 covers 240 degrees of arc and was taken on sections 7, Tp. 7, N., R. 67 W. at point nine miles east of Fort Collins and shows newly developed land under extension of North Poudre Canal. Older developed lands are in distance in background. Panel No. 1 shows southwesterly direction; Windsor Reservoir indicated by arrow. Panel No. 2 is taken in southwesterly direction and shows Timnath Reservoir location, indicated by arrow. Panel No. 3 is in westerly direction, looking toward Fort Collins. Approximate location of city indicated by arrow. Panel No. 4 is taken in northwesterly direction and on this panel location of town of Wellington is indicated. Land in foreground is irrigated by North Poudre System. It is of very recent development. Tract shown in foreground has not been under cultivation more than three or four years. Picture, taken as a whole, does not give fair representation of older developed districts of Poudre Valley. It gives idea of newer developed districts.

3068

Panoramic Photograph No. 12, covering 160 degrees of arc, was taken August 6th. Land is under Greeley No. 2 Canal. It was taken on southwest quarter of Section 20, Tp. 6 N. R. 65 W. Shows sugar beet and oat fields. Photograph shows development under older canal. Age of district is somewhat indicated by size of trees.

Panoramic Photograph No. 13 shows area just acress road from area shown on Panorama No. 12. Covers about 120 degrees arc and taken August 6, 1913. Shows southeast quarter of Section 19, Tp. 6 N. R. 65 W. being south of Lucerne, Colorado. Oats and wheat fields are shown. Approximate location of town of Lucerne is indicated by arrow on extreme left. Two lines of poles along highway throughout this photograph are telegraph, telephone and power lines. Power lines run through this district to supply light and power.

Panoramic Photograph No. 14 covering 240 degrees of arc, was taken from roof of warehouse at Lucerne, Colorado, August 6, 1913, and shows portion of territory at Lucerne irrigated by Larimer and Weld Canal. Panel No. 2 is looking in northwesterly direction and shows cultivated fields. Panel No. 3 is taken in northerly direction and shows Union Pacific Railroad running north. Approximate location of town of Eaton is indicated by arrow. Water tank of Eaton Sugar Factory is shown on horizon near center of Panel 3. On this panel is also shown in foreground one of potato cellars that are common throughout this district. Another potato cellar is also shown on Panel No. 4. Panel is taken in easterly and notheasterly direction.

3070 Finding suitable location from which to take photographs was the principal difficulty encountered. It was difficult to get location where all features that were desired could be shown to best advantage. I drove over district before taking photographer out, trying to locate advantageous position, where it would show the Wheatland country in particular as a whole. I was desirous of taking eastern portion of tract at Wheatland, as being older and better developed, and also taking western portion of tract as showing newer country. In Panoramic Photograph No. 1, for instance, I selected this point because it was highest ground in that vicinity and showed country in every direction. If I had gone further south it would not have shown north country and vice versa. I made attempt to take photograph from the small building shown on left side of Panel No. 2 of photograph No. 1. We could not get photographer up there to place his instrument, that might possibly have been better location although it would not have shown the south country as well. In selecting position for picture in western portion of Wheatland tract, I first attempted to take it from water tank to west and northwest. It would then show uncultivated area in near foreground although other directions of compass it would have shown cultivated areas. This picture was also selected because ground sloped in different direction and we were on high point to take in greater scope of country. It shows also uncultivated area as well as cultivated.

Aimed to get typical pictures in taking the Wyoming photographs. In taking two Wheatland photographs, aimed to get best in older and better cultivated districts and also best in newer portions of district.

Have examined legends preceding each of these photographs in the album Exhibit No. 122. They are correct.

Have lived in west all my life. My work as civil engineer has been entirely in west. Description and history of process of development under irrigation districts and more particularly the Wyoming areas involved in this controversy, the Poudre Valley and other areas in Colorado, which will illustrate development and reasons for lack of development are as follows:

3072 In beginning agricultural development was encouraged to large extent by necessities arising naturally in a new country and farms were first located along river bottoms, where natural growth of grass was such that hay could be cut. First development on Big Laramie River and on rivers in northern Colorado were about same time, I would say that first period extended into middle seventies. Returns from these river bottom farms were gratifying and profitable, and in these districts where these farming operations were carried on, territory cultivated or farmed gradually extended. In Laramie Valley they did not extend beyond river bottom, while in valleys or streams in Colorado, as soon as bottom lands were fully occupied, farming operations extended to higher or bench lands. Settlements along rivers formed a nucleus for further development and farms were extended out of river valley proper to higher lands. Canals in Colorado were extended and

new ones of course were built to cover high lands. This nucleus settlement along river bottoms, was very important, because it furnished feed for horses and people who developed higher lands. In Colorado, returns from development of higher lands were so satisfactory, that we see a continuous extension of canals and extension of area, until practically all area available has been exhausted. As population became more dense in stream areas of northern Colorado, people there seeking new territory scattered over almost entire west. They went to Wheatland and aided in development of that district; they went on to North Platte in both Wyoming
3073 and Nebraska and aided in development of that country. We also find people from this section in Sheridan County, Wyoming.

Development also spread from Poudre Valley down South Platte and lands there were put under cultivation gradually. During this wide spreading out of course areas in original settled district were gradually filled in and made almost one solid farm.

Arkansas Valley development was somewhat more recent in the main, than that of northern Colorado, similarly the San Luis Valley and the Grand Junction Country that was somewhat later. In Grand Junction country they did not really get into development until the eighties. Still later, people spread south as far as extreme southwestern portion of Colorado in the Montezuma Valley. Within recent years, Colorado people have gone into Idaho and into Alberta. The influence of mining has been mentioned by some writers as being very great and being the incentive for our development. This is true if limited to our earliest development. In sixties and early seventies mining was largely at head of Clear Creek and Boulder Creek and we find farm produce from Boulder Valley and from Clear Creek and some from Thompsons contributing to support of mining camps. Little, I think, if any, produce of Poudre Valley was shipped into mining camps. There have been a few efforts at mining in Larimer County, but there has been no successful mining at any time on Cache la Poudre. There are practically no mines or mining camps in that country today. There has never been what would be called mining camps. Same is true of Big and Little Thompsons. And, except on south fork of Saint
3074 Vrain, there has been no mining. That would be Boulder in County.

With discovery of Leadville, attention of people was distracted from farming operations and much of brain and brawn necessary for farming development was withdrawn from farms. If Leadville had any influence on development of farms in state it was confined to Upper Arkansas Valley and San Luis Valley. South Park of course contributed considerable in way of hay to Leadville district, but as far as northern Colorado is concerned, I think discovery of Leadville was really a detriment and money discovered in Leadville was largely spent in Denver, Pueblo and surrounding towns. South Park and San Luis Valley have developed much more slowly than northern Colorado. This I think is due to altitude and climate and notwithstanding incentive which mining camps might

have contributed, these districts did not advance as rapidly as those in northern Colorado. We find on our farms very few mining men now and little of money taken out of mines has been spent in development of our irrigation.

Money made on farms has been spent in mines. Mining was very attractive to most people and everyone who had a little surplus money was apt to put it into mines. It literally withdrew even capital farms produced.

Influences of mining in development of Poudre Valley was no greater than influence of encampment mining district was on Laramie Plains country or development of coal mines in western Wyoming in vicinity of Hanna. These mining camps here generally developed before railroads came in and produce had to be hauled long distances, so that farming districts in near vicinity of mining camps were those which contributed to mines and were practically only ones that benefited by it.

3075 Northern Colorado was very remote from mining districts, and as consequence, they have furnished little or nothing to them. On Laramie Plains district, coincident with building of larger canals in Colorado, in late seventies and early eighties, Pioneer Canal was constructed. Instead of settlement rather preceding construction, we have here construction preceding settlement, and instead of extension of areas, we have rather a contraction of area on Laramie Plains.

Results apparently obtained on Laramie Plains under Pioneer Canal were not sufficiently profitable to encourage people to go ahead with their farming operations, and while in northern Colorado, especially on the Cache la Poudre, there was tendency to cut farms into small areas, a tendency towards more intensive cultivation. On Laramie Plains, on other hand, tendency seems to have been rather towards enlarging farm unit areas. On Laramie Plains area at present. The Laramie Water Company's system covers new lands and other companies up there, such as James Lake and Talmadge-Buntin District is to take in new lands, notwithstanding that there are large areas of uncultivated lands under existing ditches. In other words investment has been made to take in supply of water and new lands, while there still remains plenty of land under existing ditches if anyone should care to go there and try to farm it.

Produce of Poudre Valley has found its market generally east and outside of state. Thus potato market is in Texas district.

3076 Panoramic Photographs contained in album marked Defendants' Exhibit 122, both as to Colorado and Wyoming areas, were taken in four successive days by same photographer who made an extra effort to take photographs as near same time of year as possible and as nearly, in fact, on same day as possible.

L. G. CARPENTER.

Cross-examination by Mr. N. E. Corthell:

3077 The return flow between the mouth of the Poudre and Iliff on the South Platte River in November, 1896, was 323.50 second feet. In 1897 the measurements were not completed. In November, 1898, the return flow as far as Snyder, thirty or forty miles above Iliff, was 291.88; in November, 1899, 450.54 second feet.

3078 L. G. CARPENTER.

Redirect examination by Mr. Fred Farrar:

Figures I have given to Mr. Corthell on cross-examination are measurements showing gain from mouth of Poudre River to Iliff on South Platte. That when I first took measurements from Iliff on down river to state line, I found loss at state line, covering distance from Iliff to that point. Later on we found that, as irrigation had increased on Lower Platte, in Fort Morgan District and below, there was a gain in water from Iliff to state line. In other words, irrigation has developed gain in river as you progress downward.

1891 was first year measurements were carried from Iliff to state line. In that year there was loss of 9.76 cubic feet per second between Iliff and state line. 1894 is next year in which work
3079 was carried clear to state line. There was loss of 34.17 cubic feet per second from Crook Station east of Iliff to state line. Gain or loss between Crook and Iliff is not particularly distinguishable but seems to have been somewhat of a gain as between Iliff and Crook. Crook is about 15 miles below Iliff.

Definite loss is shown in last part of river but it is somewhat doubtful whether there was in first part from Iliff to Crook

In 1895 there was loss from Iliff to state line of 81.86 cubic feet per second.

In next three years, 1896, 1897 and 1898, measurements were not carried to state line.

In 1899, there was gain of 83.48 cubic feet per second from Iliff to state line instead of a loss.

1900 there was gain of 50.93 cubic feet per second from Iliff to state line and no loss.

1901 there was gain of 15.85 cubic feet per second.

1902 there was gain of 40.60 cubic feet per second.

1903 gain of 48.74 cubic feet per second. A gain for years from 1899 on, and loss in those years where measurement was carried on prior to 1896, that is, in 1891-'94 and '95.

I have no measurements available at state line subsequent to 1903. The only ones I have are those I gave yesterday
3080 and those proof sheets I do not have here.

L. G. CARPENTER.

Cross-examination by Mr. John D. Clark:

3080 The Sixteenth Biennial Report of the State Engineer of Colorado for the years 1911 and 1912, at page 135, contains the following statement relative to seepage measurements:

"The entire absence of so-called 'seepage measurements' in this report will probably be noted. The omission of this class of work has been deliberate and the result of careful study. Not only are the direct results of the measurements themselves open to grave question,

3081 but the elaborate conclusions which have been drawn from them are seriously in error, and have given rise to many false impressions.

The theory of these seepage measurements is based upon several assumptions. These are:

First. An absolutely permanent condition of the stream and its tributaries during the progress of the measurements.

Second. The possibility of differentiating with certainty between the inflow due to surface run-off and that due to the ground water inflow.

Third. That the ground water inflow is due entirely to the application of water to irrigated lands.

Fourth. An assumed accuracy of the measurements themselves which is not justified.

Fifth. The most violent of all assumptions, viz., That the conditions found to prevail at the time of the measurements prevail throughout the year.

None of these assumptions are justified. The river flow is not permanent. The distinction between the surface run-off and the ground water inflow is not well marked, and cannot be accurately defined, and even if it were there is no means of knowing what proportion of the gound water inflow is due to the application of irrigation water. The differences noted in the seepage tables as gains or losses in a certain distance are frequently less than the probable errors of the measurements themselves. And, lastly, there is no justification for assuming that the conditions prevailing in the fall, when the seepage measurements have generally been made, are those of the entire year.

On these grounds it has been determined that the seepage measurements are not worth what they cost, that they show nothing that is not brought out to better advantage by the maintenance of permanent stations, and that they lead to erroneous conclusions in the minds of most people as to the quantity of irrigation water which returns to the streams."

3082 Redirect examination by Mr. Fred Farrar:

Of comments of Mr. Comstock, formerly State Engineer, his statements are made on series of seepage measurements and based on five assumptions which I read. First assumption is an absolutely permanent condition of stream and tributaries during process of

measurement. That assumption is neither correct nor necessary in method I adopted in making these measurements. On other hand rise and fall of river was excluded. In first measurements made by State Engineer's office years ago, some such assumption as that was apparently involved, but whether that assumption was used by Mr. Comstock I do not know. If he did make that assumption, I would agree with him that measurements were not worth taking. But in measurements that have been reported and given just before, fluctuations were given by measuring stream at short intervals of time and short intervals of distance, so that the gain of flow excluding fluctuations of stream was those that we found. Observers were instructed in closing work at night to set gauge at river bank and to make measurement at that place. If stream had risen or fallen during night new measurement was made in morning for new starting point. If river had not changed during night measurement made night before would be basis of determination in our next
3083 section during next day. So these fluctuations were eliminated to pretty complete extent. There were sometimes that certain sections were found to have been subject to fluctuations and those were either rated or excluded as case might be, and these tables referred to, show certain cases of that kind. So that assumption is not a correct statement of the assumptions made by a person who was familiar with actual determination of seepage measurements.

Most of seepage measurements of which I have any knowledge, taken by State Engineer's Department of this state were taken in method I have outlined rather than under assumption made in statement by Mr. Comstock. First few years or some of years before conditions were fully known, I presume measurements were not made with care in detail, but after all that does not vitiate general findings and the conclusions that we found.

Next assumption of possibility of differentiating with certainty between inflow due to surface run off and that due to ground water inflow, is not practically a difficult matter and, in fact in most cases, there is no surface inflow so that there is no differentiation to make and in second place difference between seepage inflow that may have gathered in side channel and surface run off is quite easily determined. You will notice temperatures in tables printed in Bulletins in great many cases. After first one or two sets of measurements, I provided observers with thermometers and temperature of water was taken, which sometimes aided to distinguish. As matter of fact, in most cases, distinction is very easily made and in few cases
3084 that are subject to doubt error which every way is counted would be so very small. There is possibility of surface inflow being nothing more or less than seepage water from side channels. If there were no surface inflow there would be no problem at all.

Third assumption that ground water inflow is due entirely to application of water to irrigation of land is correct. If previous knowledge of district covered by measurements was such that no water from any other source might influence inflow through the ground, then that would be the only source from which we could expect an increase. It is water in the soil and that we know from conditions,

comes almost entirely from irrigation. There have been some places where there was some inflow from natural rain-fall. I have made attempts to measure this at various times from streams reported to be very prolific of inflow like Bijou for instance, and various other streams, and in those cases I found practically negative results. That is, amount of underflow, as it was termed, from natural rain fall was so small as scarcely to be distinguished. Under Colorado conditions, outside of mountains, inflow from streams is not a problem.

Seepage from irrigated lands would be only source of gain in locality such as that between Iliff and state line on Platte River. This is explanation that is evident from conditions; it is a sufficient explanation: it is a cause that is acting, that tends to produce the effect,
and it is a cause also that is sufficient to produce that effect.
3085 At the time of these first measurements quoted, there was practically no irrigation between Iliff and Julesburg. Area given to irrigation there began to increase and amount of water applied to that territory between those points increased and in last few years area devoted to irrigation over there has become quite considerable, so that we have a change in conditions relative to irrigation in meantime simultaneous with effect that is there. As regards rain fall, there has been no material change in rain fall in meantime that would enter into the question. There have been no other changes in natural conditions there that would be of any consequence in that regard. There have been some lands plowed up outside on bluffs, there was an attempt at dry farming and that might absorb a little more water, but that was not such that would cut any figure in this consideration.

On fourth assumption of inaccuracy of measurements, there is no particular difficulty in determining accuracy. That conclusion drawn is not correct under ordinary conditions. It may be true, if an attempt were made to measure those at high water, and it is for that reason that measurements are not taken, for instance, in June and July on the Cache la Poudre, or that at least is one of the reasons. Ordinary measurements may be made to within 2% with current meter under methods adopted. In cases where gain or loss is within less than 2% of amount of measurement, there might be some question then as to exact amount that is thus found, but in most cases that does not enter as question, because discordance that is
found between two measurements which is due to gain or
3086 loss, is more than minimum of accuracy. More than that,
excluding all question as to measurements, it is known throughout all this section, and there are any number of observations to that effect, that when water has been taken out of stream entirely into ditch, leaving none in stream whatever, that in very short distance down stream there is considerable water so that the fact is well known as a fact and purpose and effect of measurements is an attempt to measure amount of this return which everybody acquainted with irrigated section on Platte and Poudre knows is case. Any errors which might prevail in instrument and in record over period of number of measurements are necessarily compensating.

These errors are eliminated if there are any due to that cause. Any individuality on part of hydrographer making measurements, assuming same man made them throughout period of measurements, would probably be compensating in same way, but, as far as the personal equation is concerned, it would be eliminated in measurements of different as well as by same observer.

Fifth assumption, termed most violent of all, is that conditions found to prevail at time of measurements prevailed throughout year. There is nothing in measurements I have given and to which I have testified, indicating I have assumed any such thing.

3087 On contrary in this published bulletin, that has not been assumed. In testimony yesterday I stated my personal conclusion that on Poudre return is now practically constant throughout year; that it was not constant in earlier days and that measurements then made were somewhat doubtful in that regard; but that measurements made during latter years, at different periods of year has indicated that return is practically constant. That statement that it is assumed as constant would depend rather upon person probably who makes it, but it would not be safe to make any such assumption without knowledge of local conditions and that water is applied at some distance from stream. If that is case, that assumption is justified. So that his final statement that none of these assumptions are justified, I entirely agree with. And hence most of the statements made in paragraph following assumptions would be beyond dispute.

United States Government, through the Reclamation Service, has sufficient faith in this system and accuracy of these measurements to carry on investigations of this kind. Department of Agriculture has done so. State of Wyoming has done so. Experiment Station of Wyoming has done so. It has been done in all irrigated sections, although most extensive ones have been made in Colorado and the firs U. S. Geological Survey has made them.

Mr. Comstock was educated as a mining engineer. He was also consulting engineer for The Laramie Water Company of Wyoming. I understand that all their plans and work was subject to his supervision professionally.

Mr. Comstock, while assuming to act as State Engineer of Colorado was at the same time engaged as consulting engineer for the concern most directly interested from plaintiff's side in the outcome of this case. That too at times cause was pending.

L. G. CARPENTER.

Cross-examination by Mr. John D. Clark:

3088 During the first two or three years of my seepage measurements I did not attempt to have all of the ditch headgates shut down, but it was not difficult to ascertain that all of the headgates were kept at a uniform height while a certain section was being measured, as the sections were short, covering 8 or 10

3089 miles, and one or two of them would be covered in a day.

We were disturbed in that way only a few times in a series of 20 years' record. We were generally accompanied by the water

commissioner of the district. A measurement would be made of the river at the head of the section and also at the foot. Sometimes a subsequent measurement would then be made at the head, but this was not general and was not necessary because we traveled
3090 ahead of the flow of the river. The measurements of course were made at such favorable places as could be found, but they compared favorably with the ordinary rating station on the rivers, and I believe the measurements were fully as accurate as measurements at regular river rating stations.

3091 The construction of drainage works has been discussed in connection with several reclamation service projects, but I do not know whether such works have actually been constructed as yet.

3092 Redirect examination by Mr. Fred Farrar:

In Poudre Valley and elsewhere in Colorado, water commissioner frequently accompanied me and assisted in determining these measurements, gave me advantage of identification of headgates and also in keeping headgates at uniform flow. Headgates are not necessarily under lock. In districts where appropriators recognize authority of water commissioner and are law-abiding, they follow his directions without having necessity of lock. They have sometimes locked headgates and in places they find it necessary so to do.

In Wyoming, where, according to witnesses for plaintiff, every appropriator of water and every ditch takes water as they see fit, there might be some doubt involved in the measurements, although if taken with sufficient pains, they might eliminate these uncertainties to some extent.

Redirect examination by Mr. Delph E. Carpenter:

Since my recent examination concerning direction of wind and prevalence of wind in Laramie Plains region, I have consulted data which, at that time, I did not have in my immediate posses-
3093 sion. I find from the records that statements I then made were essentially correct.

Actual miles winds at Laramie averages about 110,000 miles per year. That is practically at I gave it.

That is twice as much wind as at Fort Collins.

Normal direction of wind, as I then stated, is in westerly quadrants. There are three years given in records of Wyoming Experiment Station, giving number of miles of wind for each quadrant, or rather for each octant, and three westerly directions, west, southwest and northwest are rather more than 50% of total number of miles of wind.

During summer months at Laramie, records show month of June, in one case, about average, in another case it is 4% less than average for year and in July and August records show in neighborhood of 10% less.

Station at Laramie is on east side of valley almost at foot of slope of Laramie mountains to east. Principal body irrigated land is west

of Laramie and west of valley and quite a good deal of it has no particular slope but general slope to east. On east side of station
3094 slope is from east towards west, sloping downward toward station.

I have been unable to find wind records for region in Laramie Plains near Sodergreen's or at any other point westerly than area I have given. So far as I know, Laramie is only wind station.

3095 GREELEY, Colorado, March 3, 1914.

HARVEY D. PARKER,

Direct examination by Mr. Delph E. Carpenter:

Reside at Greeley, Colorado, since 1883. Engaged in wholesale produce business since 1892. Am also Vice President of the Board of Directors of Greeley National Bank. During time since 1892 have handled potatoes, cabbage, grain and onions. My firm was Mosher and Parker.

In 1892 four principal firms were handling the farm
3096 produce of Greeley: Greeley Mercantile Company, Farr and Johnson, Strong-Perkins Mercantile Company and W. R. McClelland. There were a few others in smaller outside towns. Business had so increased that by year 1910 there were 30 or 40 men in the business in northern Colorado district. There were that many different firms engaged in that line of business. Each of these firms and parties had numerous men working for them. In year 1910 principal firms were: Greeley Mercantile Company, The Farr Produce Company, Farmers' Mercantile Company, I. Rothchilds and Company, Mosher and Parker, C. Rugh and R. B. Rugh, Potato Growers Commission Company, Greeley Produce Company, Carter and English, Peter Brown & Son, Boile Commission Company and Patterson & Son. There were many other smaller dealers in the business. Number of firms engaged in handling produce in 1910 and increase since 1892 gives idea of increase of business. Potatoes were principal product handled.

3097 Greeley potato district or territory includes the territory under Larimer County Ditch, Larimer and Weld Canal, the Greeley No. 2 Canal and the Greeley and Loveland Canal, all that portion of territory irrigated by those canals east of point between Timnath and Windsor, a little west of Weld County west line. District extends about 12 miles east of Greeley. There were no potatoes produced commercially in upper portion of Poudre Valley or in Larimer County.

Principal firms I have mentioned carried on their business in outlying portions of this potato territory, as well as immediately adjacent to Greeley. Towns or villages outside of Greeley included within the Greeley potato district are: Timnath, Windsor, Bracewell, Farmers Spur, Severance, Ault, Eaton, Lucerne, Evans, Auburn, Kersey and Gill. At all those points we had warehouses, while at other places there were scales and offices.

We have had potato warehouses at all principal shipping points,

for instance, at Lucerne there were two, at Eaton two, at Ault three, at Kersey three, at Windsor two, at Farmers Spur two, at Bracewell one and Gill two. Severance has two.

3098 There are ten principal warehouses in Greeley devoted almost exclusively to the handling of potatoes and onions. Warehouses would run to about following dimensions: 50x180; 50 x 150; 45 x 150; 40 x 50; 40 x 80; 40 x 60; and 50 x 60.

Warehouse 50 x 180 has storage capacity for over 20,000 sacks or 40,000 bushels. Each sack contains two bushels. Warehouses 40 x 60 would hold 7,000 sacks or 14,000 bushels. Other warehouses had storage capacity in proportion.

Potatoes are brought by farmers in wagon loads. Where there is warehouse potatoes are stored in the warehouse and allowed to accumulate and stock was always carried on hand necessarily during fall of year. Through harvest warehouses were invariably filled and shipping took place during rest of season. Warehouses were filled in fall to keep stock on hand in order to ship during

3099 bad roads and bad weather when crop could not be delivered by growers. During fall months we can load directly on the switches at railroad and also accumulate our stock in warehouses. We have had times when we had car shortages when shipments were too heavy for railroads to take care of. During winter months potatoes are delivered by farmers at various warehouses. There is a constant current of potatoes in and out of warehouses during shipping season.

Farmers invariably have potato cellars on their farms, commonly called "dug outs." These would be of average storage capacity of about 6,000 sacks or 12,000 bushels. Farmers store their crop of potatoes in these dug outs directly from field, putting them in loose and re-sacking and marketing afterwards during season. Whole community is in position to store throughout year. Dealers buy directly from farmers. We always made a price on produce and paid them cash for whatever they hauled us. In other words, we were not commission dealers. There is difference between produce buyers and average commission dealer, selling on commission.

3100 Cabbage crop is quite important factor throughout Greeley district. Most of cabbage is buried in ground in field in pits by growers. Cabbage is generally cut and put in windrows and then covered with straw and dirt. If cabbage freezes and is allowed to remain buried in earth so as to draw frost from cabbage, it does not injure it. Cabbage carried over in pits must be left in ground until spring. Some producers store cabbage in dug-outs. Growers aim as a rule to sell cabbage in fall of year before frost.

Onions are important item among agricultural products of the region. We buy onions in fall of year, it has been policy of grower for last few years to sell all of his onions and not attempt to store them. We stored them on second floor of warehouses or in especially dry places. We carry them through shipping season in

3101 that way. March 1st is as late as onions can be carried in storage. After that time they begin to deteriorate very fast.

Warehouses for storage of potatoes and onions are kept at about 32 to 40 degrees Fahrenheit.

Greeley district is exporter of potatoes, cabbage and onions into markets in Kansas, Oklahoma and Texas principally. Shipments are also made to Nebraska, Missouri, New Mexico, Arizona, Louisiana and Tennessee. Shipments have been made to Cuba a number of years. Mosher and Parker and I. Rothschilds and Company have principally handled the Cuban trade. We first started shipments of potatoes into Cuba about 7 years ago. The trade increased. Four years ago we shipped probably 50 or more cars and established our connections over there. I personally established those connections. Went over there to do it but following year we didn't raise so much of a crop. Trade diminished.

3102 Potato shipments have been made as far west as California and as far east as New York.

1892 there were not over 3,000 cars of potatoes shipped annually from Greeley District.

Carload average is 30,000 pounds, 265 sacks ordinarily or in excess of 500 bushels.

1892 there were four principal firms handling produce. Industry increased to such extent that during one year shipments were 12,210 car loads. That would be something over 6,000,000 bushels. Acreage increased continually up to 1898 and from then on held practically constant.

Acreage in 1898 and thereafter about 30,000 acres potatoes. During those years there would be from 26,000 to 30,000 acres of land in Greeley district devoted to active culture and production of potatoes.

3103 During that time there was constant increase of production of cabbage and onions. In 1892 it was small factor in business, but from 1898 on it was quite a factor. Just the rate of increase I could not give. Annual production from 1898 on in Greeley district would be about 500 cars onion and 500 cars cabbage. That is an approximation. Production of cabbage and onions afforded opportunities of shipping mixed car loads of produce, that is, cars of potatoes with small quantities of cabbage and small quantities of onions in each car. There was considerable demand for mixed car consignments. This afforded means of obtaining little better price for potatoes.

Average production potatoes per acre on lands devoted to that industry from 1898 and thereafter was about 100 sacks or 200 bushels. That would be about average production over entire 30,000 acres devoted to industry.

Eating qualities and general appearance of potatoes gave this demand for the Greeley product.

3104 70 cents per hundredweight average price obtained by growers for potatoes handled during years I have been in business. Dealers always figured on margin of 7 cents per hundred. Out of the 7 cents per hundredweight we bore all overhead expenses. So far as price obtained by dealer is concerned, it would be about 77 cents per hundredweight on average. We have seen price here as

low as 20 cents per hundredweight and from that up to as high as $2.00. Fluctuation is caused always by supply and demand.

Texas has afforded market for Greeley potato, because while Texas grows quite a quantity of potatoes, they market their crop and it is consumed very early in season and they are buyers of potatoes after June 1 from some territory. Texas climate does not warrant keeping of potatoes so that they are buying from "hand to mouth" during whole season except in very early spring. The local crop lasts longer in Oklahoma and Kansas. We don't get in so early.

Potatoes of late variety are raised at Greeley.

3105 Early potatoes are raised in Texas, Oklahoma and Kansas. Greeley late potatoes find market after consumption of early potatoes raised in these other districts.

Have become familiar with handling of same class of products in other districts throughout country while engaged in handling Greeley produce. The early potato is invariably a red potato. The red potato goes to the market first. If not all marketed by time white potatoes come on market there is no sale for red potatoes. Varieties raised in Greeley district are white. White potatoes crowd red variety or early potato out of market. Early potato is neither so large or smooth as the late potato. Attempts have been made to raise and market early potatoes in Greeley district for market in fall in competition with the late varieties. The grower and dealer recognize the fact that if they grow a red potato for market it must be marketed early.

If white or late potatoes and early potatoes are put on market at same time, there is no sale for the early variety. Potatoes
3106 of early variety cannot compete in markets of United States with potatoes of late variety. This is true in markets to which we ship and in markets to which produce of practically all western states is shipped. In Greeley district Mammoth Pearls and Rural New Yorkers are principal varieties of late potatoes raised.

Three years ago production of potatoes declined. A blight or leaf roll affected vines and reduced crop very materially. There is a decided increase in crop one year ago over that two years ago and there will be fifty per cent more acreage put in this year than there was last year. 1912 was year of lowest acreage of potatoes in history of Greeley district. Several crops were producing a maximum yield last year. A great many yields are averaging much better than in year 1911. We have every reason to believe that potato in-
3107 dustry will recover its former state. During years subsequent to 1892 and to 1911, we and all other dealers retained regular established line of customers throughout various points of export. It was necessary for us to continue furnishing potatoes to those customers in order to retain their business. We took care of temporary depression in Greeley district by handling potatoes from other territories, principally Idaho. We hope that necessity is temporary and have every reason to believe it will be. The blight affected other district besides Greeley district. Other parts of state were affected; some of territories were as badly affected as in Greeley district. Same

disease, or a nature of disease, affected crops in Idaho, some portions worse than others. It also affected Scotts Bluff, Nebraska, Mitchell, Nebraska, although their crop was limited to early crop and has never been recognized as of any great consequence. Reports are conflicting as to whether or not the same disease affected Wisconsin and other territory. From investigations, we find this same disease has existed at different times at different places all over the world. From best information we can get the effects of the disease are temporary, lasting from three to seven years. In England, which is best
3108 example we have, they claim the country has remained immune over thirty years since they had this same disease. Every possible means for eradicating this disease has been used. Government experts have been brought here. Warehouse facilities for handling this agricultural product are remaining intact during this depression.

Potatoes in Greeley district are raised exclusively under irrigation. Same of cabbage and onions.

Am somewhat acquainted with territory embraced within the Greeley-Poudre Irrigation District. That territory, if irrigated, would be just as prolific as any other territory we have in the Greeley district. It would increase production of potatoes proportionately. We have not sufficiently analyzed soil to know what particular land grows cabbage, onions and potatoes best. Tendency is for heavy land to grow cabbage rather than the lighter soil. The territory included within the Greeley-Poudre Irrigation District, from what I know of it, is more distinctly a potato district.
3109 The territory immediately adjacent to Eaton and Ault is the best portion of the Greeley district for production of potatoes. Eaton is largest shipping point in point of number of cars of any territory. Ault is equally as good only the territory is not so large. The Eaton and Ault territory immediately adjoins the Greeley-Poudre Irrigation District.

HARVEY D. PARKER.

Cross-examination by Mr. John D. Clark:

3109 The average gross value of the potatoes in the Greeley district per acre is $84, with an estimated cost of the crop to the tenant of $45 per acre. The net return is sufficient to make
3110 the potato industry a competitor of the beet industry, the net return exceeding the net return from the growth of sugar beets. During the recent years, when our potatoes have been affected, the trade has taken Idaho potatoes in preference to those we have grown, and if we could offer the same potato that we could three years ago the trade would prefer it to those coming from Idaho.

3110 Redirect examination by Mr. Delph E. Carpenter:

We had great deal of trouble in handling Idaho potato crop last year. It is recognized by Government officials that the disease, known as their dry rot, is somewhat similar to our blight, but in

different form and certain territories in Idaho had serious trouble with the dry rot. This disease comes as a small spot on potato, then in a week there would be two or three spots of same size, sometimes larger. It destroys potato very quickly. Sometimes core of
3111 potatoes will be affected with dry rot and whole potato will go to pieces within a week. We might load a car of potatoes which is apparently sound at Idaho and find them in such shape before they reach their destination that they would ruin the market value. They would not all be rotten but would be in such condition that they could not be disposed of to advantage. We have never had any previous trouble with the blight. We have had trouble at different times with diseases but to no extent until three years ago. We did not give potato diseases so much thought or investigation as we have in late years.

Investigation of late years has proven that some disease is liable to affect potatoes in every region where they are grown. No region is entirely immune.

Seed potatoes planted in Greeley district, other than local seed, is imported from Wisconsin, Minnesota and Michigan. There have been a few seed shipped from Montrose, Colorado, District. We usually prefer to get our seed potatoes from a non-irrigating dis-
3112 trict. Potatoes raised from irrigated seed are inclined to produce runners and where we can get potato seed from what we call parent stem and not from runners, we prefer to do so as they are better. General impression seems to be that crop- grown from what we call second year's seed imported from foreign parts yield the heavier. By this I mean, seed shipped in from Wisconsin and planted first year doesn't yield so heavy a crop as seed planted from the potatoes thus grown. The second year's seed produces maximum return in crop as rule.

Farmers throughout potato region consistently select their own seed in very thorough and businesslike way. While potatoes grown under irrigation are more inclined to produce potatoes on runners, this tends also to result in an increase of production per acre. Where potatoes are raised under dryer conditions, without irrigation, the potatoes adhere more to the parent stem. That usually results in less production per acre.

3113 J. L. EWING.

Direct examination by Mr. Delph E. Carpenter:

James L. Ewing, Greeley, Colorado. Have resided at Greeley since 1875. Am not in active business at present time. Am partially retired, looking after lands more than anything else. Own farms. Prior to retirement from active work, was engaged in grain and milling business for about 25 years at Greeley, Colorado, at Model Mills and Elevator. For number of years was owner of the mill and elevator. In 1884 it was incorporated under name of Colorado Milling & Elevator Company. Was manager of properties from 1884 to 1904. Upon my retirement, was succeeded by C. F. Bell

who is now manager of same property. Was first engaged in the business as owner in 1880. We built the properties in that year.

In 1880 there were mills at Greeley called "Greeley Mills", or Johnson and Kennedy Mill. Mr. B. F. Johnson, now presi-
3114 dent of Union National Bank of Greeley, was then interested in mill. It continued to run after 1880 for about five years. There were two milling concerns in Greeley between 1880 and 1885. Old Johnson and Kennedy Mill discontinued after 1885. There were no other mills established at Greeley after that year. Subsequent to 1885 the Model Mill was only mill and elevator in Greeley. Old mill stood idle for number of years. It at that time belonged to what is now the Colorado Milling & Elevator Company. After some years it was destroyed by fire.

In 1880 there was more or less grain of all kinds grown throughout the Greeley district but not in large amount. Potato industry had not developed at that time. Grain industry grew in Poudre
3115 Valley subsequent to 1880 for few years. Reached maximum growth and developed in Greeley vicinity from 1885 to 1892. Remained constant from 1892 to about 1900. Other crops substituted grain subsequent to 1892 and caused growth of grain industry to remain stationary. Subsequently beet crop took a large acreage. Acreage of potatoes increased largely and acreage of grain decreased.

After potato and beet crops had developed their normal acreage, grain was principally used as nurse crop. It is generally true that grains are almost exclusively used for nurse crop for young alfalfa in the Greeley district now. We think alfalfa needs protection during first year and we grow grain partially for that reason. During first year's culture of land, crop of grain is obtained and also first year's growth of alfalfa.

3116 In early nineties used to purchase from 350,000 to 400,000 bushels of wheat at Greeley annually. Production of oats was probably 60,000 to 70,000 bushels per year, purchased at Greeley. Oats were partly consumed for feed on the place where raised and were mostly raised for that purpose. The same was true of barley.

Most of Greeley wheat tested more than standard weight of 60 pounds. Winter wheat tested 66 pounds. Spring wheat tested 64 to 65 pounds per bushel. It is safe to say that average Greeley wheat tested more than standard 60 pounds per bushel. Colorado oats run from about 45 pounds per bushel. That is true of oats raised in vicinity of Greeley. Standard weight of oats is 32 pounds per bushel. Difference between 32 and 45 pounds would be weight of oats in Greeley district over standard. Barley tests about its standard weight of 48 pounds per bushel. It exceeds that sometimes.

3117 Greeley Mill was exporter of flour during years I was in charge. We never shipped out any whole wheat but we shipped flour. In early years I purchased practically all wheat raised in vicinity of Greeley. Where wheat was purchased by outside parties it usually came in end to my mill for manufacture into flour.

Capacity of Model Mills at Greeley was 500 sacks per day equal to 250 barrels per day. During most of years during early nineties mill ran to its full capacity day and night the year around. Mill seldom stopped unless there was accident.

Annual output of flour from Greeley Mills ranged from 130,000 to 150,000 sacks of flour per year. We had our proportion of by-products, most of which was bran, most of which was consumed at home. Bran bore proportion of about 1/3 to flour. By-products of wheat manufacture were bran and shorts. In later years we were shipping bran away from Greeley.

More than 4/5 of total manufactured flour, during time I was manufacturing, was exported from Greeley. For number of years most of our product went into southern states. We shipped into most all southern states. Oklahoma and Texas largely. Think that is still principal market for Colorado flour.

Sack of flour, which is unit I have used, contains 98 pounds or one-half barrel. We did not always put it up in half barrels, but when we speak of it by sack we mean 98 pounds.

Greeley flour averaged about $2.25 per half barrel, per sack, throughout years I manufactured and shipped, or $4.50 per barrel wholesale. We did not retail. Correct figure of production can easily be obtained by multiplying production by price obtained.

3119 In 1880 there were no other mills in Poudre Valley except at Fort Collins. Mills at that town were well established at that time. The Hottel Mills owned by B. F. Hottel, the Farmers Mill and later the Hoffman Mill. The Hottel Mill was enjoying quite extensive milling business in 1880.

Believe there was more flour manufactured at Greeley in 1880 than at Fort Collins, but there was not much difference. Subsequent to 1880 mills were established at Windsor and Eaton. Eaton Mill was established in 1883 or 1884, and developed into large institution. It was about same capacity as Model Mills during early nineties.

3120 Production of flour I gave for Model Mills could be taken as fair illustration of production at Eaton Mills to best of my knowledge. Eaton Mill is still running. Windsor Mill was about 400 sack mill. It was engaged throughout year in production same as Model Mills during nineties. No other mills were constructed in Poudre Valley during years I was engaged in business. There were a number of elevators constructed for buying and selling grain, at Ault, Kersey, Farmers Spur, Timnath. Severance and some others. There is an independent elevator constructed at Fort Collins. There were other elevators constructed throughout valley which I do not now recall. Owners of these various elevators were engaged at grinding feed and grain locally at time I retired from business. Where owners were not engaged in manufacture of flour, they were frequently engaged in grinding of feed for local consumption.

3121 Other mills, of which I have spoken, exported flour and milling products in about same proportion I exported from Model Mills at Greeley. Most of grain stored in these various elevators throughout valley was manufactured at mills in the valley into

flour, bran and other products. Practically all of wheat produced in Poudre Valley was manufactured before export. About $200,000 was expended in buildings and machinery on mills at Greeley, Eaton and Windsor

Wheat production averages at least 40 bushels per acre, under good farming conditions in Poudre Valley. That has been average for last 15 or 20 years. It runs all way from 20 to 70 bushels per acre. We have had 70 bushels. Average would probably be 40 to 45 bushels per acre.

Oats produce on average 60 bushels per acre in Poudre Valley.

Barley produces on average about 60 bushels per acre.

During recent years some of elevators have shipped grain out of valley. Good many of them ship and manufacture right here. Part of it goes to Denver mills. That is true since same company owns all property.

J. L. EWING.

Cross-examination by Mr. N. E. Corthell:

3122 In the later years that I was connected with the flour mill when we did not have enough wheat grown locally, we shipped wheat in extensively from Idaho, Washington and Montana. Since, the acreage of wheat has been reduced, the larger part of that now grown is incidental to alfalfa, being used as a nurse crop. Wheat is grown upon unirrigated land in this district, principally winter wheat, but not to exceed over ten per cent of the total production, and winter wheat growing has come mostly since I quit business in 1904.

Cross-examination by Mr. John D. Clark:

The average price paid for wheat to the farmer has been about $1.25 a hundred, or from 60 to 75 cents a bushel. I have paid from 65 cents to $2.50 per hundred. The average yield per acre is about 40 bushels, so that the average gross return from the wheat crop would be between $25 and $30 an acre. I would not
3123 say that the cost of growing, threshing, and marketing the wheat would exceed ten dollars an acre. The acreage devoted to the production of grain grew constantly until about 1892, from which time the potato acreage increased until 1900, and since 1900 the increase in production has been in beets.

3124 Redirect examination by Mr. Fred Farrar:

Reason more acres has been devoted to beets and potatoes and less to grain is that potatoes and beets are more profitable, especially potatoes.

Highest and most economical husbandry requires rotation of crops. They rotate alfalfa as basic crop. Grain raised in this vicinity is more properly an incident to this system of rotation than a mere incident to alfalfa crop.

3125 Crop ro-ation in Poudre Valley is about as follows: Tract of land devoted to alfalfa for number of years will be plowed

up and devoted to potatoes. Then to some other crop and ultimately brought back to alfalfa again. Before it is put into alfalfa it is put into grain. It is possible to secure crop of grain and stand of alfalfa same year. They are seeded together and grain will mature early enough so that young alfalfa will not interfere with harvesting of grain. At same time alfalfa, which is perennial crop, is established.

Growing of winter wheat is of comparatively recent years. The system of rotation of crops mentioned, is practiced almost universally throughout the Poudre Valley. I refer to that portion which is irrigated. Result is that at some time or other during cycle of years covered by this rotation, all of land in Poudre Valley under irrigation is devoted to alfalfa. Alfalfa as a crop has a fertilizing tendency.

Alfalfa crop is equal each year to $15 worth of commercial fertilizer per acre. That is its fertilizing value alone, aside from its value for hay crop. This knowledge and resultant facts of
3126 plowing up alfalfa ground has come with more scientific farming in community. Alfalfa allowed to remain in ground as specific crop about three years in its rotation. Rotation is grain, potatoes or beets and then alfalfa and grain again. Yield of grain and all products has been about doubled since this method commenced.

My mill was first in this part of country to introduce roller system, which was at that time a new system and an improvement over the old mill stones.

Redirect examination by Mr. Delph E. Carpenter:

First became practice to break up alfalfa fields and plant other crops on alfalfa land in 1878 to 1880. Practice did not become extensive prior to 1890. Previous practice had been to plant a field to alfalfa and let it remain for 15 or 20 years.

3127 Am familiar with lands in vicinity of Greeley and new lands included within territory known as Greeley-Poudre Irrigation District. From my personal knowledge I would say that the lands of the Greeley-Poudre District are just as good as other lands north of Greeley. It is a continuation of same area.

Have observed various experiments conducted in country by settlers for raising grain by dry farming methods. It has been a failure, for reason that farmers do not obtain more than one or two crops out of five and discouragements are too great, spending life time without having adequate results. Dry farming is limited to small grains.

SILAS H. TURNER.

3128 Direct examination by Mr. Delph E. Carpenter:

Reside at Eaton, Colorado. Am Agricultural Superintendent of Great Western Sugar Company at Eaton factory. Have charge of agricultural department of that factory. My department includes handling of agricultural end of industry, receiving beets, distribut-

ing seed, looking after planting, thinning, etc., and in general way looking after entire agricultural part. It is my duty to see to production of crop and delivery to factory. I also have charge of delivery of by-products to various feeders. Engaged in sugar beet industry in Colorado 12 years. Started at Greeley factory; was interested in growing of beets at Provo, Utah, about 10 years before I came here.

3129 Engaged in cultivation of land by irrigation throughout my life time; 22 years in connection with the sugar beet industry. Grew beets for Lehi, Utah, factory first year it was established. It was first factory in west.

Territory under my control includes stations Eaton, La Salle, Clayton, Ault, Pierce, Cloverly, Alden, Gill, Barnesville, Lowe, Galeton and Myer. Galeton, Pierce, Myer and portion of Ault territory join Greeley-Poudre Irrigation District lands. Beet dump at Caleton is situated on lands within the Greeley-Poudre district. Lands in vicinity of Gill and Barnesville also join Greeley-Poudre District. District is north of these lands.

New railroad branch of Union Pacific constructed into Cloverly, Gill, Barnesville, Galeton, Alden and Myer districts is same branch of Union Pacific that was constructed to handle shipments of freight from Greeley-Poudre Irrigation District. Have understood

3130 that railroad was constructed with expectation of Greeley-Poudre District taking in that territory. Railroad was built in anticipation of traffic from Greeley-Poudre lands when brought under cultivation. Road has two branches, one northeasterly from Cloverly to Hungerford. Other branch goes up through Barnesville to Briggsdale.

Am more or less generally familiar with lands included within Greeley-Poudre District. Would say these lands are just as good as lands around Eaton and Ault from standpoint of sugar production. They are a continuation of the area.

3131 Sugar beet plant during first few weeks after it comes out of ground is very tender. Second year I was in Greeley we had to replant 2000 acres on account of frost. That was in 1903. Plants killed by frost were of April seeding.

Have visited Laramie Plains region, particularly in vicinity of Bosler, Wyoming. Made trip with Mr. Edgell, manager of sugar factory, and Mr. Timothy, Agricultural Superintendent of Greeley factory. Think it was during February, 1910 or 1911. Trip was made through solicitation of those people. They had been writing our general office for beet contracts. They wanted to go into beet raising business up there. Matter was referred to Mr. Edgell and myself as Eaton factory was nearest to that point, and asked Mr. Edgell if he and I would make this trip and go over territory and see what we thought of developing that country for sugar beet industry. They wanted to raise about 500 acres of beets.

3132 We decided we didn't care to take hold of it. We didn't want to go into it until it was tried on smaller scale. Principal reason was that seasons were too short; from information we obtained around Laramie, we understood they had frost there up as

late as fore part of June and as early as August. We decided that if such was case it would hardly justify them to undertake to grow beets there. We heard that frost occurred there later in spring than in Greeley district.

Such a country is not adapted to culture of sugar beets. It takes all of season we have down in Eaton district to mature a crop of beets. It costs just as much to plant, cultivate and irrigate a poor crop of beets as it does a good crop, such as grown in Eaton District. Cost of production of beets is practically same up to time of hauling them off, whether crop is 20 ton or 5 ton crop.

Cost of production per acre of sugar beets within my jurisdiction ranges from $40 to $45, including delivering product to factory or beet dump. We consider it requires about eight
3133 to ten ton crop to pay cost of production to farmer. That is returns from sugar beets alone.

We accommodated people in Bosler, Wyoming, vicinity in experiment of growing sugar beets. We sent them some seed to experiment with, sent them 300 or 400 pounds of seed. We agreed to take beets that they grew from that seed. We agreed to take them and pay them $4.50 per ton loaded on cars there, for the experiment. If they delivered any beets we expected to take cost of seed out as is our custom. It is our custom to advance beet seed to farmers and deduct price of seed from proceeds of first beets delivered in fall.

Beet seed sent to Bosler, Wyoming, would plant about 15 or 20 acres. We never heard anything from the seed or the beets. At that time my company was anxious to obtain all good outside acreage that was available.

Beet pulp and beet tops, also syrup are principal by-prod-
3134 uts of beet sugar manufacture. The beet tops are left entirely with farmer to consume or use as he sees fit. We dispose of pulp and syrup. It is fed entirely around our factories within radius of 3 or 4 miles. Some factories ship pulp but we do not on account of demand at factory. It is fed to sheep and cattle for fattening purposes. Large numbers of cattle and sheep are fed each season in vicinity of Eaton factory. We have one firm up there that is feeding 2000 head of cattle this winter right adjoining the factory. That is on premises formerly known as Bruce G. Eaton feed yards. Portion of it is in our yards.

25,000 to 30,000 head of sheep are being fed in neighborhood of Eaton factory from by-products this season.

Syrup is fed to animals by placing it on pulp. After they load pulp they distribute syrup onto load out of tanks with buckets. Other feeders grind their alfalfa hay and mix syrup with it. We do not feed any native hay. Beet pulp, alfalfa hay and syrup
3135 make up principal feeding ration of these animals. They are fed for purpose of fattening for market and not for mere growth. These animals are mostly exported to eastern markets. They there compete with corn fed animals from western and central states. This applies to both cattle and sheep.

Quality of animals fattened on by-products is equally as good as the corn fed. Feeding of these by-products tends to rapid fatten-

ing. This is especially so with old ewes. There is no feed that will take place of pulp and syrup with old ewes. Neither corn nor any other grain can compete with this ration for such animals, because feed is soft and they can chew it. Old ewes cannot eat corn. As a matter of fact, feeding of sugar factory by-products has led to greater utilization of animals of the country. Feeding of pulp, syrup
3136 and by-products has led to utilization of one of waste products of sheep industry. There is no question that old ewes that otherwise would perish from old age and exposure from inability to grind food with their teeth, are utilized as a source of meat production. Have never seen these foods applied to so great an extent with old cows, but presume it would work the same way.

Farmers and feeders with yards located on their private holdings in vicinity of Eaton utilize pulp and syrup for fattening animals. Limits of area where pulp is so utilized are about 3 or 4 miles around factory. It is limited to distance of economic haul. We are feeding about the same proportion of stock this year as usual.

3137 Sheep and cattle for fattening are brought from Wyoming. Many of them come from New Mexico. Cattle, most of them, come from Wyoming. About half of sheep fed in Eaton community are raised in Wyoming. Some of sheep fed at our factory come from grazing grounds in northern Weld County, Colorado.

Eaton factory produced more sugar beets per acre than any other factory in Colorado on an average. Our factory yields greater returns to farmers.

Direct examination by Mr. Fred Farrar:

3138 Beet pulp and by-products from manufacture of sugar are of sufficient value for feeding purpose that some factories ship it for considerable distances.

Most of $40 to $45 per acre cost of producing sugar beets is for hand and team labor. When I gave that figure as cost of production I meant cost to farmer of raising beets, including wages for himself and team for every day that he works with crop. Result is that acreage of beets is contributing very largely towards support of persons other than farmer who raises them. This labor is usually supplied by so called Russians, Mexicans and Japs. Each member of a Russian family, men, women and children, will care for about 5 to 7 acres during the season. The Japs will do a little better.

Each 7 acres of sugar beets, in addition to returns to farmer who raises them, directly or indirectly, and in addition to people who are supported by industry after beet leaves the farm, also sup-
3139 ports one person for every 7 or 8 acres planted. Taking industry as whole, it supports not only laborers who do hand work and farmer and those immediately connected with him, but also people who are directly or indirectly connected with manufacture of sugar at factory. Ultimate return is from sale of sugar and indirect returns from feeding by-products, that is, beet tops, beet pulp and syrup.

There is no other crop that grows in this general latitude which

will support directly or indirectly as many people as will the sugar beet.

Method of cultivation of sugar beets is as follows. Ground is plowed and prepared so that it is smooth. Deep plowing and breaking of clods is required. Ground is generally pulverized. Seed is sowed by drill. Seed is so small that drill plants practically continuous grow. After beets are up it becomes necessary to thin or block them, leaving one beet for every 10 or 12 inches. Later they are weeded by hand and during the summer require constant cultivation. When harvest comes they are loosened in ground by plow or puller and are pulled out of ground by hands and tops then are cut off. Beets are then loaded into wagons and from these wagons are loaded into cars by means of machines which are commonly called beet dumps but which are nothing more or less than chutes which dump whole wagon loads at one time by mechanical operation.

3140 Planting of sugar beets ordinarily begins April 1. If crop should be caught by late frost it is possible to re-plant and secure crop. We can plant up until May 20. Would not recommend planting as late as first of June. While young plant is very tender, we nevertheless have some latitude in date of planting. They may be replanted and made to return profitable crop.

Union Pacific Railroad constructed two branch lines into Greeley-Poudre Irrigation District territory in anticipation of development of territory. Several towns were started there in anticipation of development of district. Among them are Hungerford, Briggsdale and Camfield. Store buildings were erected; lumber yards and other commercial industries were started there in anticipation of the development. Capital was invested there upon faith of reclamation of district. These towns that were established will depend entirely for their development upon reclamation. If development is not accomplished the investment of capital thus made is practically lost.

3141 Direct examination by Mr. Charles F. Tew:

Have in my charge about 20 miles of territory extending along southern boundary of Greeley-Poudre Irrigation District. Territory is similar in character and soil as that included within the district. This is the territory to which I refer when I say beet yield per acre is larger than yield per acre upon any lands growing beets for factories in Colorado. We get largest yield in United States. For our territory as a whole, we get largest returns of any factory in Colorado. A part of that territory is contiguous to the Greeley-Poudre Irrigation District. We have grown largest crop of beets ever grown in United States for any one territory in Eaton factory district, also largest crop per acre. After lands of Greeley-Poudre Irrigation District have been brought into state of cultivation with these old lands, they will yield just as much.

CHARLES H. TURNER.

Cross-examination by Mr. Clark:

3142 In 1913 the sugar company had 16,500 acres of beets in the Eaton district, this being the largest acreage ever grown. In 1912 the acreage was 11,000 or 12,000. For 1914 we now have contracts for about 6,500 acres and expect to contract for 11,000 acres. Our contracts for 1914 are at a price of $4.75 per ton, with 12½ cents per ton extra for each additional one-half per cent of sugar above 15 per cent. The minimum price in 1913 was
3143 $5; the average price, $5.51. The decrease in acreage expected in 1914 is partly due to the decrease in price but mostly due to the return to potatoes.

3143 Redirect examination by Mr. Fred Farrar:

Difference in price I have described is difference of 25 cents per ton on beets of lower per cent in sugar, that is, it was a minimum of $5 in 1913 and in 1914 will be $4.75.

Redirect examination by Mr. Delph E. Carpenter:

We have one field of sugar beets near Eaton Factory that has been planted to that crop ten years, excepting one year. During that year planted beets but failed to get stand and then planted it to potatoes. That piece of ground has grown 12 crops with exception of this one year of 1911. It was very dry spring and I failed to
3144 get stand. We have averaged at least 18 tons of sugar beets per acre on that particular piece of land throughout the entire period. In 1912 we obtained 22 tons per acre.

Sugar content of beets raised in Eaton district in 1913 was little greater than that of any other factory. In other years Greeley factory had little better sugar content than we had. Sugar content of our beets is very good. Average sugar content of beets de-
3145 livered Eaton factory in 1912 was 16.45 per cent. In other words, 16.45 per cent of beet was sugar. In 1913, 15.42 per cent. Sugar content varies from year to year, due to climatic conditions.

3146 WALTER J. FARR.

Direct examination by Mr. Delph E. Carpenter:

Reside at Eaton, Weld County, Colorado. Resided there 25 years. Business live stock and farming. Am owner of irrigated lands in vicinity of Eaton. Have been interested in lands in that vicinity during last 25 years.

Engaged in sheep and cattle business, sheep business largely, during that term of years.

Engaged in live stock business for three years in Laramie Plains region, Wyoming. Was located on Laramie Plains about 25 miles south of Laramie City at base of Bull Mountain and Red Mountain.

It is 8 or 9 miles due south of Riverside Ranch. Place was located on small creek called Shell Creek, a tributary of Sand Creek which is tributary of Laramie River.

3147 Acquainted with Farr Ditch, a small ditch taking water from Shell Creek. I had it constructed when I was in that community.

Acquainted with Laramie River Valley since that time. During time was there became quite familiar with both the Big and Little Laramie River Valleys. Have been up in that country nearly every year since. Engaged in live stock business in Weld County, Colorado, in growing of animals as well as finishing them for market. During growing period live stock situated on ranch about 20 miles northeast of Greeley in Northern Weld County on Owl Creek. Kept them in that vicinity during years engaged in business. Have finished this live stock in vicinity of Eaton on irrigated area.

3148 Feed 2,500 to 15,000 head of sheep on average each year. Animals are fattened for market.

Was growing animals during years was engaged in live stock business on Laramie Plains. Animals there grown were finished for market in Nebraska. That was in years 1882, 1883 and 1884. Since that time I have been growing my animals exclusively in northern Colorado.

Have owned from one to six farms of 160 acres each under Eaton Ditch, the Larimer and Weld Canal and also the Larimer County Ditch of The Water Supply and Storage Company. The latter is same ditch that brings water across divide from Laramie River by means of Sky Line Ditch. Part of time during years men-

3149 tioned have been farmer engaged in application of water from Laramie River on Poudre Valley lands by means of Larimer County Ditch. Am familiar with agricultural development throughout that section of country.

Laramie Plains region is a stock country. It has been used for that ever since my acquaintance with country. There is some agriculture. It is not what I would term an agricultural country as compared with Poudre Valley. It is not agricultural country in sense that this is so termed. Laramie Plains is primarily a live stock country. It is a grazing country.

Am familiar with value of lands for grazing purposes on Laramie Plains. Value $1.50 to $2.00 per acre for grazing purposes. We found that it required 5 acres of land to give grazing for one sheep. For 1,000 sheep it would require 5,000 acres of land fenced up to give one season's grazing. Other stock would be kept off in

3150 order to give this return. It requires 12 to 15 acres of land to give summer grazing for one head of cattle.

Am familiar with land on Laramie Plains irrigated but not cut for hay and devoted to pasture of animals in winter time. That class of land irrigated for pasturage purposes is worth about $5 per acre. Price one would be warranted in paying for grazing privilege annually on that land would vary from 50 cents to $1 per acre, according to growth of grass, and thickness on ground and how well

it was sodded over, and I refer to land growing grass under irrigation but upon which growth is not sufficiently heavy for cutting of hay.

Area grazing lands in northern Colorado is quite extensive. This grazing land is worth, for runnig of stock, from $1 to $1.50 per acre. It requires a little more land to feed an animal in this region than it does on Laramie Plains. This is not as good a grass Coun-
3151 try. Think it would require from 1/4 to 1/3 more acreage to support same stock in northern Colorado. In comparing these acreages, I am comparing grazing lands in Weld County with grazing lands in vicinity of Shell Creek, Laramie Plains, Wyoming, which I believe is superior to grazing lands in northerly part of Laramie Plains. Grazing west and wouthwest from Laramie is better than to north.

Land at Eaton, Colorado, prior to construction of Larimer and Weld or Eaton Canal, averaged about same as grazing lands outside irrigated area do at present time. Values would be about $1 to $1.50 per acre.

I fix valuation of grazing land by first figuring cost of land, fencing and taxes and then figuring number of head it will support per acre.

Construction of Larimer and Weld Canal has increased land values. At the present time these lands range from $60 to $150 per acre, depending on character of land and location, the lay of the land and improvement and amount of water with the land. These values include water rights. Prior to construction of canal this was mere grazing land. Reason for increase was irrigation.

Methods of growing and finishing live stock in this region are as follows: Stock is bred and raised largely on outside range, on grazing land not used for agriculture, except that some of bottoms are used for cutting of hay, and stock is grown to one to three years old. It is then brought in onto farms during winter season, and is fed with alfalfa and grain and finished for market. It is then most of it shipped east. Some of livestock is finished on by-products of sugar factories. Sheep are principally fed. They are fed in small bunches of about 1000 head, located on different farms here and there over district. Greater percent of farmers feed some stock during winter. Some a few sheep, cattle or hogs, but most of them feed sheep or cattle. Sheep feeding is carried on more extensively than feeding of any other animal.

I have been engaged continuously since 1894 in finishing sheep for mark-
3153 et by feeding on farms, until last three years. Previous to 1894 I finished sheep off and on for several years.

Fattening sheep for market developed as industry in this vicinity along about 1888 to 1890, when it started in a small way. It has constantly increased from year to year since that time up until about four years ago when it dropped off on account of shortage of hay. Shortage was occasioned by grasshoppers and failure to get stand of alfalfa for two or three years. Feeding was restored and revived in 1913 and 1914. More feeding during 1914 than ever before in my district.

Fattening sheep for market is quite profitable to farmer one year with another.

75 cents to one dollar per head would be my average profit for feeding sheep over period of 15 years. That is in addition to profit received from fertilization on farm. Value of fertilizer received from stock fattening industry is very decided element of profit.

Fattening for market is carried on with small bunches almost altogether. There are a few large bunches fed but that has largely been by speculators or sugar factories. Larger feeders operat-
3154 ing on large scale usually locate at sugar factories if they can. That gives sale for sugar factory by-products. The fertilizer from even such feeding is left in the community.

Profits obtained under my experience would be fair example of profits obtained by large number of small feeders throughout Weld County. Farmer feeding 1000 head of sheep each year would not only receive profit of fertilizer but also a net profit of $750 to $1000. That would be an average. There are some years when they have made nothing and some years when they have made as high as $2 and $2.50 per head on sheep. I made a loss only one year during my experience and that loss was only 30 cents per head.

Fattening sheep for market is usual method of disposing of alfalfa hay raised in Cache la Poudre Valley.

Familiar with growing of alfalfa in Poudre Valley. Three cuttings are usually obtained each year. Some years we obtain a fourth cutting but you cannot depend on it. After third cutting alfalfa is watered and again cut or the growth is used for pasturage. This fourth growth is largely used for winter forage. It is
3155 especially valuable for conditioning animals for going on to winter feed. It is especially good pasture.

Lack of water for irrigation hinders production of normal tonnage of alfalfa in third cutting in some years. After second cutting is taken off there is not sufficient water then to irrigate the crop and third cutting does not amount to much unless there happen to be some rains, as there are in some years. If alfalfa is irrigated there is no trouble about getting three cuttings. It is common experience under Larimer County Ditch and Larimer and Weld Canals to have light or short third cuttings of alfalfa owing to water shortage. There has been a short crop during more years than there has been a good crop on account of shortage of water at that time.

Reservoir water is used on potatoes and beet crops first and then if they have enough left they irrigate the alfalfa.

First growth alfalfa matures sufficiently for first cutting in Eaton District on average about June 10.

First cutting alfalfa in Eaton and Ault districts, if properly watered, produces two tons hay per acre. When I speak of properly watering I refer to sufficient quantity of water to go over crop early in season. Some seasons are dry and we have absence of rain. During seasons when we have sufficient moisture to start with, we don't need to apply water until a little later, but if we are short of moisture and do not apply water early it cuts down the crop. During some seasons water supply comes a little late owing to lateness of melting of snow in mountains.

Two tons of alfalfa hay per acre is usually expected from first cutting.

Second cutting of alfalfa produces from 1 to 1½ tons per acre.

Third cutting of alfalfa produces about 1 ton per acre.

Total production per acre alfalfa hay in Eaton and Ault Districts is about 4½ tons per acre during year.

Fourth growth of alfalfa cannot be counted upon for cut-
3157 ting for hay. During most years we would not get enough tonnage to pay for cutting for reason that plant is too short. Last year was exceptional and there was some fourth cutting.

Am familiar with various rules adopted for measurement of alfalfa hay in stack to ascertain tonnage. Have bought and sold a great deal of hay by measurement. 512 cubic feet is standard adopted for ton of alfalfa hay in stack. This standard applies after hay has been settled in stack.

Shrinkage of alfalfa hay by settlement in stack depends great deal on how hay is put up. If hay was green when put up it will shrink from 20 to 25 percent. If hay is pretty well dried it will shrink from 10 to 15 percent.

3158 Rule of measurement I use is as follows: Ascertain length and breadth. Then take over measurements from ground to ground and subtract width from what we call over, divide that by two and that gives what we call height. Then I multiply height by width and length and divide by 512. That rule of measurement has checked very satisfactorily when hay was weighed over scales.

3159 It requires just as great an expenditure of money to raise and harvest an acre of poor alfalfa hay as it does an acre of good alfalfa hay, with exception of putting up hay. It does not cost as much per ton to raise good alfalfa hay with good stand and heavy yield as it does to raise poor alfalfa with lighter stand and yield. Lighter yields require greater cost per ton.

Am familiar with growing oats in Eaton District. Yield runs from 50 to 80 bushels per acre under the Larimer County and Larimer and Weld Canals. Exceptional crops of course go good deal higher. We frequently raise crops of over 100 bushels of oats per acre. Oats run about 40 pounds per bushel. They run more than standard of 32 pounds. If figures in bushels which I have given had been determined by standard of weight rather than by measurement yield would have been much larger. It would take more bushels if you take it by weight. The oats are very plump and heavy

3160 and weigh up well. If yield were ascertained by weight figures I have given would be increased about 25%.

Oats crop on my farms during years I have been farming have ranged in yield from 60 to 100 bushels and as high as 110 bushels of oats per acre by measurement. I have raised 100 bushels of barley per acre. Those are exceptional crops on very good manured land. Measurement I have given I machine measure.

Oats in Eaton District mature quite uniformly and early.

Never raised any grain on Laramie Plains but observed them growing there and they do not ripen up like ours do. Oats keep green on Laramie Plains. I have noticed different seasons when crop

did not ripen at all and frost would injure it. As rule oat crop does not ripen uniformly like it does in Eaton district. You will notice green streaks running through field. Oats mature later there than they do in Poudre Valley. Ripening is very slow on Laramie Plains.

3161 Am familiar with production of wheat in Eaton and Ault areas. Yields of wheat in that district range from 25 to 60 bushels per acre. About 35 bushels per acre, machine measure, would be fair average of that district. During last five years yield has not been as high as formerly for some reason. We raised from 40 to 60 bushels per acre of wheat.

Fluctuation in yields over different periods of years is common in all agricultural crops. There is variance from year to year. We believe that after raising sugar beets we do not raise as much grain per acre as we did prior to that time.

Am familiar with production of potatoes through Eaton and Ault District. Before 1911 crop would average from 75 to 150 sacks or 150 to 300 bushels per acre over the district. Very frequently yields would be far in excess of figures I have given. In 1911 potato crop was afflicted with a general blight. It took 95 percent

3162 of crop. In 1913 blight affected crop somewhat. Crop was about 80 percent. of normal in Eaton district in 1913.

Have lived or been interested in lands under Eaton or Larimer and Weld Canal for long periods of years. We have been short of water in fall seasons. Also in latter part of summers. We had to go up into hills and build a number of reservoirs to store water for later use.

Larimer and Weld Canal system has had nothing but litigation for 25 years past. Litigation has been over water all the time. I do not think there ever was a time when we were out of litigation. Constantly fighting for water supply. Country has developed notwithstanding constant strife for water supply. Area of land under Larimer and Weld Canal compares very favorably with other portions of United States with which I am familiar. It is very highly developed country agriculturally.

Development agriculturally under Larimer and Weld Canal has been great deal higher than development under Pioneer

3163 Canal on Laramie Plains. There is really no comparison as to development under two ditches in agricultural area. Crops under Pioneer Canal do not compare with crops under Larimer and Weld Canal. They have some good homes up on Plains above Laramie.

Climatic conditions make difference agriculturally between Laramie Plains region and Poudre Valley. I state this from my own experience.

Laramie Plains country is a high, cold country. From my own experience, it is even colder than other districts of same altitude. It is also quite a windy country with cold winds. Spring season is late. When I was living there we had a fall of one foot of snow June 12. That was depth on level. Weather gets cool very early

in the fall. That is reason oats do not ripen up as they should. They have cold nights and cold days too.

Poudre area is one of longer and warmer growing seasons. It is almost a month earlier in spring of year and about that much later in fall.

Laramie Plains region is considerably colder during middle of summer months than is Poudre region.

3164 We need all the growing season we have in Poudre Valley in order to mature crops. We could use a little more in fall of year.

Laramie Plains is live stock country for growing and maturing stock. They feed steers on hay for market there. They do not feed them for market to same extent that they do in Poudre Valley. I have never known of any sheep feed carried on on Laramie Plains as it is in Poudre Valley.

WALTER J. FARR.

Cross-examination by Mr. N. E. Corthell:

3164 I lived on Shell Creek on the Laramie Plains from 1882 to 1884. This creek was a tributary of Steamboat Lake, but when the lake filled up as it did the two years I was there, it would overflow into Sand Creek. Since 1884 I do not believe the
3165 lake has ever overflowed, as a ditch was taken out by Hutton, and since then the lake has become dry. Since I sold out, my trips through that country have been for pleasure and for the purpose of purchasing livestock. My statements relative to the value of various kinds of land are of the economical value and not market value, with which I am not familiar. The grazing lands on the Laramie Plains are worth more than those in Weld County, Colorado, because the grass is of better quality and more nutri-
3166 tious. Having stock upon land is necessary to its continued fertility, as the production of grains, potatoes and beets exhausts the soil. Alfalfa is a fertilizer, but does not furnish all of the requisites or elements supplied by manure. The production of beets is hard on the soil, as land after being cropped with beets will not produce good grain until it has been re-seeded back to alfalfa and fertilized with manure. The custom in this
3167 district is to plow up land which has been in alfalfa for two years or more, put in a crop of potatoes, and follow with a grain crop, which will be very successful. Either potatoes or grain will furnish good crops following alfalfa, but not following beets. I woud expect to see these results in any country, and to see larger crops upon land which has been in alfalfa than on land which has not been in alfalfa.

3168 Upon my ranch there was abundant water for spring irrigation of hay land, but not enough for the irrigation of cultivated crops. The uneven ripening of grain which I noted on the Laramie Plains I always attributed to the cold climate, but it might possibly have been due to uneven irrigation. A heavy frost on the night of August 25, 1910, injured the potato crop

materially in parts of the potato district, but where the frost did not strike there was a good yield. In 1911 the blight de-
3169 stroyed about 95 per cent of the crop, and about half the crop in 1912, and about 20 per cent in 1913. The acreage devoted to potatoes has been materially decreased, and it was estimated that in 1913 the acreage was about 60 per cent of what is called the normal acreage. There was a snow storm on June 12 in 1883 upon the Laramie Plains. I do not know its effect upon crops, as there were no crops in my vicinity. Some garden
3170 potatoes of a neighbor were frost-bitten. The snow disappeared quickly, and a very good growing season followed.

3170 Redirect examination by Mr. Delph E. Carpenter:

Natural growth of grass on Laramie Plains area is a little more nutritious than that in northern Weld County. That is the general rule in higher mountain regions both in Colorado and Wyoming. Same rule would apply to higher lands in Larimer County, Colorado. I used to run my sheep over Boulder Ridge on Sheep Creek in Larimer County, Colorado. I found same kind of grass there that they have on Laramie Plains.

3171 Actual value of land is finally determined by returns it will bring to the owner. Speculative value must finally return to the crop produced to owner on the land.

Wheat always did well in Weld County on land that had previously been planted to potatoes. We could always figure on a heavy A-1 crop of wheat on potato ground. When potatoes follow alfalfa, or follow potatoes, we have no trouble in raising good crop of wheat. Even before they took to plowing up alfalfa ground and planting potatoes then followed by wheat, it is fact that before that time they expected large yield of wheat from potato ground. When land was new we expected and obtained large yields right along. Potatoes do not have the same exhaustive effect on soil that beets do. You can plow up alfalfa ground that has been seeded for three years, followed with potatoes twice and get a large yield, but we have always figured alfalfa land of that character plowed up was good for from 4 to 5 large crops of potatoes or wheat before gain re-seeding to alfalfa. We could get two successive years of potatoes and then two or three years of grain before finally re-seeding to alfalfa. Alfalfa is re-seeded in conjunction with crop of grain as a rule.

3172 Frost of August 25, 1910 was the only frost at that time of year I have ever experienced in this region. Same general cold wave went through northern part of United States to Atlantic Coast and extended quite far south.

Frosts usually kill potato vines so that farmers can get into fields and harvest from the first to the fifteenth of October. That is in Eaton and Ault Districts and throughout Poudre Valley.

3172 TOBIAS MATTOX.

Direct examination by Mr. Delph E. Carpenter:

Reside 3½ miles from Greeley. Farmer. Have been farming in vicinity of Greeley about 30 years. Have lived on present farm 17 years.

Have 8 acres of orchard which I cultivate in conjunction with general farming. Have apples of different varieties, pears, cherries, plums, grapes, raspberries, currants, gooseberries and have raised some fine peaches but peach trees winter kill. There are 21 varieties of apples in this orchard.

Have Jonathan, Baldwin, Wallbridge, Gano, Greening, Winesap and other winter varieties of apples. Have summer apples such as Duchess, Transparent, Yellow Harvest and Red June. Have Concord and Moore's Early and other varieties of grapes.

Have raised Bartlett pears. Had very fine pears last summer.

First started growing fruit in 1883. Started an orchard on what is now called Colony Ranch. I set out orchard there when I first took up land from Government. It was bearing well when I traded ranch off and I then moved to where I now live. I set out this orchard and have raised fruit ever since.

I have a thrifty, living and growing orchard. I never had any blight.

I generally get about two, three or four first premiums wherever I show with my fruit. At last Apple Show in Denver I got sweepstakes. I got some first premiums on different varieties and I got sweep-stakes. Was in general competition including exhibitors from Oregon, Washington, Idaho, Utah, California, British Columbia, Montana, Michigan, Indiana, Kentucky, Arkansas, Missouri and New Mexico.

3175 Notwithstanding competition with those states I took sweepstakes with my exhibits. Apples are judged from standpoint of size and quality, also appearance, shape and color. Medium sized apples, well colored and of perfect form are preferred.

Raise some very large apples. Wolf River is largest variety. Had one that weighed one and one-half pounds. Wolf River is just a show apple. It is not first class cooking or eating apple but is principally for show. It is finely colored and large.

Practically all of my apples do well one year with another.

Grapes do very well as a rule and make good crop and are finely flavored.

3176 In 1913 I had 2,900 boxes of apples. I have sold apples from 60 cents to $2.50 per box. Average obtained would be about $1.75 per box. Box contains 48 pounds, 1 bushel. 1913 fruit crop from my orchard netted me $1500.00. Sold most of my apples at Greeley, but some of finest were shipped to Denver. I get more money for them in Denver than I do here.

7 acres of my orchard in apples. Balance of one acre is in small fruit, cherries, grapes, plums and other like fruits. I marketed the small fruit at Greeley.

I have 340 acres out of a total of 400 acres of my farm under

cultivation. Do not devote my whole time to orchard business. Simply carry on orchard in connection with general farming.

3177 Any person can raise their own fruits under irrigation where soil conditions are same as mine. I have sandy loam with clay sub-soil. If land in Greeley Poudre Irrigation district is of that character, there would be nothing to prevent orchards like mine throughout the entire region.

3178 J. F. McGREERY.

Direct examination by Mr. Delph E. Carpenter:

Have resided around Greeley 21 years. Was farming for 15 years, 4 miles northeast of Greeley in Pleasant Valley. That vicinity is on north side of Cache la Poudre River under Greeley No. 2 Canal. Farmed 80 acres.

80 acres is about average farm under Greeley No. 2 Canal. I sold out five years ago. Obtained $18,000 for my 80 acre farm including one canal water right and one reservoir water right.

During years was on farm became thoroughly familiar with agriculture as practiced in Cache la Poudre Valley. I attended to the farm myself. My family lived there with me.

3179 Have been in Commercial Club work during last five years. Entered that work owing to fact that I had made a study of grains and grasses for grerat many years and was acting as judge at great many fairs, both County and State, and at different fairs over the state. They put me at this work because I am familiar with grasses, grains, agriculture and irrigation.

Was put in office for purpose of obtaining more accurate statistics than had previously been obtained. Have given my time entirely to that work. Have traveled extensively in connection with agricultural statistical work. Don't suppose there is town of any size in Colorado which I have not visited. Have traveled in foreign states. Have made trips of three or four months' duration, going to New York, Pittsburg, Ohio, Pennsylvania and other states.

My farm in Pleasant Valley district compared favorably with neighboring farms. It was settled about same time, in early days.

Wheat following potatoes would run from 40 to 60 bushels per acre. For nine years I averaged 125 sacks of potatoes to acre. I have harvested as high as 175 to 200 sacks per acre. 125 sacks would be equivalent to 250 bushels.

Have cut 2 tons of alfalfa per acre on first cutting. Alfalfa ran from 4 to 6 tons per acre per year. Fourth growth alfalfa used for pasture. Once in a while fourth growth was cut in my vicinity, when we had plenty of reservoir water to irrigate it.

Failure to obtain cutting from fourth growth alfalfa came from lack of sufficient late water. We have to water alfalfa for every cutting. Some seasons we would not have quite enough water to give third crop good irrigation. Shortage of water would cut down yield.

Oats on my farm would average from 50 to 80 bushels per acre. Have harvested as high as 112 bushels per acre by machine meas-

ure. Standard for oats is 32 pounds per bushel. Our oats usually in Colorado run around 40 pounds per bushel. If we don't get 40 pounds oats we do not consider them good. To yield given you would add 25% in figuring production by standard measure.

3181 Barley will run from 50 to 80 bushels per acre. Have known one large yield grown on Igo place where California seed barley made 140 bushels per acre on 20 acres of land. This was by machine measure. It would run from one to two pounds over standard measure.

Production on my farm would be indicative of production in that vicinity. Production under Greeley No. 2 Canal may be just a trifle stronger than that under Eaton Canal. The water rights under Greeley No. 2 Canal are a little better and prior. Eaton Ditch in most years, compares very favorably with Greeley No. 2 Canal. Larimer County Canal compares just about the same.

Am familiar with land in Greeley-Poudre Irrigation District. These lands are just as good as the lands under the three ditches I have mentioned and lie about the same. Have had op-

3182 portunity to investigate soil in digging wells out there. Ran sheep in that region for two of three years. Soil is sand and clay mixed with clay sub-soil. Soil is designated as Colorado sandy loam in U. S. Geological Survey Map.

Land in Greeley-Poudre District will compare favorably with other adjacent lands under irrigation. It would be equally productive. During last few years extension of Greeley No. 2 Canal has been made and considerable new land has been reclaimed. This is of same soil generally and is just as productive as soil further down under Greeley No. 2 canal and raises just as large crops. Same is true of land recently brought under reclamation under extension of Eaton Canal. Taking these two extensions of old canals as an index, it is apparent it would just take few years to get the unreclaimed lands in that region in same productive condition. These arid lands are practically worthless now, unless you want to dry farm. That experiment has not proven a success. They are not good for grazing now owing to fact that they have been over stocked. Cattle and sheep have exhausted grass on them and growth is not prolific.

3183 This has been occasioned by situation near irrigated area. A great many farmers put stock on adjacent lands and bring the stock to their farms in fall, consequently ranges have been over stocked.

In 1911 I worked on system of getting accurate crop statistics in Weld County, realizing the fact that statistics we had before were matter of guess and were sometimes over-estimated and at other times under-estimated. In that year I prepared a set of blanks. Took copy to County Commissioners and they authorized printing of these blanks and County Assessor gave them to his deputies and each deputy was directed to take crop statistics of every man he went to in obtaining tax list throughout farming community. Assessors go out in summer. After crops are in ground and before harvest.

In 1912 was not satisfied with form of blank and so revised it and got out another in book form and Assessors did work also that year, turning in statistics compiled in 60 to 75 books under signatures of each deputy assessor. I compiled these in office giving summary of reports of all assessors covering county. We found
3184 these preliminary reports very satisfactory. Union Pacific Railroad officials came to office and obtained statistics and checked them and found them correct. They stated they also had system of checking. I concluded our method was accurate and have kept it up ever since.

This was made the law of Colorado in 1913. Henceforth assessors in every county are required by law to comply with this regulation. My 1911 blanks were not satisfactory. In them I did not state whether I wished data in bushels or hundredweight or tons and in many instances farmers got confused. Could not compile yields but acres compared with assessors' books. That is way we had of checking them up on previous years.

Industry of the valley is divided into a few general crops, for example, canning and truck gardening industry, potato industry, beet sugar industry, grain and milling industry and live stock feeding industry. My statistics cover the entire county. 255,169
3185 acres total irrigated land in year 1912 in Weld County. That portion of irrigated area in Weld County lying outside of Poudre Valley is about same as irrigated area in Poudre Valley and in Larimer County.

305,000 acres of irrigated land in Weld County in 1913, according to Assessor. Irrigated acres outside of Poudre Valley in Weld County about offset irrigated acreage in Poudre Valley in Larimer County. They are just about acre for acre.

Commodities canned or preserved in canning industry are cabbage, tomatoes, peas and beans. The Empson Canning Factory is located at Greeley. He has sub-factories at Johnstown, kind of a hulling station for peas and one at Ault, where they bring peas in and hull them and bring the hulled peas down to the Greeley factory and there can them. They transport them by automobile truck. The vines and hulls are put in sacks and fed to cattle or sheep. They are of about same feeding value as ensilage. That is the particular by-product obtained from peas.

3186 1,174 acres of canning peas were grown in Weld County in 1912. About 800 acres were grown in Poudre Valley for Empson factory. Average net return to farmer in dollars per acre in garden peas is about $35 to $40.

534 acres of green beans for canning in pod, string beans, were grown in Weld County in 1912. About 225 acres were grown for Empson factory at Greeley. Net return to farmer in dollars per acre from string beans is about the same as for peas.

1,726 acres of dry beans were raised in Weld County under irrigation during 1912. These usually bring about three cents per pound to farmers. They produce from 1200 to 1500 pounds per acre. Have known them to go as high as 1800 pounds but that is above average.

1,233 acres of cabbage were raised in Weld County in 1912. About 1000 acres cabbage were raised in Poudre Valley.

3187 1,041 acres of tomato-s raised in Weld County in 1912. Principally raised in southern part of county, there soil is more adapted to growing tomato-s than the soil adjacent to Greeley About 250 acres were raised in vicinity of Greeley.

36,408 acres of potatoes were raised in Weld County in 1911. In 1912 there were 20,952. Major portion of this acreage in Weld County with exception of a few hundred acres of early potatoes that were grown further south. Cache la Poudre Valley potato area is not devoted to cultivation of early potatoes. They are not as profitable as late potatoes. Falling off of about 16,000 acres was due to blight of 1911 and 1912. It started more or less in 1910. We had quite a frost in certain sections of our country and the blight was very bad in 1911 and 1912. There were three years of discouragement to farmers. I referred to same frost that occurred on Laramie Plains. I was there at Riverside Ranch at that time. Frost was heavy. We broke ice next morning to obtain water with which to wash. Ice was quarter inch thick. We went to Greeley in Automobiles. Hardest frost in this district was west and north of Greeley. Further north we went the harder was the frost. Across river on south side near Kersey, it was not very bad. Potato vines

3188 were just tipped. Further north we went the harder was the frost. I was at Riverside Ranch in Wyoming with party that was interested in Denver, Laramie and Northwestern Railroad. The party was trying to sell lands and I went as visitor.

205 acres of onions in 1912 in Weld County. In 1911 there were 264 acres. Low price in east caused dropping off of acreage in 1912.

2,300 acres of cabbage under irrigation in Weld County in 1911. In 1912 it was 1,233 acres. The low price obtained for crop caused falling off.

30,604 acres of beets were raised in 1911. In 1912 there were 55,000 acres. Beets have taken up the acreage that potatoes and other crops lost.

We have 550 barrel capacity flour mill at Greeley and one mill at Eaton and one at Windsor. There are elevators at other loading stations.

40,750 acres spring wheat in Weld County in 1911. 24,479 acres spring wheat in Weld County 1912. 38,324 acres winter wheat in 1911 and 14,498 acres in 1912. The 1911 figures for spring wheat included that on both dry and irrigated land. The 1912 figure for spring wheat was for irrigated land only. This applies also to winter wheat. 15,830 acres barley 1911. 17,510 acres barley 1912.

3189 88,899 acres of alfalfa in Weld County 1912. 87,881 acres of this were under irrigation.

136,500 sheep fed in Weld County during winter 1912-13. I procured those figures from railroad officials and that is actual number of head shipped out of district.

10,000 head cattle fed during winter 1912-13. Those figures are in round numbers and not absolutely correct.

Estimate by railroad men is 225,000 head of lambs being fed

in Poudre Valley during year 1913-14. There are about
3190 25,000 head of cattle on feed. The enormous yields of alfalfa and the by-products of sugar factory, beet tops, pulp and syrup have caused the increase.

Beets and alfalfa have in large part been substituted for potato crop during last three or four years, beets especially.

General figures I have given for Weld County, in so far as acreage is concerned, will apply to Poudre Valley. Larimer County is not a potato country. Potato figures I have given are confined almost exclusively to Poudre Valley; the Greeley District, as they sometimes call it. Larimer County feed as many if not more sheep than Weld County does. They have large hay crop and sugar factories with by-products. They also have a fine grazing section. In Larimer County portion of area, beets and alfalfa would be largely substituted for acreage given by me for potatoes in Weld County.

I do not have figures for 1913 as our Assessor has not obtained them.

3191 Average production of wheat in Weld County, all classes, both irrigated and dry lands, runs 32 bushels per acre. Average production of wheat on irrigated section will run from 40 to 60 bushels per acre. Fluctuations in figures which I have given generally indicate fluctuations that have occurred in production of crops in valley during my residence. It is expected to find fluctuations of one crop or another from year to year. This is usually occasioned by price of crop, if they have over production in immediate locality they all cease to raise the crop because they think there is not going to be any price next year. We usually expect to find rather low acreage in any one crop following a season of low prices for that crop. This applies to all crops. It includes the feeding of live stock. Price of hay has considerable to do with live stock feeding, also quality.

Alfalfa hay in Greeley, Eaton and Ault Districts, one year with another, will average about $7 to $8 per ton. It has brought as
high as $11 or $12 per ton. Alfalfa values depend on water
3192 supply for previous years and local conditions arising.

We have grasshoppers about once in six or seven years. Farmers fight them and their extermination depends good deal on climatic conditions. If springs are proper a great many grasshopper eggs are killed and the eggs rot in ground and we get rid of great many of them that way.

Cache la Poudre Valley is not more afflicted with grasshoppers, lice and other pests and diseases than other sections of the country. I have observed this condition of fluctuation of crops and products, as well as various causes that prevail in other sections of country.

Am unable to get accurate figures on production of minor truck garden products, such as lettuce, radishes, cucumbers, etc. It was estimated at about $25,000 worth annually of such produce sold around Greeley. Kuner people of Denver have salting sta-
3193 tion at Greeley for preserving cucumbers. Farmers raise good many cucumbers. Have never been able to get acreage accurately.

6,605 milk cows in Weld County in the irrigated sections in 1912. 7,810 in entire county.

125,653 hens in Weld County in 1912 of which 122,841 were in the irrigated section. 8,203 turkeys in irrigated section of Weld County in 1912.

5,818 hogs in irrigated section Weld County, 1912.

1,239 colts in irrigated section same year.

Horses raised in irrigated section Weld County are draft stock. Heavy draft stock, Percheron-Norman, Clydesdale and Belgians. Farm horses Greeley District average 1200 to 1300 pounds each. A good many of them go up to a ton. It is necessary to have large, powerful draft horses in Greeley District on account of number and tonnage of heavy loads of beets and potatoes and for the heavy
3194 farm work. The plowing of alfalfa sod is very heavy work requiring from 4 to 5 horses. Very large acreage of alfalfa sod is plowed up each year. I do not have the total acreage. Do have figures of new seeding each year but do not have figures of breaking.

26,966 acres were newly seeded to alfalfa in 1912.

The figures which I gave for production of colts referred mostly to draft stock colts. This class of colts at weaning time will bring $100 per head. The stallions from which these draft colts are obtained cost farmers from $2000 to $4000 per head.

J. F. McCRERY.

Cross-examination by Mr. N. E. Corthell:

3194 The total acreage of winter wheat in 1912 was 24,845, of which 10,347 was upon unirrigated land. I cannot give the production in bushels. The acreage of irrigated native hay land was 10,627; of unirrigated native hay land, 4,565.

3195 The acreage and yield of several crops grown under irrigation in 1912 as shown by one deputy assessor's report was as follows: 360 acres of winter wheat producing 10,770 bushels; 106 acres of spring wheat producing 2,720 bushels; 60 acres of oats producing 2,139 bushels; 25 acres of barley producing 825 bushels. All of this was in the Fort Lupton area in the South Platte Valley, and not in the Poudre Valley. A report cov-

3196 ering the district near Windsor in the Poudre Valley gives the acreage and yield of several crops grown under irrigation in 1912 as follows: winter wheat, 171 acres, producing 2,614 bushels; spring wheat 557 acres, producing 13,710 bushels; oats, 475 acres producing 14,099 bushels; barley, 482 acres producing 10,056 bushels. The report of the crops grown on irrigated land in 1912 in a district about 8 miles northeast of Greeley under the Greeley No. 2 Canal, gives the following: spring wheat, 394 acres, producing 4,975 bushels; oats, 442 acres producing 4,180 bushels; barley 499 acres, producing 11,045 bushels. These reports are sent in by the deputy assessors, and the information in them is obtained from individual farmers.

3197 Redirect examination by Mr. Delph E. Carpenter:

Have already stated my ability to get crop returns in bushels was very unsatisfactory. Some of farmers would give that in bushels and some in hundredweight and it was hard to get it accurately. I did not try to compile that. Series of figures Mr. Corthell referred to from books I happened to pick up included figures of this uncertain class. I find them to be very inaccurate. I checked back and forth on yields, enough to ascertain they were not correct. That was second year these books had been in existence but it was not compulsory to obtain these figures at that time.

80 acres about average farm under Greeley No. 2 Canal. There is at least one family on every 80 acres and during beet season there are sometimes two. Larimer and Weld area is not so closely subdivided. Larimer County Canal area is larger. Considerable portion of Larimer and Weld area is held by the B. H. Eaton Estate. Those areas are listed in units of about 160 acres as
3198 a rule. They are generally in a high state of cultivation.

Bruce G. Eaton is now acting manager of that estate and is largely interested in it.

I. Rothschild.

Direct examination by Mr. Delph E. Carpenter:

Reside Greeley, Colorado. Resided there 27 years. Wholesale produce business. Handle particularly potatoes, cabbage, onions and beans. All farm produce. Am principal member of corporation I. Rothschild Produce Company. Have been engaged in handling farm produce on wholesale basis in Greeley District 25 years. During those 25 years have been in intimate touch
3199 with production of crops throughout Greeley District, more particularly with potato industry.

Supply and demand gives Greeley potato its market. We have searched for markets because we have the potato and we usually get the best markets and get maximum price for potatoes raised here and our principal markets are Kansas, Oklahoma and Texas. Texas produces an early potato. Greeley potatoes follow their potatoes and supply the demand of that country. Their potatoes will not keep very long and by time we are ready to ship all of their potatoes are out of way. Same is true of Oklahoma but not so much of Kansas. Condition of market rather diminishes as one goes northerly.

Appearance is what sells potatoes. It is not so much the quality as it is the appearance. This obtains with potato no matter where grown. This means that potatoes must be smooth and good sized in order to outsell potato of dark color, rough and mixed. In other words, we have built up our trade here through efforts of grading our potatoes, by sorting them over screens that are made for that purpose and putting one variety of potatoes in a sack. We
3200 do not commingle sacks of two or more varieties.

Greeley potato has been of exceptionally good quality. This quality has built up a reputation for Greeley potatoes.

25 years ago when I entered the industry, the acreage of potatoes was limited. It has increased every year since then until 1911.

20,000 to 30,000 acres average between 1910 and 1911. Of years that industry increased, 1903 and 1904 showed most marked increase in production. Those were heaviest years.

11,000 car loads of potatoes was production of Greeley crop in 1903. Shipment was about same in 1904. There were something like 3,000 car loads left in the district that year. Total production of Greeley District for 1904 was about 14,000 car loads. Failure to ship the 3,000 car loads was owing to over production in United States.

3201 9,026 car loads was average production of potatoes in Greeley District as shown by number of cars shipped out in either year period beginning 1902.

Car load of potatoes contains 400 to 700 bushels. Most cars have limit of 30,000 pounds or 500 bushels. Average car would contain 550 bushels.

4,500,000 bushels would represent total shipments out of valley annual average during the eight years. This assumes an average of 500 bushels to car for purpose of easy computation.

72½ cents per hundredweight was average price paid to farmer over the twenty-one year period beginning in 1891. This price ranges from 20 cents to $1.75 per hundredweight during the time. Those are the low and the high figures.

Shipments of potatoes from Greeley District as rule begin in September and cease in May. We are shipping continually throughout the winter months. Heaviest months are October, November and January.

3202 Cuba is our furthest market to which we have shipped Greeley potatoes. I have been operator in that field. We have shipped to Cuba for 6 or 8 years. We also shipped to Mexico, City of Mexico, but not much beyond.

We have shipped car loads of potatoes as far east as New York City and as far west as San Francisco.

Greeley District is of particular importance for production and shipment of potatoes from standpoint of market for reason that they can get potatoes from Greeley District in less time than they can get them from most any other district. That is into our markets.

It takes a shipment of potatoes from 5 to 7 days to go from Greeley to the Texas market. It takes from 3 to 5 days for Kansas. Shipments from Greeley to Cuba or City of Mexico occupy about 12 days on average.

In order to meet these market conditions, we and our associate dealers in this district have constructed warehouses at most every railroad station in the district. The farmers have provided

3203 storage facilities on their farms. They call those storage cellars "dug-outs." They are cellars excavated down into ground for 2 or 4 feet then poles are erected and covered with straw and then with dirt, making storage warehouses. These dug-outs

on average farm in Greeley District would have average capacity of about 5,000 bushels. They are owned by the farmers. By this system of storage farmers are able to keep temperature uniform so as to preserve potato throughout storage season. Dug-out and warehouse facilities are sufficient to take care of nearly the entire crop throughout the district.

Have traveled extensively over the country during years I have been engaged in produce business. Have bought great many seed potatoes in different sections of country, principally in Maine, Michigan, Wisconsin, Minnesota, the Dakotas, Idaho and Utah. Have traveled extensively in potato producing districts of Colorado and Idaho particularly. I was the outside man for purchase of potatoes in those districts for two or three years. I represented several dealers who had associated themselves together for purpose of placing me in those fields to purchase these potatoes. During those purchases I had occasion to visit these various sections
3204 of the country. During that time I became familiar with potato industry as a whole throughout these regions. During time I have been engaged in business have kept a rather accurate record of conditions from year to year and prices obtained. It is a fact, that I am told that I have what is probably the most complete log or record of condition from time to time and year to year, to be found in the potato producing sections of the United States.

Figures of production and prices I have already given are taken from my memorandum which I have written up from time to time since 1891. I have that record written in the form of a log or sort of diary.

Pearls and Rurals are principal varieties of potatoes raised in Greeley District. They are white potatoes of late variety.

Experience of myself and associate dealers relative to ability to market early varieties of potatoes in competition with potatoes of later variety, for example, marketing Early Ohios and Early Rose potatoes dug and placed on market at same time as Mammoth Pearl and Rural New Yorker is that the early potato will sell all right when there are no other potatoes on the market, but as soon as the Pearl potato goes onto the market it is very hard to sell Ohios. The trade demands a white potato and they prefer the Pearl
3205 potato to the Ohio on account of its looks. The Pearl, while a late potato, is a variety earlier maturing than the Rurals. It ripens about two weeks earlier. The Pearl is the first variety marketed from the Greeley District out of the general crop of potatoes in that district, we have a few early potatoes every year. Early potatoes are usually marketed early. We find that necessary in order to obtain any market.

Am also engaged in handling and shipment of cabbage and onions. Production of cabbage and onions offers special advantage to potato industry by virtue of fact that it allows us to ship mixed cars. Trade in many of smaller towns prefer mixed cards of produce. It enables them to avoid shipping locally. This also affords

a means of commanding a little higher price for potatoes as well as for the cabbage and onions.

We dealers try to make from 5 to 10 cents margin per hundred on all potatoes handled by us from the Greeley District from 1890 up to date. Once in a while we get a loss. We think we handle potatoes on less margin in the Greeley District than in any other producing section of the United States.

3206 The Greeley farmer gets nearer the price the consumer pays for his potatoes than does the farmer from any other section. This gross profit which I have mentioned that the dealer obtains, includes all our office expenses, the handling of potatoes, loading and covering with straw and papering that we use in loading the car. I would not say that it included the warehousing. That is purely speculative, when we store potatoes that is on speculation. This warehousing has proved very disastrous during the last few years. Out of the gross profits of 5 to 10 cents per hundredweight, we pay all overhead charges incurred from the time the potato leaves the farmer's wagon until it is placed in consumer's place of business, excluding freight.

We dealers have had a representative in the southern fields for the greater part of the last ten years for purpose of assisting in disposing of our potatoes there. It was necessary to keep agent in those fields on account of rejections. Usually rejections are bona fide but keeping representative there avoided many rejections that we would have had had we not had man on ground. Rejections occur from causes sometimes originating here and sometimes in transit. Freezing is our greatest fear. That sometimes occurs in transit.

3207 Rejections occur from usual incidents of handling any crop of perishable produce.

Acreage in cabbage in Greeley District has increased to great extent during last 15 years. Acreage was rather limited 20 years ago. Later acreage became considerable of an item and 5 years ago it probably reached its highest point.

Annual production per acre of cabbage through Greeley District will run up to 25 tons per acre. We consider 15 tons of cabbage very good crop and I doubt whether average is over 12 tons per acre. These figures apply to both early and late varieties.

About 500 acres is average area devoted to raising of cabbage in Greeley District in later years. Price of cabbage fluctuates more than with most any crop. I have computed average price paid to farmer for cabbage over period from 1896 to 1912 and found that the average was 52 cents per hundredweight for the 16 year period.

3208 About 500 acres has been area devoted to onions in Greeley District during past few years. Average price obtained for onions according to records from 1896 to 1912 was $1 per hundred. Average production of onions in Greeley District is about 300 bushels per acre.

My firm alone shipped in 1913, 1,000,300 pounds of cabbage and 750,000 pounds or 25 car loads of onions.

Earliest shipment potatoes 1904 according to my books. First

car went out July 21. There had been a few shipments before that. These were early potatoes. They were raised in the Peckham District which is to the south of us and a little on the edge although we include it in our Greeley District. Since then that district has discontinued raising potatoes altogether. That is a region that usually produced early potatoes almost exclusively. They evidently found other crops more profitable.

330,000,000 pounds would represent annual average shipments of potatoes from Greeley since year 1903. That is equivalent of 11,000 car loads.

270,780,000 pounds per annum would be average shipment of potatoes from that district over a period of years figuring the average as 9,026 cars of 30,000 pounds each.

$2,055,616 would be the gross return to the farmers of the Greeley District as an annual average for potatoes, the average price of which was 72½ cents per hundredweight. That would represent with reasonable degree of correctness average amount paid Greeley farmers for potatoes covering eight years during which average shipments were about 9,026 car loads per annum. That gives fairly correct idea of potato industry of Greeley District at normal condition in its prime and under present conditions I think it will come back. Crop was affected with blight in 1911. It damaged crop so that we only shipped out 600 car loads. During the year previous we had shipped about 5,639 car loads. Our shipments were little heavier in 1912, the acreage had been reduced, we shipped out about 1,800 cars. In 1913 the potato industry shows recovery and there are great many fields of potatoes that average as well as in former years. 1913 showed about 60% of average crop. Considering
3210 the acreage planted the crop for 1913 was about 80% of normal. There is every indication of a return to normal conditions in immediate future.

Had occasion to make special observation and investigations concerning this blight which affected potato crop during 1911, and 1912 in particular. Was appointed by number of farmers to investigate conditions in fall of 1913. We finally ascribed blight of 1911 to climatic conditions. They have potato diseases in other producting sections of the world. This same disease has been known to afflict potatoes in other sections of the country. It has proven to be but temporary in its effect Blight of 1911 continued to afflict potatoes of 1912 for reason that seed potatoes from 1911 were planted in 1912. I understand that the same climatic condition affected potatoes in 1911 on eastern slope of Rocky Mountains from Canada to Gulf of Mexico,wherever they were grown,from strip about 400 miles wide. It affected potatoes of North Platte region of western Nebraska known as Scotts Bluff country and Mitchell country. The Stove Prairie country to west of us was affected as also Divide country to south of us and country all around Sydney, Nebraska. My statement that this was due to climatic conditions is on authority from men we have had here from Department of Agriculture who have studied the matter thoroughly. It is their opinion that with

proper change and care in seed, industry will return to its previous condition.

3212 Acreage 1913 was only about 25% of acreage 1911. 1911 acreage was 30,000 acres. That was about 10% to 20% above normal acreage. The acreage which was planted that year returned in crop about 80% of normal.

It is not uncommon to find potatoes throughout potato producing sections of United States afflicted with some disease. Idaho potatoes are afflicted with dry rot, powdery dry rot. It causes potatoes to decay and go to pieces. They have quarantined the Idaho potatoes. It has affected the market to some extent. Diseases have affected the potatoes in Maine. Reports give it as powdery scab. There is an embargo on Maine, on account of that disease. That section is quarantined now. We have never been bothered in Greeley District by that disease. Navada has the Eel worm. Wherever you go potatoes are liable to become afflicted with some disease, rot or blight, varieties more than sections.

I am informed that in 1881 or 1882 a similar disease affected the early growers. At that time acreage was very limited and there were only 3 cars of potatoes shipped from Greeley District that year. Thirty years previous to 1911 a similar blight affected the potatoes of this region.

L. ROTHCHILD.

Cross-examination by Mr. N. E. Corthell:

3213 The number of cars of potatoes produced and shipped from the Greeley district since 1903 has been as follows: 1903, 9,409 cars; 1904, 11,189 cars; 1905, 10,935 cars; 1906, 8,043 cars; 1907, 9,914 cars; 1908, 9,138 cars; 1909, 7,940 cars; 1910, 5,639 cars; 1911, 1,027 cars; 1912, 1,800 cars; 1913, 1,000 with
3214 645 carloads still on hand. The average for eight years has been 9,026 cars. The production reached its maximum in 1904, but the maximum acreage was in 1911, when more than 30,000 acres were planted in potatoes. In 1912, 18,000 acres and in 1913 from 6,000 to 7,500 acres were in this crop. In my opinion the potato blight that occurred in 1911 was due to climatic con-
3215 ditions, the extreme heat causing the stems of the plants to become woody and prevent the flow of sap.

3215 Redirect examination by Mr. Delph E. Carpenter:

I mean to state that there was some direct effect of heat upon plant at a critical stage of its development. This occurred during month of August. During that month we usually have cool nights and that is what gives growth to potatoes in this country. During 1911 we had very hot nights and hot days and that seemed to affect potato. In order to get good growth on potatoes it is necessary to have hot days followed by cool nights. This extreme heat in the nights of August, 1911, caused fuscarium in the vines, a woody growth. The sap refused to go to the tuber. It could not get down

through the stem and the consequence was it stopped its growth of the tuber and the potatoes were small and did not amount to anything. Prospect is, that if we can secure proper seed, acreage
3216 in Greeley District for 1914 will be twice acreage of 1913. There will be about 15,000 acres.

When acreage of potatoes fell off in 1912 and 1913, the acreage thus relieved from potatoes was devoted in large part to cultivation of beets. Increased acreage of potatoes of 1914 will most affect beet crop. That will be correspondingly reduced.

During this time of blight, the Greeley dealers purchased potatoes for our trade in outer districts. We had no other alternative. We sought other fields and handled potatoes from other producing sections. We continued in that because we did not have very large crop of potatoes here during last three years. As soon as normal conditions are restored at Greeley we will cut out other districts. It was necessary to make these purchases and shipments from other districts in order to hold our customers. If we had not
3217 done that we would have had to seek other lines of business. We would have got out of touch with our former line of customers. We wanted to be identified with shipment of potatoes.

Potatoes purchased from other parts were shipped and billed as potatoes coming from the districts from which they were shipped. For example, potatoes shipped from Idaho were billed as Idaho potatoes and not as Greeley potatoes.

Redirect examination by Mr. Fred Farrar:

It is my theory that this potato blight is transmitted to some extent through the seed. The pathological condition of potato was responsible for trouble. Climatic conditions started the trouble. Potatoes that have been planted from potatoes that were blighted may show the effect of the blight. That would show that there is a specific disease transmitted through the seed. Prevalence of that disease was accompanied by peculiar weather conditions.

3218 I answered that acreage of potatoes would be increased by low price of beets. By low price of beets I refer to the reduction of 25 cents per ton on lowest standard paid to farmers.

3219 It is a fact that this shifting from one crop to another is an example of the fact that farming can only be successfully carried on in communities where they can raise several paying crops. Where they cannot raise a beet crop they will raise a potato crop and if they cannot raise one of these, they will raise something else.

3220 FORT COLLINS, COLORADO, March 5, 1914.

W. A. DRAKE.

Direct examination by Mr. Delph E. Carpenter:

William A. Drake, Fort Collins, Colorado. Am farmer and sheep feeder. Engaged in that business in vicinity of Fort Collins for 32 years. Am engaged in banking business to some extent, looking particularly after farms and farming interests than those of bank.

Am associated with First National Bank. Was State Senator from my district for eight years.

I have always fed more or less stock on farm but have been
3221 quite extensively in sheep feeding business for 22 years.
First winter I fed about 1000 head. We gradually increased. For last 8 or 9 years we have averaged 40,000. I have on feed this year 42,000 head of sheep. I know of no other feeders in Poudre Valley who have so many. Have been engaged continuously during 22 years in feeding sheep for market. These sheep are fed for purpose of fattening animals for slaughter and for finishing the product.

Lambs and sheep fed by me and other feeders in Poudre Valley are purchased in Arizona, New Mexico, Colorado, Wyoming, Utah, Nevada and Montana. Lambs are generally fed on barley, corn and alfalfa. Old sheep are largely fed on alfalfa, sugar beets, sugar beet pulp and some cotton seed meal.

Sugar beet by-products are most valuable feed we have for old sheep. We fed about 15,000 head of old sheep. Some were fed corn and alfalfa and some were fed beet tops, some of them were fed sugar beet pulp and alfalfa and old sheep seem to have done better on sugar beet tops or pulp and alfalfa than they did on corn
3222 and alfalfa fed alone. Why they should do so well on sugar beet pulp I believe is one of the mysteries.

Poudre Valley is a finishing section for sheep. Other districts from which we purchase our sheep, particularly Wyoming and Montana, are largely growing districts. There are some sections in which they finish quite a number of sheep but they are largely a range proposition.

Laramie Plains region is very largely a growing region.

Farmers of Cache la Poudre Valley generally feed their sheep on their farms. It is our custom to divide up the sheep into smaller units. I feed more sheep than I can feed on my own farms so we feed large number on other farms where we can get corrals and hay. In such cases I simply take the place of the farmer feeding himself. I buy his alfalfa and rough feeds if he has any. I leave the fertilizer for his benefit. It is general custom throughout Cache la Poudre Valley for better class of farmers to feed some stock each winter.

3223 We generally obtain a little better price for our Colorado product than that obtained from sheep and lambs fed in other sections. As a rule we finish them better and have better quality of mutton than they do in other sections. This is true as well of sheep fattened on beet pulp and by-products as sheep fattened on hay, corn and barley. The sheep that are made fact on beet pulp will sell as well as those that are fattened on corn. I have made a number of shipments to eastern markets and Denver markets, with sheep fattened on beet pulp and by-products, and there has been no discrimination on part of buyers as to what they sheep were fattened on. They have all brought same money.

Lambs and sheep fattened in Cache la Poudre Valley are exported to Denver, Kansas City, St. Joe, Omaha and Chicago largely. Once in a while some shipments have been made south and east to

Buffalo, Jersey City and St. Louis. These lambs and sheep compete on eastern market with lambs and sheep fed over eastern and central states. The results are as I have given.

Barley fed to sheep in Cache la Poudre is grown in valley. I have never known of any barley to be shipped into the valley. It is all a home product.

Alfalfa fed is home product. Sugar beets and other by-products are home grown. Corn is only food that is imported. It is shipped largely from Nebraska. This year some of it has come as far
3224 east as Iowa. Cotton seed meal is imported from Texas and Oklahoma. Cotton seed meal is a good fattening product. It contains a large amount of protein which is necessary for fattening of animals and is used in connection with cheaper foods such as beet pulp and straw and molasses and makes an excellent feed. By using a certain portion of this food we obtain a perfect fattening ration for animals. We balance the ration by adding cotton seed meal. We do not use large quantities in balancing the ration. It is not used very much in connection with corn and alfalfa. With good alfalfa and corn we obtain a balanced ration and when feed is largely alfalfa, altogether alfalfa and corn, we do not care for cotton seed meal with it, but with straw and cheaper feeds such as molasses and pulp, it makes an excellent mixture.

Straw that is left from grain raised in Cache la Poudre Valley is largely cut and mixed with syrup to feed both sheep and cattle. Some of it is used for bedding for sheep. Very nearly all the straw of the valley is consumed in the feeding industry one way or another. We very seldom see straw stacks burned any more. In an early day it was not an uncommon sight to look out of evening and see twelve straw stacks burning all over country. You do not see that
3225 any more. Sheep feeding industry has utilized all that waste product.

Alfalfa contains large amount of protein which makes it particularly valuable as a food.

Four tons per acre per annum is about average production of alfalfa on farms of Poudre Valley. Owing to lack of water for irrigation we do not always get a good third cutting. Grasshoppers have also troubled us here for two or three years and our crops were damaged by them. They are a pest which comes and goes and are not permanent. Three crops of alfalfa are obtained in Poudre Valley. Sometimes we get quite a large fourth crop and it always makes a lot of pasture. Sometimes we cut the fourth growth but
3226 not often. Fourth growth is generally used by stock which are turned onto it and feed it off. We utilize nearly all of the fourth growth with old sheep and lambs brought in for feeding. It gives them a good start. It seems to put them in good condition for feed lots later. At any rates they take on flesh better when placed in lots if they have had a chance to forage in the field for a little time previous. This is also true of cattle.

Have grown 6 tons of alfalfa per acre. I purchase a great deal of alfalfa. I have known of some fields of alfalfa that would average

as high as 6 tons per acre but that would be about the largest yield I know of.

Have known 2½ and 2¾ tons of alfalfa obtained per acre from first cutting. I had 30 acres this year that measured 2¾ tons per acre for first cutting. There was some voluntary wheat with this alfalfa but I could not say that it was all alfalfa because examining hay I found out we had some wheat with it. My hay measured the tonnage I have given. Most of alfalfa I purchase is brought
3227 by measure. We use the following rule: Take one-fourth of the measurement over the stack, multiply it by the width and length and divide by 512. Another rule used sometimes is: Subtract width from over, divide by two and multiply by width and length. Third rule which is not very satisfactory, never has been to me, is to take circle of stock, that is add the width to the over, divide by four, square and multiply by length and divide by 512. In long years of experience I have found that average alfalfa in country does not hold out in weight on that rule. That is, if I were to buy a stack so measured it would not weigh out as many tons as the measurement showed, not unless they had stacked it partly green and it had settled a long time and was very compact. Average alaflfa put up in the country will not hold out by that rule.

512 cubic feet of alfalfa equals a ton. I have bought hay by that measurement all my life. We divide by 512 cubic feet to get tonnage.

I would say that the first two rules I mentioned would either one of them be correct for measuring alfalfa hay. The second rule that I mentioned gave absolutely number of cubic feet in stack. It does not make any difference, that rule is perfect as giving number of cubic feet in a board, whether measured lying down or standing up, so that would really be the correct rule for getting the number of cubic feet. That would weigh out as a rule.

3228 512 cubic feet of alfalfa hay would be required to make a ton in Wyoming, Montana or Nebraska. In state like Nebraska or any section of country where they have greater rainfall than we do, their stacks will settle more than our hay here. In case of that kind there might be a difference. If there was less rainfall than we have the reverse would be the case.

If stacks of alfalfa in a field were unsettled, that is, in condition they were soon after being put up in summer, and were measured on third rule I have given and tonnage ascertained by 512 cubic feet, average of hay in Colorado would not hold up.

Alfalfa is always allowed to settle in stack at least thirty days before making measurement and computation.

Have had occasion to test my measurements from year to year during past 22 years have been feeding, by later weighing the stacks already measured. In this way get double check. Have
3229 bought hay measured by this third rule. Bought two hundred tons at one time which was all weighed afterwards. It was very unsatisfactory and only weighed out two-thirds of a ton. It fell short one-third. That was worst experience I ever had. I don't buy by that rule only when compulsory. There are certain

sections of state in which that rule is almost completely used. In southern part of Colorado there is no other rule in measuringhay. At all such places we expect to get worst of it. That rule is also in vogue in Wyoming. I buy some hay in Wyoming. After buying first time I never buy any hay in Wyoming by that rule unless stacks are measured and we agree upon measurements.

In measuring hay it depends largely on way line is held so when I buy alfalfa in Wyoming, where it is custom to measure by that rule, we see before we close contract, we absolutely see hay measured and see that we get very liberal holding of lines on that hay so we know we are getting as near our money's worth as possible. Bought hay at Torrington, Wyoming, three years ago, 1200 tons of alfalfa. It was all measured by the third rule I have mentioned. I was not satisfied with that, so we drew lots on first, second and third cuttings by putting numbers in all stacks and putting them in hat and drawing them out, then we weighed one stack out of first, second and third cuttings of that kind of measurement and I paid for hay on basis of what it would weigh afterwards. We bought from 6 or 8 different men. Buying from about 6 or 8 different men and weighing hay, one stack, and averaging from each man that I bought of, we didn't find one solitary stack that held out to measurement. A purchaser buying by measurement with that rule gives benefit to land owner.

I use the following rule: One quarter of line over stack, multiplied by width and length. In measuring large numbers of stacks of hay on those two rules, where individual stacks vary greatly, it comes out in long run about same. The third rule falls short about one-seventh or one-eighth, something like that.

Have grown wheat, oats and barley principally in time have been farming in Cache la Poudre Valley. My experience in raising wheat shows that since we got to plowing up alfalfa and growing sugar beets we have made an average of almost 50 bushels of wheat per acre for last 15 years. My yields have gone as high as 68 bushels per acre. That is larger than average for the county. Yields approaching that are presumed to prevail among better farmers. We
3231 have great deal of 50 bushel wheat grown following sugar beets or on newly plowed alfalfa.

We grow some of our largest yields of wheat in Poudre Valley after sugar beets, in Larimer County. Last year I had one field following sugar beets that made 60 bushels of wheat per acre.

Have grown oats ranging from 30 to 100 bushels per acre by machine measure. These oats are usually heavier than standard weight so it would add 10% to 15% at least. Oats weigh from 40 to 44 pounds to bushel as rule. Think it would be safe to add 8 pounds as a rule every year. 8 pounds would make 25% of 32 pounds thus requiring addition of 25% to machine measure in order to get bushels per acre. You may get many 70 to 80
3232 bushel yields per acre by machine measure. Those yields may be expected by farmers under good conditions.

Have raised about 80 bushels of barley per acre.

Larimer County is not much of potato section.

Sugar beets and fruit are principal crops in Fort Collins district of Poudre Valley outside of alfalfa and grain. A large acreage is devoted to culture of sugar beets. We have factory here.

3233 Have list of about number of sheep that have been fed in entire section of the country. It would include sheep that were fed at Loveland and Longmont which would make pretty close estimate of what have been fed in Poudre Valley. From my experience and knowledge of sheep feeding industry think I could apportion that pretty accurately. We know number of cars and about how many sheep are usually shipped in a car and have ascertained in that way about number that has been fed and can approximate very closely for the Poudre Valley.

This list I have I made from car records and make an estimate. 1903, 207,000 sheep; 1904, 344,000; 1905, 509,000; 1906, 582,000; 1907, 562,000; 1908, 645,000; 1909, 462,000; 1910, 291,000; 1911, 160,000; 1912, 232,000; 1913, 500,000; and this spring approximate number of sheep on feed in same district is very close to 700,000 head.

To get correct number fed in Poudre Valley we should take from 75% to 80% of the numbers given. They do not feed many sheep at Longmont or at Loveland.

Am not so well posted on cattle industry but I have been told by cattle men and others that there are around 25,000 head of cattle on feed. More this year than previous years.

3234 The cattle feeding industry seems to be increasing very rapidly. They have always finished good many cattle here since we got alfalfa hay, but since day of sugar beets and getting pulp and tops, cattle fattening has largely increased. These cattle are largely fed in transit.

By feeding in transit is meant that railroads make rates to all points on Missouri River and then charge certain amount for privilege of stopping off and finishing the feeding. The universal rate is now $15.40 per ton. There is a through billing with privilege of feeding in transit of most of sheep fed in valley.

Sheep are produced in northern Larimer and Weld Counties. They are very largely fattened in Greeley and Fort Collins Districts. Same is true of cattle.

One man can take care of about 1500 sheep if you have quite a flock. In small lots it takes more men for that number.

One ton of alfalfa hay will feed 6 or 7 sheep. With sheep amount of hay varies with amount of grain. If cattle are fed other feeds they eat less alfalfa. I fed bunch of cattle and a bunch of sheep one winter and sheep had grain and cattle did not and it took same amount of alfalfa to feed one steer that it did for twenty lambs, but lambs had some corn with it and cattle did not.

In speaking of alfalfa production on farms for this year I referred to year 1913.

W. A. DRAKE.

Cross-examination by Mr. N. E. Corthell:

3236 The first plowing up of alfalfa land and planting the same in wheat occurred about 20 years ago, and the practice has increased the yield of wheat very greatly, about two and one-half times in my own case. Field peas, a very successful crop, largely used in feeding sheep, are not raised to any extent in the Poudre Valley.

3237 Redirect examination by Mr. Delph E. Carpenter:

Average profit per head obtained by farmers from feeding of sheep in Cache la Poudre Valley over a period of years, exclusive of fertilizer obtained, would be from 60 to 80 cents per head. Fertilizer obtained from stock feeding is considerable source of profit especially when you are growing root crops afterwards, like sugar beets or potatoes.

In earlier years of wheat growing in Fort Collins District, when sod was first broken up and land was new, we grew from 30 to 40 bushels of wheat per acre and by continually cropping with wheat we got wild oats into the country and our wheat yields were reduced by foul lands and steady cropping. The falling off of the production of wheat was due to failure to rotate and the diminishing fertility of soil. Production was about as I stated at the time of this change in manner of rotating crops by plowing up alfalfa sod and putting it into wheat.

HENRI S. MCCLELLAND.

3238 Direct examination by Mr. Fred Farrar:

Have lived at Fort Collins for forty years last June. Father was pioneer newspaper man of Fort Collins. He established Larimer County Express in fall of 1872 or spring of 1873. That paper is still published here. It is a daily. There are three papers published in Fort Collins; all three are dailies and publish weekly editions.

Am engaged in fruit business and general farming. Orchard located about 4½ miles south of Fort Collins. Irrigate mostly from Pleasant Valley and Lake Canal. That ditch takes water out
3239 of Cache la Poudre River on south side about ten miles west of Fort Collins.

Have about 80 acres of orchard. My orchard is commercial and not incident to my farming business. Orchard devoted to apples, cherries and plums. Have about 50 acres apples; about 25 acres cherries and rest of orchard is in plums. Raise nearly every variety of apples but principally Jonathans, Ben Davis and summer varieties, such as Wealthies. Raise Montmorencies and Morello cherries, and many varities of plums. They are what are called cultivated native plums. By native, I refer to native of the United States. Plums vary in size from quite small to medium size. They are sour plums.

Orchard established 1875, planted just a little at a time as my

father could afford to buy a few trees every year. I am still adding to it. Irrigation is necessary for this crop.

3240 Ben Davis apples on old established orchard in full bearing yield close to 1000 bushels per acre. Some varieties of apples begin to bear within three years after they are set out but we do not consider them in full bearing until about eight years of age. Trees continue to grow and increase in size and yield every year. Apple trees in this vicinity are not so large as they are in eastern states. 1000 bushels of Ben Davis apples per year per acre is reasonably good crop. This would apply to such trees as I have on my place. Trees from eight years old and over.

Jonathans bear about 500 bushels per acre per year. Wealthies bear about same as Ben Davis, 1000 bushels per acre per year. Trees will average from fifty to seventy-five per acre.

Cherries with normal crop will run close to 15,000 pounds per acre on good large trees. Morello cheries commence to bear next year after they are planted. Montmorencies bear about three years after they are planted. My experience is same as to progress of yield as trees grow older. Cherries run from 150 to 200 trees per acre. Yield of good normal crop of 15,000 pounds per acre per annum is from well established orchard of large trees from eight to ten years of age, such as I have in my orchard. My cherries are marketed by the pound and that is the unit measurement employed.

Plums are very heavy bearers and I would have to guess a little as to production. I would say that they would yield from 6,000 to 7,000 pounds per acre per year.

Fruit is quite extensively grown in this area, especially on river west of Fort Collins. La Porte is situated in the heart of that fruit section. I am not in that section. Mr. Mogg has a large orchard north of Fort Collins. Mr. C. R. Evans has an orchard west of Fort Collins; he has 40 acres of cherries.

3242 All kinds of small fruits are also raised around La Porte. Apples, plums, currants, strawberries, raspberries and blackberries are all raised there. The area which I have described as generally to west of Fort Collins, mine to the south and those to the north are all in the Cache la Poudre Valley. The conditions—yields are about the same in all of these localities.

A very small portion of the fruit is consumed locally.

I market quite a considerable portion of my fruit in Wyoming. One year I sold my whole crop of apples to a Laramie City firm. The name of firm was Wyoming Commission Company. Mr. A. L. Erb was representative with whom I dealt. I shipped him between 12 and 15 car loads of fruit. One car went to Hanna, Wyoming; another to Rawlins and all rest were billed to Laramie City.

Denver consumes quite a large portion of the summer apples. Winter apples are shipped to Cheyenne, Wyoming, Oklahoma, Texas and Chicago.

Am able to compete with apples from western slope of this state and also from fruit growing districts of United States.

3243 Cherries are marketed mostly in Chicago. In previous years marketed them in Kansas. Used to ship my own cher-

ries mostly to Kansas points, quite a few to Kansas City and St. Joe, Missouri. Cherries are packed and handled in bulk. They are pulled from stems and put in small boxes and loaded in car. From there they are taken to Fort Collins where they are packed by firm who buys them. There is cold storage concern in Fort Collins prepared to handle them.

Plums are marketed mostly in Denver.

About 50 cents per bushel is average price obtained for Ben Davis apples. This is the price boxed. One box of apples is a bushel.

Average price obtained for Jonathans is $1.25 per bushel or box.

Average price for Wealthies is about 75 or 80 cents per bushel or box. Other varieties of apples would bring about same price as Wealthies.

Five cents per pound is obtained for cherries. With 15,000 pounds yield per acre, my return would be about $750 per acre. This is
the price obtained for cherries in bulk and not boxed or
3244 crated. Expense is merely taking them from trees and de-
livering them to railroad station immediately adjoining orchard. Colorado and Southern runs right along immediate boundary and through orchard.

Plums bring from 2 to 5 cents per pound, varying with condition of season. I would say that they would average about 3 cents per pound. They are sold in baskets. The price I have given is net after we have furnished the baskets.

Crop varies from year to year both as to quantity and quality. Occasionally have frosts; these occur when trees are in blossom. Trees bloom from May 1 to May 15, as nearly as I can remember. Of course have other physical conditions which sometimes con-
tribute to loss which might be incident to any country. We
3245 have occasional hail and winds damage the fruit a little.

Took $18,000 from my orchard during one year. It was a good crop and with good prices, normal prices I should say, it was probably a little above average crop. Would say that that amount of return should average right around the normal annual crop with normal price.

Fruit raising is my principal business. Nearly all of the farmers in my vicinity have orchards incident to their farms. Some of these are commercial orchards. With same care given to cultivation their returns would be about same as mine. My land and conditions are not extraordinary in any extent. I specialize in raising fruit.

3246 Redirect examination by Mr. Fred Farrar:

The area of 12 miles takes it practically to foothills of mountains. Just within first range of hogbacks or foothills is what is known as Pleasant Valley. This is within the outer range of hogbacks or foothills but outside of the mountains themselves. It is just this side of the mouth of the cañon of the Poudre River. Fruit raising is quite large industry in this section. It is by no means confined to my orchard or to the other two orchards I have specifically named.

3247 C. E. MOGG.

Direct examination by Mr. Fred Farrar:

Am raising fruit and taking a rest. Previously was clergyman in Pennsylvania. Have nominal charge called Fort Collins Circle at this time. It is indefinite and I work as I choose. Live in Fort Collins.

Have orchard 3 miles northeast of Fort Collins. Between 25 and 30 acres in orchard. Orchard 10 or 12 years old, part of it 4 years. Devoted to cherries, apples, plums and prunes. Have about 20 acres cherries, 2 acres apples and balance in plums and prunes. Have about 200 trees. Major portion of orchard devoted to cherries.

Last year yield was quite prolific. Yields have been quite uniform but I never figured it very close until last year. My 10
3248 year old trees produced about $400 per acre.

Crate some of my cherries but sell mostly in bulk. When crated standard box is 24 boxes to crate. Received about $2 per crate on average. Cherries that are not crated are sold in bulk. Receive 5 cents per pound for such.

$2800 was received by me from 7 acres of young Morello cherry trees in 1913. This was gross receipt. Cost of harvesting was about $300. Received not return of $2500 from 7 acres of young Morello cherries, just accounting for harvest, of course there was previous expense of cultivation. Am able to segregate that particular 7 acres from balance of orchard because they were set out at the time by themselves in a separate year. Those 7 acres are in no manner different from the rest, they adjoined the others. They are merely a sample of the return for the balance of the orchard last year. They are younger than the other trees in the orchard. I don't think there would be much difference in the yields. That would be
3249 a fair standard of return from my whole cherry orchard.

Am acquainted with Charles R. Evans. Know his cherry orchard west of Fort Collins. Think he has 35 or 40 acres. The fact that Mr. Evans sold $3000 in fruit off his orchard 3 or 4 years ago, started me into the orchard business. Orchards in vicinity of Fort Collins are not confined to mine, Mr. McClelland's or Mr. Evan's. There are many others. All I know to northwest are Mr. Jones and Mr. Anderson. There are good many orchards about La Porte but I could not approximate acreage. Fruit is not confined to any particular spot but is general throughout this part of valley.

My experience with apples has been quite favorable with good yields. Of course my trees are young and small. Ben Davis apples this year, 1913, brought about 700 bushels per acre, 700 boxes of one bushel each. These were marketed locally and to towns of within 25 miles of here or at Denver.

My prunes bring from $1 to $1.25 per crate. Four small baskets make a crate, about 22 pounds I think. They are marketed in same territory as apples. They are not treated in same manner as big commercial crops from California are, but sold fresh for family use.

Met young man by the name of Gardner, a photographer from

Greeley. He took picture of my orchard. Took several photographs. He explained to me they were for purpose of this case.

Made Fort Collins my home about one year. Resided at Greeley previous to coming here. Formerly had a charge at Wilkes-Barre, Pennsylvania.

I set out this orchard. It was a vacation joke. I came out here for fun and didn't expect it to be so serious a business proposition. In other words I commenced a vacation amusement and it became a profitable business. It has run ahead of my expectations.

3251 I am under Larimer County Canal of The Water Supply and Storage Company.

Market value of orchard lands in vicinity of Fort Collins runs from $300 to $1200 per acre for good, well developed cherry orchard. Apple orchards would not be worth quite so much.

3252 FRANK BAXTER.

Direct examination by Mr. Fred Farrar:

Live at La Porte, Larimer County, Colorado. La Porte is 6 miles northwesterly from Fort Collins on Cache la Poudre River. It is about 3 miles in direct line from canon of Cache la Poudre River where it emerges from mountains. Have lived in Larimer County 30 years last September.

First few years was in cattle business in hills west of Fort Collins but most of time since then have been in general mercantile line at La Porte, part of time in Fort Collins.

La Porte is an unincorporated village. We hardly know what our village is. I should say 50 to 60 people right there in a little cluster. It is situate right on river. The immediate irrigated area of Cache la Poudre Valley next to La Porte is rather narrow not averaging over a mile at that point or a little above. Perhaps 1½ miles across. Some of the land is broken and is of no value. Bellvue in

3253 Pleasant Valley, another village, is just about two miles west of La Porte. Front range of hills before you enter mountains is called hogbacks. It is of stratified formation consisting of sand stone strata. This Pleasant Valley I mention is just inside the first row of hogbacks between what we call hogbacks and the foothills. It is what might be described as a pocket in there.

Cache la Poudre Valley, as far as plains part is concerned, really commences at point where river comes through those hogbacks and that is just above La Porte. From that valley spreads out in fan-like shape being wider as you go downstream.

From Fort Collins up the river part of way there are general crops such as alfalfa, grain, sugar beets and like crops. This is for first 2 or 3 miles. As you get nearer La Porte it is principally gardening and fruit. Over in the Pleasant Valley there is a good deal of market gardening but rather more farming than there is in immediate vicinity of La Porte. When I say farming, I am making a distinc-

3254 tion between farming and market gardening. When I mention gardening I refer to market gardening.

A spur of the Colorado and Southern Railroad runs from Fort

Collins to La Porte, Bellvue and beyond. That is only a freight line with no passenger service. It is freight only for car-load lots. There are no other shipping points on this line other than La Porte and Bellvue in that area. There are sugar beet dumps between Fort Collins and Bellvue. There is a dump at La Porte and also one at Bellvue.

La Porte District includes perhaps four square miles. I think that would cover practically the gardening area where gardening is done in the La Porte District, of course, that is not all gardening, but that would cover all of the territory where market gardening is done. Am not trying to draw distinction between La Porte District and other district between Fort Collins and La Porte and what may be just above La Porte. I am defining the La Porte District as merely containing area of four miles and by that I refer to what actually comes to La Porte to be shipped.

Onions, cabbage, strawberries, raspberries (both black and red) apples, plums and other crops are raised in La Porte District.
3255 There are some cherries and more or less celery but not on so large a scale as the others. Cabbage is shipped in car lots. Probably 20 cars per year. Cabbage yields about 20 tons per acre. Prices for cabbage vary a good deal. I have known it to be quite low but I think they figure on about $1 per hundred. A field yielding 20 tons per acre and sold at $1 per hundred would bring $400 per acre to the farmer.

Cabbage raised by Mr. Herring, one of our largest producers, is usually shipped by rail to Laramie City, Wyoming. Don't know whether he ships to Cheyenne or not. Most that I know of is shipped to Laramie. Great deal is hauled by wagon to Laramie, Cheyenne and North Park.

10 to 15 car loads per annum of onions are raised and shipped from La Porte. Yield is from 300 to 400 sacks per acre.
3256 They complain if they receive less than $1 per hundred and obtain sometimes $1.25 per hundred. Onions yield from $300 to $400 per acre.

Onion seed is another industry that is centered at La Porte. A great deal of seed is raised. Cannot give amount or price but a large amount is raised every year for export. Denver firms handle most of that. Practically all of it goes out of the valley.

Have forgotten number of car loads of fruit that went out this year. I know one man shipped 56 cars and there were two or three other shippers. One gentleman from Laramie Grocery Company bought several cars there and sent his people down to pack apples and to ship them out but cannot tell how many.

Practically all kinds and varieties of apples are raised. About $1 per box or bushel is usual price received at time of shipping. Have about 85 trees on one acre of land on my place. Have had each tree yield from 7 or 8 bushels to as high as 22 or 23
3257 bushels. This is yield for same year on different trees and different varieties. Think trees would average ten bushels each for good apples.

Inclined to think majority of orchards in that community are better than mine.

$680 would be return from my orchard figuring 85 trees in my orchard occupying approximately one acre of land with average yield of only eight boxes of apples per tree and bringing $1 per box.

In addition to this return from apples, I have two rows of raspberries between each two rows of trees and I cannot give you exact figure produced from these berries, but we sold last year, which was first year after bearing, about $150 worth of raspberries off of that patch besides what we put up and gave away and used. That acre brought me at least $820 last year.

Nearly all of the orchardists or farmers in that locality have plants such as raspberries or other small berries between the apple tree rows in their orchards. Mr. Younger told me the raspberries inside of his trees paid him over $400 per acre in addition to the production of apples last year.

3258 Strawberries are very good crop there. From $300 to $400 per acre is realized from strawberries.

This is all raised under irrigation. It would be impossible without irrigation.

Great deal of the fruit and produce from La Porte District is hauled by wagon to Laramie and Cheyenne, Wyoming. Men make that their business during the whole year, buying and hauling to those places. Quite a little goes into North Park.

La Porte District is nearest to Laramie Plains region of all the lands in the Poudre Valley. It is about 65 miles' haul from La Porte to Laramie. There are from 4 to 5 men who are engaged regularly in hauling fruit and vegetables from this district into Wyoming.

Do not know whether it is more expensive to ship by rail than by wagon freight. I do know that the men who do the hauling say they make good wages by hauling it themselves.

This has been the practice ever since I have known that country. Think there was more shipped by rail last year than ever before. It is necessary to ship on C. & S. and transfer to Union Pacific Railroad in order to get to Laramie by rail. Until Colorado & Southern extended to Cheyenne few years ago, it was necessary to do this to get to Cheyenne by rail.

Average farm unit in La Porte district is about 5 acres. Owner of land will lease to several parties who will farm from three

3260 to five or six acres each.

5 or 6 acres of land in La Porte District will support a family. I am speaking of the garden land.

I counted 116 people supported on one square mile at La Porte. Portions of the district would not run so high. Think I could find another square mile that would run fully as high and maybe a little higher. I refer to square mile starting south of river and running north a mile and taking half mile on each side of this line. Think this area would run a little more than the figure I have given. Have made this estimate from memory.

Am acquainted generally with Cache la Poudre Valley. Resided

at Fort Collins. Was County Commissioner of Larimer County at one time.

La Porte district is in no way peculiar or different from rest of Poudre Valley. With same class of farming, don't see why whole valley cannot be handled as well as that portion is. There are portions that would not be quite so good, but think larger per cent of land along Poudre is capable of raising crops we have.

3261 We raise beets in that district as successfully as in rest of Poudre Valley. Do not raise very much grain. We cannot afford to. Ground is worth too much for these other purposes. You cannot afford to raise alfalfa and grain on $400 to $500 land. If we did we would lose money. Grain and alfalfa would grow just as well there as in any other part of valley. There is a little alfalfa grown here and there and some grain but not very much.

Same system of intensified farming could reasonably be expected to prevail over larger areas in Poudre Valley if development was such to bring it about. This intensified farming extends in general way from Fort Collins up the river. Any of the ground near the river not only can, but always has raised as good onions and cabbage and like crops several miles this side of La Porte as well as at that place.

3263 Redirect examination by Mr. Fred Farrar:

La Porte is oldest settled district in Poudre Valley. It was the old overland stage station and we have some of those old buildings there yet. It was camping place for soldiers before they camped where Fort Collins was later established. Think La Porte postoffice was one of very first in Northern Colorado, if not first outside of Denver.

A piece of land in La Porte district with boulders coming very close to surface that had never been considered valuable at all, and was practically raw, was lately sold. It had practically no improvements. They tried to grow alfalfa on it but failed. Last year Mr. Lambert put some apple trees on it, just one year's growth. It is a three cornered piece lying just northwest of our new school building. It contains three and a fraction acres. It sold a few days ago for $1200 spot cash, practically four hundred dollars per acre. Do not know of any recent sales of improved orchard lands in that vicinity.

3264 In La Porte district we have consolidated school in which five districts were consolidated into one. Last year we constructed strictly modern school building with heat, light and water and same system they have at Fort Collins. We have seven teachers and have seven teams that go and haul all of pupils in in morning and take them home in evening. Think about 300 pupils attend in all grades. The course includes high school. We prepare for entrance to College. Our high school is accredited so that graduates enter college without examination except exactly same as the city schools at Fort Collins. Practice of sending out conveyances and getting school children and bringing them in is rather new here. Until

I commenced looking it up in Government reports, supposed it was new generally. It has been thoroughly tried and in every case has been a success.

Our school building cost $25,000. It is three story building.

Mr. Pennock has been engaged quite extensively in or-
3266 chard business for a good many years. He is in what is called Pleasant Valley district. I do not intend to make any definite limits on La Porte district but rather to speak of whole area which ships produce out of La Porte station. Intensive farming extends clear to Fort Collins and beyond in greater or less degree.

Stages which crossed river at La Porte were on what was known as Overland Stage Line that ran here in early day. They went up through Virginia Dale and must have gone through Laramie. It is same route followed in general way by wagon road today.

There has been rather intimate connection between La Porte section and Laramie Plains for a great many years. There has been interchange of garden produce for live stock and so forth.

FRANK L. WATROUS.

Direct examination by Mr. Fred Farrar:

Reside 1½ miles northwest of Fort Collins, Colo. Same here in 1871 and this has been my home ever since, although I have been absent on one or two occasions, once for one year in Wyoming, another time one year in Texas and four years at Rocky Ford, Colo.

3268 County Commissioner Larimer County. Have been associated with experiment station of Agricultural College. Began work for college 1887 on Rocky Ford Station in the Arkansas Valley and remained there four years. That station was devoted to experimentation generally in farm, garden and fruit crops. After that was associated with college here to take place of man who left farm department and was appointed assistant agriculturalist. Was so connected with institution here a little over eight years. Total of twelve years with institution.

At present engaged in raising fruit about four miles from La Porte and between La Porte and Fort Collins. Have tract of nine acres which I am getting into fruit. Commenced about four years ago. Have about four acres now in fruit. Have apples, pears, plums, cherries, raspberries, strawberries, and black and
3269 white currants. Orchard just beginning to bear. Agriculture in my vicinity is mixed, quite a little gardening, considerable fruit raising and quite an area of peas, alfalfa, wheat, oats and barley. Market gardening and fruit raising to quite an extent.

In my vicinity we have finest celery farm in Larimer County and have some fine raspberry patches and good orchards. Orchards of apples, cherries, plums and several large raspberry and strawberry patches. The C. R. Evans of forty acres is situated about one-half mile from my place and between me and La Porte.

Celery yielded about $800 from 1¼ acres last year on Adolph

Anderson place near me. Celery has not been cultivated to large extent. Anderson has grown celery on this same farm for last fifteen years successfully. It is marketed locally to large
3270 extent but a great deal is shipped to Cheyenne, Wyo. Soil in my vicinity is of equal quality with that of the La Porte district varying only in its nature. My immediate vicinity is as well adapted to raising of market garden products, fruits and vegetables and general intensive farming as is the La Porte District.

Quite familiar with Laramie Plains region in Wyoming. Have traveled over there great many times during last 35 years, and know nature of country. Resided near what they call tunnel near Laramie River off and on for 2 or 3 years and used to travel across Laramie Plains to Laramie City, from Laramie City to Fort Collins, and owned ranch at St. Cloud and traveled from St. Cloud to Laramie and Tie Siding, Wyoming. The tunnel near which I resided is situated directly west of Wheatland, Wyoming, and is the tunnel through which water from the Laramie River is di-
3271 verted for irrigation of Wheatland tract. I resided in mountains on Slate Creek. While there did my trading sometimes at Laramie, sometimes at Cheyenne and sometimes came clear down to Fort Collins. Also traded at Uva, a little settlement on Laramie River north of Wheatland. St. Cloud is about 35 miles southeast of Laramie in Colorado. While living there, traded frequently at Laramie.

Would not call Laramie Plains a farming country. There is no comparison at all between that region and the Poudre Valley in Colorado. Have not been through Laramie Plains Region overland during past nine years but went through on cars during that time. My testimony from personal knowledge of conditions is of those prevailing prior to last nine years. It is a great big plains country with nice grass and a good range for stock. It produces live stock. I have seen a few patches of rye, a few patches of potatoes, perhaps just a little garden in way of cabbage and some
3272 hardier vegetables near houses. These gardens were just small patches. I never saw any alfalfa growing there but have understood there was some.

Fruit and market gardening district of Cache la Poudre Valley is not confined to La Porte district. I do not know of any reason why same system of cultivation and same products could not be raised in other places up and down Cache la Poudre Valley, that are now raised at La Porte. As valley broadens out we have what we call first, second and third benches. Each bottom rises from one below. There is difference in quality of land each area being better adapted to certain crops. Lands right on river bottom where it is free from seepage and is good alluvial land, is of same quality as soil at La Porte and just as well adapted to market gardening. That same condition prevails clear down to Greeley. Market gardening, particularly raising cabbage, onions and crops of that nature is quite extensive at Greeley and in that vicinity. As you rise to next bench, my place is on second bench, we have a little more

clay, it is just as good for some things, better for strawberries, apples and some other fruits than is the first bench. It is not quite so well adapted to celery, onions and some of these garden products but is better for fruit. On third bench we have a little more clay, which
makes it better for apples, wheat, oats and other agricultural
3273 products. Early settlement of La Porte Valley district is
reason for intensive agriculture there. In early settlement of country little ditches could be taken out and a small body of land put under cultivation and there was a large market for things they could raise there. La Porte was closest point to Laramie and Cheyenne and the land has been cut up into smaller patches and at an earlier date than the rest of the valley. People could make a living up there on a smaller piece of land than in lower stretches of the valleys.

Markets at Cheyenne and Laramie contributed to this condition. Think it was also due to fact that number of ditches were taken out up there. It is quite important to gardeners to have water handy and, being close to head of ditches, they had less trouble in successful gardening.

Canal of The Water Supply and Storage Company, commonly known as Larimer County Ditch, heads a few miles above La Porte. Canal of The Larimer and Weld Irrigation Company, commonly called Eaton Ditch, heads a few miles below La Porte, a few miles above Fort Collins. There are other ditches that irrigate on south side of river and head in same general vicinity. As matter of fact, larger ditches which irrigate upper end of Poudre Valley and even those which extend into Weld County, to some extent, radiate from
this point and extend in fan shape from this common point.
3274 On south side of river there are the Pleasant Valley and
Lake Canal, called the High Line; the New Mercer, the Larimer County No. 2 and the Arthur Irrigation Company ditches. On north side of valley there are the Poudre Valley Reservoir Company Canal, now a part of the Greeley-Poudre Irrigation District system, the Larimer County Ditch of The Water Supply and Storage Company and the Eaton Ditch of The Larimer and Weld Irrigation Company, together with a number of smaller ones.

FRANK L. WATROUS.

Cross-examination by Mr. N. E. Corthell:

3274 I lived in Wyoming for a year or so in 1886 at the head
of Slate Creek, seven or eight miles east of the Wheatland
3275 Tunnel, and used to travel to Laramie and from Laramie
along the railroad to Tie Siding and then to Fort Collins. Excepting possibly for some few ditches to irrigate meadows, none of the country through which I passed on these trips was irrigated land, and there were only a few narrow strips of irrigated land along Slate Creek. I was not familiar with the land lying west of the Laramie River and along the Little Laramie River. My land near Fort Collins has quite a little clay in it, being on the first bench

above the river bottom, and such land is considered better
3276 adapted for apples, strawberries and cherries than the river bottom land, which has less clay.

Redirect examination by Mr. Fred Farrar:

My farm has nine acres. Family consists of wife and one small son. This nine acres furnishes livelihood for my family. Just commenced on land 4 years ago. Am putting it into fruit as
3277 fast as I can. It takes several years for fruit to come into bearing to make it what we call a paying proposition, and it is only during last two years I got place in shape so I could figure we were making living off of it.

C. P. GILLETTE.

Direct examination by Mr. Delph E. Carpenter:

Reside at Fort Collins. Am connected with Colorado Agricultural College and with Agricultural Experiment Station. Am head of Department of Zoology, including Entomology. I am also director of Experiment Station. Have been director three years. Succeeded Professor Louis G. Carpenter. Came to college in January, 1891, as head of Department of Zoology and Entomology and Entomologist of Experiment Station. Was raised in Michi-
3278 gan and received my college education at Michigan Agricultural College. Was assistant in Department of Zoology and Entomology in that institution about 1½ years after graduation. Was raised on farm. Have been identified with agriculture throughout my lifetime. After leaving Michigan Agricultural College went to Iowa Experiment Station at Ames. Was Entomologist of Experiment Station there for not quite three years. Came from there directly to Agricultural College in Colorado.

Have been a member of American Association for Advancement of Science since 1888. Have been a Fellow in same Society for fully 20 years; a Charter Member of the American Association of Economic Entomologists and a member of several minor scientific societies from time to time.

3279 Published a few bulletins in Iowa Experiment Station while I was there, wholly along Entomological lines and have published several bulletins in connection with this institution. Have published one scientific paper for Smithsonian Institute on insects on the Jessidæ of Colorado (Typhlocybynae). We commonly speak of these insects as leaf hoppers, the small sucking insect that takes foremost part in failure of plants. I have published a number of scientific papers also on plant lice. Have made a specialty of the study of plant lice.

My work as Entomologist has kept me constantly in touch with agricultural and horticultural conditions and conditions of general crop development through states in which I have been engaged. I am State Entomologist for Colorado. My duties as Entomologist for the College and for the State cause me to travel a great deal over Colorado and adjacent territory, especially in fruit growing

districts, beet growing districts and wherever agriculture is somewhat intensified. Where agriculture is most intensive, we have most trouble with insects. Have been familiar with agricultural sections of Colorado throughout my employment with College since 1891. My investigations have taken me into regions of high altitude as well as those of lower altitudes. On some occasions have gone to San Luis Valley to investigate insect troubles, that is one of our higher agricultural regions of Colorado.

3280 Have been especially familiar with Cache la Poudre Valley during the term of years I have been with College, also familiar with development of the region. The only real visit I made over the Laramie Plains region in Wyoming was about July 14, 15 and 16, 1913. Made this trip of inspection with Professor House and Professor Freer of college faculty. Professor E. B. House is now at head of engineering department. Professor Freer was at that time with Agronomy Department and also beginning to act as state agent for Government farm enlargement work. That involved a series of studies regarding farm economics. During this trip of inspection, traveled more or less over Laramie Plains region. We left Laramie and went directly to Lake Hattie, by way of what they call the higher road and from there across country to Sodergreen Ranch. From there to Woods Landing and from that point by lower road went back to Laramie. Also went over other portions of

3281 Laramie Plains on succeeding day. During second day of inspection on Laramie Plains, made a trip to Little Laramie Valley. Went from Laramie over intervening mountains to Wheatland and from there back to Cheyenne.

My general impression of Laramie Plains region, according to my notes made at the time, was that the country was only adapted to grazing and that it seemed to me they were attempting to spoil a good grazing country by trying to farm it. Native grasses seemed to be slow in coming in again where lands had been broken. After spending the day I mentioned, leaving Laramie, going to Lake Hattie and from there to Woods Landing and back again by lower road to Laramie, according to my notes, we did not see even a fairly good farm crop during the day. The best crop we saw was that of barley near Mr. Grable's house on lower road. There were parts of that field which I estimated might yield from 15 to 20 bushels per acre, but there was quite a large portion of field that would yield little or nothing and my estimate for whole field was that yield would probably not exceed 7 or 8 bushels per acre, that may be a little

3282 low, I am not sure. Best alfalfa we saw on that trip was also there at Grable place or near-by. We spent quite a little time in alfalfa field looking over stubble. The stacks were small and from estimates I decided yield could not exceed one ton per acre for whole field in that cutting. Cutting of alfalfa was nearly complete. Most of hay was in stack. From portion of field they were hauling to stack. It must have been first cutting of alfalfa. It was middle of July. It could not have been second cutting. Remember visiting Hart Ranch where they were also putting up hay. Impressions were practically the same there. Remember only other field of grain

which I saw that I thought would possibly pay for care of crop was field of unirrigated rye, where we estimated there might be 5 or 6 bushels per acre harvested. It seemed to me that all other crops they were attempting to grow were really a dead loss, they could not get back the money that they had put into the crop.

First problem of agricultural development is to obtain from soil crop returns sufficient to meet expenses of cultivating ground and harvesting crop. Returns must be more than that before they could make profit out of the work. It is not to be taken as probable that, because plants will grow on a certain territory, they will therefore yield net returns to the farmer.

3283 Observed native hay growing in Big Laramie Valley on Riverside Ranch region and down the river from there. Growth seemed to be pretty fair. We drove for some distance through one strip of country where they were growing native hay, but even there crop did not seem to me to be heavy, it seemed to me that profit would be in growing of native hay and in grazing on country adjacent. My conclusions in this regard were confirmed on second day's trip over Little Laramie region.

My general conclusions were that the Laramie Plains is a grazing territory. It is a region adapted to the growing of animals rather than the finishing for market. Would hardly think it suitable for finishing animals without the growing of considerable grain.

Attributed condition of country to cold climate and short season. Country is high to begin with, being pretty well north, and they necessarily have a short, cold climate with cold nights which limits plant growth. I might say in addition to that, that over a good deal of country through which we passed, there was a very gravelly soil which of course is not strong soil for agricultural purposes.

Where coarse gravel came near surface land is hard to cultivate. There is considerable land where cultivation could be carried on very well. The land does not respond to cultivation very rapidly. Even in better land which we found, where gravel is not so coarse, land does not cultivate so economically as do the soils of the Cache la Poudre Valley.

Do not think I saw any land that would compare favorably with most of land in Cache la Poudre Valley.

Was impressed with fact that we traveled over country where there were old irrigating ditches and passed many laterals of considerable size that were apparently unused. It seemed strange to me that a country that had had irrigating ditches for something like 35 years was still lying unirrigated. No crops to speak of growing on land. We also noted on that day a considerable number of alkali lakes where their irrigating water seemed to be collected and from which there seemed to be no possible means of getting water out again. This seemed to be rather a bad condition in region.

3285 Soil auger was used for boring holes in earth in the country visited by party. The Water plane in many places was close to surface. I did not pay much attention to that. Think it ran from 3 to 5 feet through a good deal of the territory. Think that was true on Hart Ranch also. Test for soil and water plane

was made in alfalfa field on Hart Ranch. It was in one of the best fields that we saw.

As an entomologist I observed a peculiar characteristic indicative and confirmatory of my views obtained from reconnaissance of the area. I could not help but observe the insect life and make some conclusions on the trip. I recall especially some observations of one of the plant lice on the cottonwoods up there where all of the broods of the season were gathered in one gall, indicating that the insect must pass through its life history in a very short time. Not only was the stem mother, that is the louse that starts the broods for the season history, in the gall but the entire broods of the season, including the a-sexual forms were all in the same gall.

This was indicative of very short season in which the lice had to pass their life histories. Otherwise they would have escaped and produced from other forms, but finding the whole life history in the same gall, indicated that they were living in a cool climate
3286 with a very short season in which to go through their transformations. This I concluded from observations actually made on the ground during the trip.

Possibilities of the Laramie Plains region increasing in population and supporting a large number of people are very small, compared with Cache la Poudre Valley. This I concluded from crop observations I observed, the short growing season and the limitations they must have of crops that could be grown because of their short, cold climate. It seemed to me the area was limited practically to grazing. That is not regarded as a profitable industry when confined to small areas.

I see no reason why Cache la Poudre Valley should not develop into an area of dense population. It has an excellent, deep soil, and, with water to irrigate it, I see no reason why it should not be as productive as any section that can be found almost anywhere in the country. In fact, when I go out over other sections of the country, I come back to Colorado thinking that I am coming back to the best agricultural section. I am familiar with the best agricultural sections throughout the Central States as well as the Rocky Mountain Region. I make this statement having in mind these other sections.

Population on irrigated area of Cache la Poudre Valley has been steadily increasing since I came here in 1891. This is indicative of the future increase of the population of the valley.

3287 Cultivation has been improving since 1891. Farms are better cultivated. Farmers are keeping up fertility of soil better than they did a few years ago. When I first came to Colorado, farming seemed to me to be very slip-shod and shiftless, while today farmers are conserving their manures and rotating their crops better and are building and retaining fertility of soil. Cultivation is more intense and on a better scale than it was.

Units of land cultivated by various farmers and families are becoming smaller. That is to be expected.

I do not believe the individual holdings in the Laramie Plains region are liable to decrease. I do not think that smaller holdings can be profitable to the owners. In fact, I should be surprised if

holdings up there do not become larger in those sections where they have been selling land for agricultural purposes. This will come from a failure to make a living on their farms where they are trying to grow grains, alfalfa and farm crops, in my judgment. In other words, the net return from the land will not be sufficient to warrant an attempt to cultivate smaller areas by families.

3288 So great a variety of productive and profit yielding crops cannot be cultivated in a region of the climatic conditions of the Laramie Plains. I think the number of crops that could be grown upon Laramie Plains as compared with Poudre Valley, would be very small indeed, no matter to what extent they might try to carry crop improvement and production of new varieties. The production of plants of any kind to stand severe climate is very slow process. There would be many new plants found which would be adapted to cultivation in the milder climate where one would be found that would withstand the severe climate.

An acre foot of water will bring a much greater return, both to the farmer and to the community, in the Poudre Valley than it will on the Laramie Plains region.

C. P. GILLETTE.

Cross-examination by Mr. N. E. Corthell:

3288 Excepting when passing through on the railroad, I have never traveled across the Laramie Plains excepting one trip
3289 I made in July, 1913. The first day we did no more than drive to Laramie City, and the next day we drove up to Woods Landing, stopping at Sodergreen's and one or two other places, and on the return making several stops.

3290 The return trip occupied the next day, and the following day we went to Wheatland. The gravelly condition of the soil was most noticeable from Lake Hattie up to Sodergreen's, and then from Sodergreen's down to the Grable ranch. From the Grable ranch into Laramie, conditions were better, and I
3291 recall finding no gravel. We inspected some fields of oats, and saw some wheat and rye, but the oats and rye were not headed out, but I do not recall seeing any truck crops of any kind. We noticed but did not make any careful examination of
3292 some of the plots in the experiment station farm. The soil between Grable's ranch and Laramie City is quite similar
3293 to the lighter soil in the Poudre Valley and not quite as heavy as our heavy clays. I would compare it to the soil in the vicinity of Greeley, Eaton, and Ault, which are good potato, beet, grain, and alfalfa soils. Some rather large laterals which may have been main ditches, and some smaller laterals were noted
3294 above Sodergreen's ranch, which appear to have fallen into disuse. I do not know the names of the ditches nor who they belonged to. My examination was not sufficient upon which to base a reliable judgment of the agricultural possibilities of the country.

3295 Redirect examination by Mr. Fred Farrar:

Professor E. E. House was with me when these soil samples were taken.

Even if I were to examine that country for one, two, three, four or ten seasons, I could not alter the climate or the elevation. Even if certain portions of Laramie Plains had soil conditions as good as those in Poudre Valley, that would not alter the climate nor the elevation. I considered the bad agricultural conditions there due really to their short, cold climate chiefly, but also directly to their poor soil over a considerable part of the section.

Whether or not plots at Experiment Station grounds are indicative of economic probabilities or possibilities, depends on what the real object is in growing the plots. If they are attempting to show what could possibly be done with very best care and fertilization of soil, that would mean one thing. This I presume was what they were doing there, they appeared to be show plots, a favorable piece of ground near buildings.

The second day of the trip was devoted during the morning to the section between the Grable Ranch and Laramie and the balance of the day was taken up in investigation of Little Laramie area. I remember going down Laramie River on west side as far as Bosler Station and through what is known as Talmadge-Buntin tract. My general conclusions that I have given cover that area as well as the other.

3297 Redirect examination by Mr. Delph E. Carpenter:

Found better agricultural section around Wheatland than around Laramie, apparently very much better.

Do not remember seeing any painted farm houses in Laramie Plains region outside of new house of Mr. Grable and houses immediately west of Laramie in suburbs near Experiment Station. Just before turning to go directly into Laramie, on our left, there were 2 or 3 little houses that were painted, otherwise I do not think they were painted.

3298 B. F. HOTTEL.

Direct examination by Mr. Fred Farrar:

Lived at Fort Collins, Colorado, for 35 years. Engaged in milling business principally during that time, flour milling. Connected during that period at one time with Mason & Hottel, later B. F. Hottel and later succeeded by The Fort Collins Milling and Elevator Company. Was manager of latter company. Company owns mill at Fort Collins called Lindel Flour Mills. Mills on present site have been destroyed twice by fire.

Original mill constructed — Fort Collins in 1867, operated mainly by water power. We have an appropriation of 90 cubic feet per second for water power from Poudre River.

We are unable to secure enough water at all seasons of year to

supply this 90 cubic feet per second. During part of winter
3299 season do not have sufficient water to suply this amount. Operate the mill by steam during that time.

Appropriation for water power is in April, 1867. None of the larger ditches in vicinity of Fort Collins have a full appropriation earlier than that. Earlier appropriations are small ditches.

Engaged in milling business when — came here 35 years ago. That was my business until January, 1913. Am no longer manager of mill but still interested in mill same as I have been.

Production of wheat in vicinity during period I have been here varies somewhat. During first year's production was about 200,000 bushels and ranged from that up to 500,000. There has
3300 been a gradual increase in acreage devoted to wheat. About 15 years ago yield had dropped off to about 18 or 20 bushels per acre. Since that time yield has come up to about 30 bushels per acre on average. Have known wheat to produce as high as 70 bushels per acre. Yield in bushels per acre decreased about 15 years ago on account of wild oats that had gotten start in country. This has been mostly eradicated. Beet production has had good effect on growing of wheat. It has cleaned up ground and put it in better condition due to careful farming and fertilization.

There are two flouring mills at Fort Collins now. In addition to these mills there are elevators that are not connected with them, three elevators. There is elevator at Wellington, and one at Timnath.

Wheat is exported from Poudre Valley. It is shipped from these points we have named. We import wheat at our mill mostly from Idaho in order to blend it with our Colorado wheat, it makes a whiter, softer and more desirable flour for southern trade. This importation is because of different quality of Idaho wheat.

Wheat produced in Cache la Poudre Valley is of good quality. Our northern wheat generally runs over 60 pounds per bushel, 61-2 or 3 pounds. Most of spring wheat runs about 60 pounds per bushel.

Our mill has capacity of 300 barrels of flour per day. Flour is usually handled in sacks in this region. A sack of flour weighs 98 pounds net. It is one-half of a barrel.

We ship flour from Fort Collins to Wyoming. Laramie, Wyoming. We ship about 2 carloads of flour per month to Laramie, Wyoming. A carload is about 30,000 pounds. Have made shipments of flour to Wyoming ever since I have been in milling business.

We also ship flour to other points, to southern states and
3302 as far as old Virginia.

3303 Redirect examination by Mr. Fred Farrar:

This mixing of Idaho with Colorado wheat is to supply a popular demand for a certain kind of flour in certain markets. The importation of this outside wheat has only been made during last 2 or 3 years at this mill. Do not think we bought any wheat from Idaho last year but we did before, in 1912, I will look that up and find out exactly.

Examination by Mr. Corthell:

In my statement which I will hand to the reporter, I will include all of the wheat imported by me from any point outside of the Poudre Valley.

3304 Examination by Mr. Fred Farrar (continued):

My statement will apply only to wheat purchased at my own mill. It will not be a statement as to other mills or other elevators in valley.

The statement furnished by Mr. Hottel, is as follows:

Aug. 27, 1894, to	July 31, '95	Colorado wheat.....	4,558.477	Lbs.	Wheat
July 31, 1895, to	Oct. 5, '95	" "	1,774,658	"	"
Fire.					
Oct. 5, 1895, to	Aug. —, '96	No purchase.			
Aug. 1, 1896, "	Aug. 16, '97	Colorado wheat.....	6,168,170	"	"
Aug. 16, 1897, "	Aug. 15, '98	" "	8,593,739	"	"
Aug. 15, 1898, "	Aug. 12, '99	" "	10,637,660	"	"
Aug. 12, 1899, "	Aug. 11, '00	" "	8,640,685	"	"
Aug. 11, 1900, "	July 27, '01	" "	9,463.415	"	"
July 27, 1901, "	June 21, '02	" "	7.640,690	"	"
June 21, 1902, "	" 22, '03	" "	5,795,385	"	"
June 22, 1903, "	" 18, '04	" "	7,374,442	"	"
June 18 1904, "	" 30, '05	" "	5,902.647	"	"
June 30, 1905, "	" 30, '06	" "	8,857.885	"	"
June 30, 1906, "	July 6, '07	" "	8,906 815	"	"
July 6, 1907, "	June 20, '08	" "	8,532,995	"	"
June 20, 1908, "	" 19, '09	" "	3,308 102	"	"
June 19, 1902, "	" 25, '10	" "	6.787,487	"	"
June 25, 1910, "	" 17, '11	" "	10,352 640	"	"
June 17, 1911, "	" 8, '12	" "	12,835.269	"	"
		Idaho "	846,601	"	"
June 8 1912, "	" 16, '13	Colorado "	10,900,480	"	"
		Idaho "	160.000	"	"
June 16, 1913, "	Feb. 28, '14	Colorado "	11,390,165	"	"
		Idaho "	3,457.645	"	"
Total Colorado Wheat.....			157.521,805		
" Idaho "			4,484,246		
			162,006,051	lbs.	

3305 DENVER, COLORADO, March 9, 1914.

W. L. PETRIKIN, Denver, Colo.

Direct examination by Mr. Delph E. Carpenter:

Vice President of The Great Western Sugar Company. Identified with corporation since 1905. Identified with sugar business since 1902 at which time commenced at Eaton, Colorado. Entered sugar business at Eaton as scale man, weighing beets in 1902. Identified with Eaton sugar factory until Spring of 1903. Then became identified with factory at Windsor in capacity of cashier until spring of 1905. Was called to Denver office as chief clerk. Since that time have acted as Secretary of The Great Western Sugar Company

part of time, first as director and as secretary and then later as
3306 Vice President. Was Secretary for about 5 years.

Prior to entering sugar business was located at Eaton, Colorado. There about 9 years. Five years of time in employ of Ex-Governor Eaton and four years in mercantile business. During time was in employ of Ex-Governor Eaton became thoroughly familiar with general administration of lands in Laramer and Weld Counties belonging to Governor Eaton and his associates, so far as I looked upon term "familiarity" in those days. Since that time have kept in touch in large measure with agricultural development of Cache la Poudre Valley in northern Colorado in particular. During time have been connected with beet sugar business it has been my special line of work to keep in touch with agricultural development and live stock industry in northern Colorado.

Research work of my company has extended to question of study of feeds and balanced rations and endeavoring to make experiments along certain lines to demonstrate practicability. The purpose of these investigations have been two-fold, first for purpose of making more money in feeding of stock we had in our own control and second gaining information to give growers of beets, so they could profit to greater extent by use of bi-products of their crops.

3307 It has been policy of The Great Western Sugar Company to give preference in disposal of by-products to the growers. This has been universal policy in some sections. In what we call Platte River Valley it has not been to same extent, because we had an unfavorable experience there in first 2 or 3 years and on account of uncertainty of growers consuming by-products of factories each year. Under six northern factories, it has been universal practice to give growers of beets preference of by-products.

Factories at Eaton, Greeley, Windsor, Fort Collins, Loveland and Longmont go to make up the six factories of northern Colorado.

The pulp in most of territories is consumed within distance of about 4 miles from factory, up until last year when some of the territories distributed pulp to distance of 8 or 9 miles. It is principally confined to the zone naturally determined by economical wagon haul. There has been some but no great amount shipped by rail.

Best pulp is fibre of beet that is left after sugar is diffused from the fibre. Sugar is diffused from fibre by use of hot water and
3308 steam. Beets are sliced before going into diffusion batteries. They are sliced into what we call cossettes. These are slices that are serrated, so as to dissect and bring into contact with the water the greatest part possible of the sugar beet slices. After sugar has been diffused fibre passes into what we call pulp and is put into a pulp silo. The pulp silos are large excavations which are floored at the present time with 2 x 4's on edge and the sides are covered with planking. Through the flooring at different intervals there are drains. These drains are constructed to allow surplus water in pulp to pass off into sewer. The pulp is conveyed to these silos by centrifugal pump and water. It is screened on top of flume and greater amount of water taken out. Pulp is transported from silos to place

of feeding mostly by team and wagons. Teams and wagons drive into silos for purpose of loading.

Molasses is another by-product produced at factory and used for feeding of live stock. It is what we call a refuse molasses and when we discard it, it contains about 50 per cent. of sugar, but together with so many impurities that it is not economical to extract any greater amount of the sugar with any process that is econom-
3309 ical in this territory. It is principally a carbo-hydrate feed. It is used as a substitute for corn or other grains.

Demand for this molasses from other localities than in immediate locality of factory, is greater than we can supply. We had offers for about 15,000 tons this year that we could not supply. These offers come from molasses feed manufacturers, situated on the Missouri River, St. Louis and points in Illinois and Indiana. If we had accepted these offers in lieu of giving first option to growers this year, we would probably have obtained an average of close to $3 per ton more than we did from the growers. I think it is a fact that we could export our entire output of molasses outside of Colorado territory, if it were not for our policy of permitting it to be consumed of immediate vicinity of factories.

Molasses and syrup also act as a general conditioner for animals They act the same as condition powders, to make it plain. I would state that Mr. T. B. Hoard of Central City, Nebraska, who is one of largest outdoor feeders in the state, stated to me the year before he died that he would use molasses at the price it was costing him at that time which was $23 per ton by time it reached the cattle, rather than to use corn to the extent of 3 or 4 pounds per day, regardless of how cheap the corn got in the country, for
3310 benefit he received in performance of other foods outside of that of molasses. There is no question but that molasses acts as a conditioner and permits a greater absorption of nutritious values from other foods. My conclusion is based on practical observation rather than any scientific proof I could produce on the subject. The same is true of beet pulp, but probably to a greater extent.

Alfalfa is the principal food that is consumed in northern Colorado region along with sugar beet pulp and syrup. In some cases cotton seed meal cake is used. Cotton seed meal cake is a formation of concentrated food for supply of proteids. Cattle on full feed will consume from 2½ to 4 pounds per day per head. The purpose of cotton seed cake is to supply deficiency of protein occasioned by feeding of syrup or pulp or food carrying carbo-hydrates principally.

About 12 pounds of alfalfa hay per head per day is consumed by cattle who are at the time time fed all of the syrup and pulp and cottonseed cake necessary to balance the ration. These cattle would then be consuming about 5 pounds of syrup and about 95 pounds of pulp per day on average. Sheep and cattle principally are
3311 fed on these two by-products of sugar beet industry. Quite a large number of these are fed on grounds immediately adjacent to factory.

Fertilizer remaining in feed yards near factories and elsewhere in

vicinity, in northern Colorado district, is disposed of to beet growers adjacent thereto. It forms a considerable factor in benefits derived from feeding operations.

Best tops constitute another by-produce of sugar beet industry fed throughout beet growing districts. The beet top is the stem, leaf and part of the crown of the beet, that is cut off and left in the field. The crown of the beet is cut off and left with the tops because it carries such a low percentage of sugar that it is not economical to attempt to extract the sugar therefrom. This by-product, the beet top, is left in the immediate possession of the farmer or in other words is retained by him. The factory does not exercise any control over these beet tops. Up until very recently, they were pastured by sheep and cattle, just allowed to lie in the fields and be pastured off after the beets themselves had been hauled from the field. There has been a change in this method of feeding. They are attempting at present time to use them in a more economical way, first by hauling tops in and using them as they would hay and second by siloing them and using them in form of silage. It has been the
3312 observation of farmers that this newer method is much more efficient than the former when considered from the standpoint of values obtained from the tops.

In early history of beet sugar industry value of beet tops as stock food was not realized by growers. Progress in this regard has been rather slow. The tops are supposed to equal about 75% to 80% of the weight of the beets that are harvested and marketed. For example a fifteen ton crop of beets as delivered to sugar factory would leave in the field about twelve tons of beet tops. To express it in another way, where farmer obtains 16 tons of beets off of an acre of land and hauls them to the factory, he also obtains about twelve tons of sugar beet tops which he keeps in his field.

During recent years farmers are obtaining much higher benefit from beet tops than by pasturage methods. The extent of this benefit in dollars and cents I cannot give because I cannot rely on data given me by those who have done it to any great extent.

The theoretical feeding value of beet tops, as compared with some other feeds used with alfalfa hay and corn, has been worked out for me and furnished me. I have this data with me and will read it into the record:

3313 *Value of Beet Tops.*

"The weight of green tops and leaves of an acre of sugar beets averages about 75% of the weight of beets harvested. In years with wet falls it is considerably more than in years with dry falls, or when leaf diseases destroy leaves it is less. Therefore, a crop of 16 tons of beets per acre will average about 12 tons fresh tops and leaves. This is in addition to the weight of the beet itself.

Henry in "Feeds and Feeding" page 589 (the recognized American authority), gives as his analysis of Sugar Beet Leaves, the following: 12 percent. dry substance; 1.9 percent. crude protein digesti-

ble; 5 percent. carbo hydrates digestible; 0.2 percent. fat; making 7.1 percent. total digestible nutrients.

The same authority gives the following analysis for Dent Corn: 89.4 percent dry matter; 7.8 percent crude protein digestible; 66.8 percent carbo hydrates digestible; 5.3 percent fat; a total of 78.9 percent.

If the digestible part of the beet leaves, according to Henry, has the same food value as corn, then 1,110 pounds of leaves would contain the same amount of digestible nutrients as 100 pounds of corn. Or, one ton of beet leaves would be equal to 181 pounds of corn. If corn is rated at $1.10 per hundred, the average Colorado, price, the food value of one ton of leaves, based on the corn value, would be $1.99. The food value of one acre of leaves yielding 12 tons would be $23.88.

It appears, however, that Henry's analysis refers only to leaves and not to leaves and tops, the latter being a small part of the beet connected with the base of the leaves. This part has a higher nourishing value than the leaves alone since it contains sugar.

The German authority on this subject, O. Kellner, gives the following analysis for beet tops and leaves; 16.2 percent dry substance; 1.7 percent digestible crude protein; 7.0 percent digestible carbo hydrates; 0.2 percent digestible fat, which makes a total of 8.9 percent digestible nutrients.

On this basis one ton of fresh leaves and tops would contain the same amount of digestible nutrients as 225 pounds of corn and if one of the same value as corn at $1.10 per hundred, would be worth $2.25 per ton or $27.00 per acre.

On this basis an acre of beets yielding 12 tons fresh tops and leaves as by-product of a 16-ton beet crop would produce 2,136 pounds digestible food, equivalent to 2,700 pounds of corn or about 45 bushels of corn.

Hoard's Dairyman gives the total average yield of digestible dry substance from an acre of corn silage in Wisconsin as 3,600 pounds.

Timothy hay, according to Henry, contains, 2.8 percent. digestible crude protein; 42.4 percent. digestible carbo hydrates; 1.3 percent. digestible carbo hydrates, a total of 46.5 percent.

A yield of two tons per acre is considered high. This would give 1,860 pounds digestible food per acre.

Alfalfa, according to Henry, contains; 10.5 percent digestible crude protein, 40.5 percent digestible carbo hydrates; 0.9 percent digestible fat; or a total of 51.9 percent total digestible nutrients. Two tons of alfalfa per acre would contain 2,076 pounds digestible — per acre.

It is of course not quite correct to compare different feeds simply by the total amount of digestible nutrients they contain, as the feeding effect of the nutrients, for instance of corn and alfalfa, is certainly different. However, modern investigations give us a figure to do this. For a large number of feeds it has been determined by feeding tests, what amount of fat they produce in the animal body, in comparison with starch or carbo hydrates. On the basis of the

results of different feeds have been given what is called "starch value," a figure which expresses the pounds of starch necessary to produce the same amount of fat as 100 pounds of the food in question. This allows a comparison of the different feeds more easily.

The German authority, Kellner, gives the following starch values: fresh beet tops and leaves, 7.2; corn, 81.6; alfalfa, 26.5, Timothy hay, 29.1.

On this basis a ton of tops and leaves contains as much fattening value as 175 pounds of corn, or with corn at $1.10 per hundred, a value of $1.92 per ton, and with a yield of 12 tons per acre, $23.03 per acre.

A crop of two tons alfalfa would produce a starch value of 1,060 pounds per acre, equivalent to about 1,300 pounds of corn or $14.30 per acre.

On whichever basis the value of these tops is figured, it is considerable, although this fact was only recently generally realized by the farmers.

The comparative value of beet tops and alfalfa would also be found as follows:

At the experimentation in Fort Collins, the following results of feeding tests were obtained:—Pounds of food consumed to obtain 100 pounds gain in live weight, in A, it took 2,200 pounds alfalfa alone, C, 1,800 pounds alfalfa and 380 pounds corn.

On the basis of starch values, the 380 pounds of corn could have been replaced by 2.2 tons tops and leaves. The material for the production of 100 pounds of live weight, (with an acre yield of 3.5 tons alfalfa and 12 tons of tops) would have been produced on 0.26 acres alfalfa and 0.18 acres of beet tops, or a total of 0.44 acres.

If a two-ton crop of alfalfa alone, would have been used for the production of beef, it would have taken 0.7 acres to produce 100 pounds of live weight.

The tops are mostly utilized by pasturing them off. This is the easiest and probably the least efficient method. Between $3.00 and $5.00 per acre are usually paid for this pasture. That by this method not much higher values can be obtained is certain. Part of the leaves are tramped into the soil. Snowfall or rain make the tops inaccessible. The wind soon drys out the tops, transforming them into a horny mass which can hardly be chewed.

In the dairy districts around Fort Lupton and Johnstown, Colo., the farmers gather up these tops and feed them in the feed lot. None of these farmers assign a value of less than $12.00 per acre to these tops. Some go as high as $30.00. The reason that beet tops are not better utilized is that many farmers handle beet acreage up to the limit of what beets can be hauled by the number of teams on the farm. Therefore, there is no team labor available during beet harvest time.

The price obtainable for fat beef has been only during recent years high enough to stimulate rational and intensive feeding. The adjustment of farming systems to new price levels for the products is notoriously slow.

Summary.

	Basis pounds digestible food per acre.	Pounds starch value per acre.
12 tons beet tops	2136 pounds.	1728 pounds.
Equivalent to Corn	2707 pounds.	2105 pounds.
10 tons Corn silage (Wisconsin)	3600 pounds.	——
2 tons Timothy	1860 pounds.	1164 pounds.
2.0 tons Alfalfa	2076 pounds.	1060 pounds.

3317 This article on the subject of the value of best tops was prepared by scientists in employ of The Great Western Sugar Company. It was prepared by Mr. Hans Mendelson. At present time he is in charge of our beet seed raising and our experimental farm. He is a recognized authority on the subject of sugar beets and beet sugar.

The farmer is now approaching a basis of scientific feeding of beet tops as distinguished from the former wasteful and extravagant methods. There is evidence from year to year, of a better utilization of this by-product of the industry, to the extent that a great many of our growers say if it was not for the feed values of the by-products they would not engage in the industry at all.

The beet top is the only by-product which is distributed uniformly throughout the feed raising districts. It is the only one that is accessible equally to all growers.

It is difficult to state what per cent. of the sugar beet goes into the beet pulp. We actually recover from the silos in weight an amount sufficient to be about 27.31 per cent. of beet as introduced into the factory.

I could not give the value of beet pulp to the man who feeds it to stock. I have been offered $1 per ton. The factories receive on an average of about 65 cents per ton.

3318 $8 per ton is received by the factories for the syrup.

The northern Colorado sugar factories were constructed in the following dates: Loveland in 1901, Eaton and Greeley in 1902, Windsor, Fort Collins and Longmont in 1903, Sterling in 1905 and Fort Morgan and Brush in 1906. The Sterling, Fort Morgan and Brush factories are in the class commonly designated as the South Platte. The Fort Collins, Windsor, Eaton and Greeley factories are located in the Cache la Poudre Valley. Greeley also receives some of its beets from upper South Platte area between Greeley and Denver.

Acreage, tonnage and aggregate moneys paid to farmers or growers for years 1910 to 1913 inclusive for the four factories located in the Cache la Poudre Valley (Fort Collins, Windsor, Greeley and Eaton) and also the sugar production per acre for each of the factories during those years is as follows:

Eaton Factory.

Acreage:

1910..... 4,081;
1911..... 4,501;
1912..... 10,451;
1913..... 16,597.

Tonnage:
1910..... 51,886;
1911..... 61,930;
1912..... 160,965;
1913..... 217,889.

Money paid the Farmer:
1910..... $284,205.33;
1911..... 336,696.77;
1912..... 958,444.73;
1913 estimated..... 1,237,945.35.

Sugar per acre. This contains the approximate tons of sugar per acre in the beets harvested:
1910..... 2.05;
1911..... 2.19;
1912..... 2.55;
1913..... 2.04.

Greeley Factory.

Acreage:
In 1910..... 5,384;
1911..... 6,340;
1912..... 10,089;
1913..... 11,489.

Tonnage:
1910..... 65,515;
1911..... 84,487;
1912..... 121,727;
1913..... 137,484.

Paid to the farmers:
1910..... $361,182.56;
1911..... 474,106.37;
1912..... 739,253.91;
1913..... 778,215.60.

Approximate tons of sugar per acre in beets harvested:
1910..... 2.01;
1911..... 2.21;
1912..... 2.05;
1913..... 1.84.

The Windsor Factory.

Acreage:
1910..... 5,248;
1911..... 4,908;
1912..... 10,326;
1913..... 13,401.

Tonnage:
1910..... 64,285;
1911..... 58,446;
1912..... 138,931;
1913..... 172,876.

Paid to farmers:
1910..... $351,681.94
1911..... 320,883.07;
1912..... 821,364.27;
1913..... 975,819.89.

Approximate tons of sugar per acre in beets harvested:
1910..... 1.95;
1911..... 1.90;
1912..... 2.20;
1913..... 1.97.

Fort Collins Factory.

Acres harvested in—
1910..... 8,018;
1911..... 8,087;
1912..... 12,348;
1913..... 14,392;

Tonnage harvested:
1910..... 73,090;
1911..... 88,131;
1912..... 149,232;
1913..... 158,174.

Paid to farmers:
1910..... $392.215.27;
1911..... 487,957.41;
1912..... 875.478.83;
1913..... 875,698.72.

Approximate tons of sugar per acre in beets harvested:
1910..... 1.43;
1911..... 1.78;
1912..... 2.01;
1913..... 1.69.

I would like to state that all these figures do not pertain to exactly the same territory in each year, but the total acreage pertains to the total acreage of each year. There might have been some variation in the division between the factories in any separate year. In the aggregate it is compensating. There might be a slight variation from the rule I have given.

The variation would be owing to fact that in 1912 and 1913, and possibly 1911, there was rather a small acreage of beets grown at Wheatland, Wyoming, which is included in these figures.

Crop returns in beet tops to farmers for any year can be ascertained from the crop returns given, by computing 75% of the tonnage harvested. 75% of the tonnage as given by me in this tabulation.

It is necessary to employ a great deal of manual labor in connection with growing, harvesting and manufacturing sugar beets. Greatest amount of labor is hand labor employed in cultivation of beets. Sugar beet requires careful attention and high degree of cultivation.

Hand labor is used for blocking, thinning, hoeing, pulling and topping. That labor is employed by farmers at a stated price per acre. Customary price paid by farmers over a long period of years is $20 per acre. These laborers work largely under their own supervision. Of course farmer watches them and they are also supervised to some extent by the field men of the sugar company. About
3322 only concern farmer has is to see that work is done properly and at the proper season of year.

We have experts who have charge of these various districts, known as agricultural or field men. Their duties are to give what information is possible to the farmer, how to grow beets so as to obtain greatest tonnage per acre containing the highest sugar content and to supervise as nearly as possible agricultural methods, to see that this result is obtained at lowest cost possible.

It most assuredly is to the advantage of the Sugar Company to have profitable returns to the farmers, because it simply means that the more profit we can accrue to the farmer, the more productive the industry is.

3323 The team work is usually done by the farmer and is under his immediate supervision and is controlled entirely by him. Really all the work is controlled by the farmer. The agricultural experts do not pretend to supervise the work. He advises to quite an extent in reference to all work. It is up to the farmer to take that part of the advice he sees fit.

We employ a great number of men during receiving season at the receiving stations in capacities of scale men, dump men and tare men.

Method of receiving and weighing beets at dumps and obtaining tares and percentages is as follows: Load is first weighed over wagon scale which gives us gross weight of load. Wagon is then drawn over an elevated dump where load is dumped over gratings into a railway car standing on track at one side and below elevation of wagon when dumped. As the load of beets passes over the grating, a larger quantity of the dirt passes through the grating into a hopper and is there then weighed on a platform scale and is returned to what is known as the dirt screening device into the farmer's wagon. The farmer, if under the system of the dirt screening device, hauls the dirt back over the wagon scale and it is computed with the weight of his empty wagon to obtain the tare weight, the difference giving us what we call the first net. Just as the beets have passed over the grating, a sample is obtained by a crane with a basket or box.

3324 This sample is then weighed to obtain gross weight of sample. Beets are then removed, screened and re-weighed, which gives the first net weight of the sample, the difference being the tare weight. That tare weight is then computed on a percentage to determine what percentage it is of the gross weight of the sample. The per cent. obtained is used for the deduction of tare on the first net weight of the wagon. After this deduction, we obtain what we call our final net weight of the beets delivered.

Samples for ascertaining percentage of sugar are largely taken from same sample from which tare is obtained and are put in sacks, canvas bags, which are prepared as far as possible so as to exclude action of atmosphere, transported to the factory and there tested by analysis to determine sugar content, which sugar content determines the price paid the farmer for the beets weighed.

In this manner we keep daily accounts not only of tonnage but also of sugar contents of all beets delivered to the various factories from each individual grower.

Number of laborers employed in the field in growing the beets for

the Eaton, Greeley, Windsor and Fort Collins factories through years 1910, 1911, 1912 and 1913 are as follows: 3,247 for the four factories in 1910; 3,405 in 1911; 6,173 for 1912 and 7,982 for 1913. These are all laborers who do the hand labor in the field, and is exclusive of team labor. I obtained these approximate figures by first computing a certain number of acres per hand laborer and then checked it as near as possible with data we had on hand as to the actual number.

Number of employes at the four factories during the four years are as follows: 987 for 1910; 1,012 for 1911; 1,031 for 1912; and 1,087 for 1913. This does not include the employes at the dumps. The figures include just what we call factory employes, which means the laborers in the beet chutes and factories proper. It would not include office employes. In addition to these we have various clerical and office employes. This however probably includes the laboratory men.

Number of live stock fed on sugar beet by-products, pulp and syrup, at these four factories during four years 1910, 1911, 1912 and 1913, cannot be given very accurately, but I can give you number of cattle that could have been fed on by-products produced at these factories during those four years. This could be ascertained by the amount of by-products each year. Using this as a basis, number of cattle by-products would have fed during the four years at the four factories are as follows:

12,168 in 1910; 14,223 in 1911; 26,597 in 1912 and 28,820 in 1913. In arriving at this calculation I assumed one head of cattle for each five tons of pulp.

To ascertain number of sheep you will simply multiply figures I have given by 9 or 10, that is, 9 or 10 head of sheep equal one head of cattle. This of course does not include cattle, sheep or other live stock fed by farmers on beet pulp by-product.

About one ton of alfalfa per head for cattle would be approximately amount of hay consumed by these cattle during this feeding process. I am assuming an average feed of 150 to 160 days.

3326 Examination by Mr. Fred Farrar:

Not all the sheep and cattle fed in the Poudre Valley are fed on pulp and molasses.

Additional railway facilities had to be provided for handling the sugar beet industry, outside of the regular lines which entered the district. We constructed a railroad out of Loveland to Johnstown and I think first branch doubled back towards Berthoud and Wellington. Later it was extended to Longmont, Milliken, Windsor and Eaton. That is primarily a sugar beet road built primarily for that purpose.

Examination by Mr. Delph E. Carpenter:

I am not an official of this railroad company at the present time but have been during the past.

3331 Redirect examination by Mr. Fred Farrar:

Line of demarcation between the Poudre Valley proper and the adjacent valley of the Thompson near the Platte River, to which both streams are tributary, is not very clearly defined. Areas from which each factory draws its beets are usually those immediately surrounding that factory.

A very small percentage of the beets utilized at the Greeley, Windsor and Fort Collins factories would come from territory without the actual drainage area of the Cache la Poudre Valley or land irrigated by water from that stream.

I do not have the beets grown at Wheatland, Wyoming, separated. Another official of my company will give that if you desire it.

A large per cent. of the labor employed at the factories themselves would be common labor. Am rather doubtful of classing it as skilled labor. It is what you would better term experienced labor in that certain line of business; I suppose it would be classed skilled labor. In some instances the labor is highly technical and commands a very good salary.

3333 Redirect examination by Mr. Delph E. Carpenter:

There is no question but that, if the industry continues to exist, we will come nearer to the ideal in obtaining the scientific and theoretical feeding value, not only of beet tops but of all by-products.

The lime cake, although not at present utilized, brings $1 per ton where utilized. It is used to recover seeped or soured lands. About only communities using it are in Michigan.

WALLIS LINK, recalled.

Direct examination by Mr. Fred Farrar:

First went into Laramie River country in Colorado in 1874. First made residence there in 1890. Between 1874 and 1890 was familiar with Laramie River Country in Colorado. Observed development of ditches in that section. From 1881 I was up through the country more frequently than I was prior to that time. Did not observe ditches prior to that time, any more than knowing people
3334 had settled there prior to that date. Resided in that country about eleven years.

This was prior to time I projected this system concerning which I have previously testified to.

Am acquainted with ditch known as Long Park No. 2 diverting water from Laramie River in Colorado. Charles Shipp constructed that ditch in 1902 about middle of summer.

Link Ditches Nos. 1 and 2 were constructed by me. Date of construction of Link Ditch No. 1 was about 1894. Link Ditch No. 2 was constructed in 1896.

The Hills Ditch was constructed by J. J. Hills who used to live in Laramie. Was constructed in about 1880. He became interested in

that country about same time Yelton first went in there. The date I have given is approximately correct.

3335 Am familiar with Yelton Ditch. It was constructed about 1880, between 1880 and 1882.

Familiar with Upper Smith-Brown Ditch. It was constructed about 1879. It is sometimes called the Upper Hills Ditch.

Familiar with Lower Smith-Brown Ditch. Constructed about 1880 or 1881.

Familiar with Comet Ditch. Constructed about 1895 by the Stewarts, or a man by the name of Slack who lived there prior to the Stewarts may have constructed it.

Familiar with Homestead Ditch. Constructed in about 1884.

Familiar with Mansfield Ditch No. 1, constructed in about 1882.

Familiar with Mansfield No. 2 Ditch constructed about 1880, according to decrees, but think it was a good deal older. Believe it was constructed in about 1878, from fact that Mr. Mansfield went up and settled that country in 1874 and I know those meadows will not grow hay for several years after reclamation begins. Mansfield No.

3336 1 Ditch is later than Mansfield No. 2 Ditch. In the tabulation given by Mr. Whiting, a witness for Wyoming, Mansfield No. 2 Ditch is an earlier one than Mansfield No. 1.

Familiar with Bliler and Boswell Ditch. Think those ditches were constructed prior to 1880.

Familiar with Warren Ditch. It was constructed pretty near the same time as Bliler and Boswell Ditch. Bliler is surname of Warren. Warren in fact is the first name of Mr. Bliler. Warren Bliler was his name. He used his last name in one instance and his first name in another.

Familiar with Stuck Creek Ditch. It was constructed in 1881.

All of these ditches which I have mentioned divert water from the Laramie River in Colorado or the tributaries of that stream within that state.

WALLIS LINK.

Cross-examination by Mr. John D. Clark:

3336 I moved into the upper Laramie Valley in 1891 or in 1892, when I was about 30 years old. In 1874 I had been there on

3337 the roundup and in 1882 I worked for a ranchman in that country. My acquaintance with the ditches in the upper Laramie Valley dated from the time I moved there, and at

3338 that time so far as I know, there had been on extensions or enlargements of the older ditches. Since that time nearly all of them have been enlarged and extended as the sage brush has been cleared off and the hay land developed. The ditches extend from 100 feet to a half a mile from the river, depending on the condi-

3339 tions. Irrigation commences from the first to the 15th of May, and the water is turned off between the 7th and 20th of July, the season lasting from six to eight weeks. Sometimes after that period they will permit water to run on to a piece of land from

which the sage brush has just been cleared, but it does not do much good excepting to kill sage brush which has not been taken off.

There is a water commissioner who regulates the headgates.

3340 My Link Ditch No. 1, with 190 acres under it, had an adjudicated priority of 14 second feet, and some of the other ditches used a great deal more water in proportion to the number of acres. In cases where the land has contained a large amount of boulders which have been caused to sink by placing water on the land, they have been grassed over. My No. 2 ditch irrigated

3341 about 50 acres, and I used three second feet of water through it. After two or three weeks of irrigation, a surface run-off from the meadows back to the river was noticeable. The ditches now constructed cover substantially the whole of the upper Laramie Valley.

3342 Redirect examination by Mr. Fred Farrar:

An altogether different method of irrigation prevails under these ditches, concerning which I have testified to, than prevails in Poudre Valley. Cultivated soil would not stand the current or volume of water they throw onto the meadows in Laramie Valley for irrigation. The meadows are very close woven grass sod which protects the soil. If it were not so it would probably wash away. They irrigate very plentifully using great quantities of water.

They use the same methods down in the hay meadows on the Laramie Plains.

3343 Redirect examination by Mr. Delph E. Carpenter:

Little Laramie River drains Centennial Valley in Wyoming. A number of smaller streams flow into the Little Laramie River up in the Centennial Valley.

Centennial Valley in Wyoming compares just about the same from standpoint of use of water, as Big Laramie Valley in Colorado. Same method of irrigation prevails. There are three forks of the stream, North, Middle and South Forks which come together and it is principally meadow land between those forks, extending from one to another. Further down on north side of stream and east of where North Fork forms junction with main stream, there are some hay meadows. All of this territory of which I am speaking is above what they call Filmore.

Same characteristics of rapidity of return of water would apply to Little Laramie Valley above Filmore as prevail in Big Laramie Valley above Woods Landing. In comparison to width of meadows water would return as rapidly and in some cases more rapidly.

3344 There is the same general character of country on these two streams above these two points. They are similar. In fact nearly all of native hay lands in all these different sections up there are under same methods and characteristics of soil are similar.

Little Laramie River Valley below Filmore is irrigated by nearly same method as that prevailing on ranches above Filmore. There is a little more soil below Filmore, considerably more, in some places there is very good land along Little Laramie River.

It is customary to turn off water on these lower meadows before cutting hay, two or three weeks prior to mowing. The same is true of meadows in the Big Laramie River Valley in the Laramie Plains.

In examination some weeks since of agricultural conditions on Laramie Plains now as compared with seventies, I made a general statement. This I desire to make more clear at this time. Of course they have made an effort towards agriculture in that country on the uplands, outside of river bottoms. In some instances they have a fair crop but generally speaking, I would consider it a failure. I would consider that the attempt at raising agricultural crops in that area is a failure. They may get a good crop once in a while, but a man could not figure on that for a livelihood, because it is too uncertain.

3345 Water which has been diverted out of the Laramie River by the canals, as in case of the Pioneer Canal, has been applied to the plains, to prairie country, and nearly every depression there on the Laramie Plains at the present time, near those canals, is partially filled with water. In fact there is a general tendency to form lakes.

Not very many of those lakes had water in them prior to the construction of the Pioneer Canal. Soda Lakes were natural lakes. There is a sort of a water course that runs in a southeasterly direction from the Soda Lakes, there is a depression in there which had water in it at times, but there are a great many smaller lakes there now that were not there before the Pioneer Canal was built.

3346 Redirect examination by Mr. Delph E. Carpenter:

I have been along the ditches a number of different places and I never have seen any particular overflow, yet at some places where the hill is a little steeper than at others and the lay of the soil, which would be of a little tighter formation, the water would not percolate through it and there the water has come to the top, but if that had been an overflow it would have shown signs ne[illegible] the ditch of an overflow. The ditch is quite a considerable elev[illegible]on above these depressions. I have never seen water running directly over the surface of the ground, I have seen it where it leaks out of banks of ditch and runs into the depressions. That is what we generally call seepage.

There is no outlet to any of these ponds that I know of.

3347 Redirect examination by Mr. Delph E. Carpenter:

This little ditch out of Seven Mile Lakes is not the class of ditch you usually find in a country where lakes are drained and water is used for irrigation. I would not call it a drain ditch, not such as we have here. The contour of the country below, until you get at a considerable distance from those lakes, is higher than it is at the lake or the lake would not be there. The ditches I have seen there are surface shallow ditches. I have never seen a deep ditch there. A new road going to Woods Landing has got quite a fill and there is an outlet through for a portion of the water. I believe if the lake was not at a certain depth that the water would run out through that,

but it would not drain it. It amounts more to an overflow way
3348 than to a drainage. It is not a drainage ditch at all. Sort of an overflow or what we might call a spillway here, that is what I would term it. It has been a good many years since I was out there to see those lakes. There are three natural lakes there. The others are formed from irrigation water being used that runs through the Pioneer Canal.

LOUIS G. CARPENTER, recalled.

Direct examination by Mr. Fred Farrar:

My work has to quite an extent led me into rather a definite knowledge of various legal systems among different arid states providing the method of making appropriations and of adjudicating water rights. Discussing the Wyoming method, under laws of that state, and comparing it with the method which prevails in Colorado under the laws of that state, and considering the question from both a practical and legal standpoint I will state:—In Colorado, whose custom runs back to the earliest settlement, the right has been initiated by use, and so has had a special definition in law, that is the commencement of construction.

3349 In Wyoming, however, the right has been initiated by an application for a permit to a state officer and the granting of a permit by him.

The provisions, then, of the Colorado law, have been provisions indicating how a person, who made an application, should prove the fact, while that of Wyoming and those who have followed that system, has seemed to depend upon the prior permit.

In the development of the Colorado law, the practice has obtained of making a filing, as it was called, in the office of the State Engineer, at the present time,—earlier in the office of the County Clerk,—but all for the same purpose of giving the public notice of the fact of the intention and the filing as so made. The filing of the notice was simply preliminary statement. It might be considered to some extent as analogous to the filing on public land as a homestead. This did not give any definite right, but was treated by law and the courts as being a prima facie statement. Afterwards, the court having jurisdiction, took evidence on these various diversions of water and as a conclusion they then found a decree in which they stated the respective dates of the different ditches. The dates of each individual ditch, the amount of water to which they were entitled and this then became what we speak of as a decree. The filing was simply a preliminary statement and, as I stated, had a position not very clearly defined, but whatever it was, when the Court found its decree, the filings were entirely merged into the decree and then became simply steps, possibly, to the final decree.

3350 Beneficial use has always been the one essential under the law of Colorado, upon which appropriation of water is based. It is so under the constitution, but was always recognized prior to the constitution and was statement of an existing custom and not the initiation of a new law.

In Wyoming a permit was necessary from the State Engineer, an application was made for a permit. It is still necessary. This permit is made the beginning of their right and the State Engineer had authority to make certain conditions to these permits, fixing the time within which they were to be used and very often other conditions. At some subsequent time the individual who acquired the permit, proved up or submitted proof of his having complied with the conditions of the permit.

State of Engineer of Wyoming can refuse to grant a permit on application, under certain conditions. As I understand, he has the right, in his discretion to state whether or not there is sufficient unappropriated water in the stream for the project covered by the application. I think he has very frequently done so and he has had quite a wide discretion I believe in the matter. Under the Wyoming system, the final proof was submitted to the Board of Control an efficient board consisting of the State Engineer as chairman and of various superintendents, and their finding in the matter was equivalent to the Colorado decree.

Under the Colorado method the hearings are in court and
3351 all those affected have an opportunity to be heard. I do not understand that such is the case with the final decrees that are given in Wyoming subsequent to the early ones which included the whole stream, that is where they have given the findings for individual ditches. In fact, it has been complained of in the official reports of the State Engineer at different times, that this was one of the defects of their system, that the adverse user had no opportunity to be present and to present evidence contrary to the claims of the interested user. I do not understand that notice is given but I am not quite familiar on that detail. Where there has been a general adjudication at the beginning, that is the first adjudication on the stream, where a great many ditches come in, then a notice is posted and there is an opportunity to be heard, but subsequent to that time an individual ditch may prove up at any time and without reference to anybody else, an isolated case. An appeal lies from Board of Control to District Court in Wyoming.

Main difference between the two systems would then be, that in Wyoming a prerequisite to institution of a right is the granting of a permit from the State Engineer, which is discretionary with him, and that he and his superintendents sitting as a quasi-judicial body, later adjudicate the water rights and grants the decrees. In Colorado the filing is an incident to the essential, which is the application of water to a beneficial use. The right or decree when finally entered, dates back to the inception of the work, which was the beginning of the survey, assuming that the work is prosecuted with diligence from that date. Our statute has indicated the survey as the beginning of the work.

The decree is entered in Colorado by a district court which is a court of general jurisdiction.

State Engineer of Colorado does not have the judicial or quasi-judicial powers which are vested in State Engineer of Wyoming.

In Colorado the findings of the court are a declaration of facts and

do not depend upon the judgment or whim, you might call it, of an officer not giving a permit. Of course I do not mean to say that the official in Wyoming has ever subjected anybody to his personal whims, I don't know that he has, but it is not far different from what I have found was the practice in British Columbia, where no citizen really had any right to go on any public domain anywhere, unless the government gave him a right so to do, that he was a trespasser without a permit.

In Colorado the appropriator can construct his ditch and make his appropriation regardless of any permission having been given by the official.

I have made a critical examination of the decree of the district court of Wyoming, sitting at Cheyenne, which has heretofore been offered in evidence by plaintiffs in this case, and marked Exhibit N. I have compared it with the decree of the Board of Control, from which an appeal was taken.

3353 In Wyoming, the water is adjudicated to the lands specifically. It is an appurtenant to a particular tract. The decree so indicates in almost all cases.

In Colorado that is not the practice. In that state a ditch is given a decree for so much water.

I checked the Wyoming decree, shown by Exhibit N, in order to ascertain whether or not same pieces of land were given adjudications under more than one ditch, in other words, whether or not the decree duplicates or triplicates as to any particular land. I checked the two decrees in order to compare the lands in both and, in so doing, it developed that there were quite a good many tracts of land that were counted two or three times. I did not anticipate that in the beginning, but it did develop and I have the records of those.

There are 5,720 acres that are duplicated and an additional 615 acres that has been counted a third time, making a total of 6,339 acres in excess. This is all in the Big Laramie Valley. I think all of it is under the Pioneer Canal. This duplication arises by decreeing land to Pioneer Canal and also decreeing it to some other ditch and in some cases to two other ditches.

Duplications and triplications occur in detail as follows: In Section 20, Tp. 16 N., R. 73 W. there is in the last decree, that is court decree of 1912, 603 acres that are decreed and in addition to that in the same section there are 260 acres which would therefore

3354 be a duplication or practically so. This last area of 280 acres is in the various sub-divisions of the east half of that section. The 603 acres is decreed to Pioneer Canal Company and the 280 acres to the Bamforth Ditch. In Tp. 17 N., R. 73 W., Sec. 32, there is also a duplication in the S. W. ¼ and the N. W. ¼. There are 320 acres in those two quarters decreed to Pioneer Canal and at same time 79 acres to Fisher High Water Ditch. Inasmuch as those two quarters have only 320 acres, there is manifestly a duplication, or in other words, water is decreed to same land twice. In Tp. 15 N., R. 74 W. there are several duplications. In Sec. 12 there are 656 acres decreed to Pioneer Canal Company and also 32 acres under Cole Brothers' Ditch is decreed at same time. I do not find many cases

where Wyoming sections, according to decrees, contain 656 acres or in excess of 640 acres. On north and west of the township sections would not likely under United States measurements contain more than 640 acres. Likewise I might, in passing, speak of Sec. 14 as not being quite certain whether there is a duplication, but there appears to be because a part of that section is decreed both to Pioneer Canal and to The Laramie Suburban Homes Company. It appears that the same portion is thus decreed, but I am not absolutely sure of that fact in that section. The next case in that Township is Sec. 23, wherein the S. E. ¼ of the N. W. ¼ the Pioneer Canal has 40 acres and the Laramie Suburban Homes Company is decreed
3355 20 acres. As the area is only 40 acres there is a duplication. In the N. W. ¼ of the N. E. ¼ of the same section the Pioneer Company has 40 acres and the Laramie Suburban Homes Company is decreed 15 acres, which is therefore another case where water is decreed twice or the land is counted under two places under two ditches. In the N. E. ¼ of the S. W. ¼ of the same section, 40 acres is decreed to the Pioneer Canal and 30 acres to the Laramie Suburban Homes Company, which is again a case where the land is counted twice in the statement of the decrees. Again in same township in Sec. 30, there is 636 acres decreed to Pioneer Canal and 560 acres decreed to Last Chance Ditch. Another case where same land has received two decrees. In Sec. 32 in same township, W. ½ N. E. ¼ 80 acres is decreed to Pioneer Canal Company and same decree gives to the Laramie Suburban Homes Company 18 acres in S. W. ¼ of N. E. ¼, which is included in section of land under Pioneer Canal decree and therefore there is a duplication. It is a case where same land is given water under two different headings. In Tp. 17, N., R. 74 W. there are several cases where land has been counted 3 times. This occurs in Sec. 2. In this township, the S. W. ¼ of Sec. 1 is decreed twice. My memorandum of the owners to whom these decrees were given is not at hand. In S. ½ of Sec. 2, 320 acres, the S. E. ¼ or 160 acres and the S. W. ¼ of the S. W. ¼, 35 acres, are counted twice, both in the court decree and in the finding of the Board of Control, once to the Haley Live Stock and Trading Company in the Abbott Water Ditch and once to the Estate of Marcus W. Towne in the Abbott and Coleman Ditch. The
3356 N. ½ of the S. W. ¼, 80 acres, is decreed three times in each decree. Once to the estate of Marcus W. Towne in the Abbott and Coleman Ditch, and twice it is counted for the Haley Live Stock and Trading Company in the Abbott Water Ditch. In Tp. 18 N., R. 74 W. Sec. 22, S. E. ¼ of the N. E. ¼, 40 acres have been counted twice. In Tp. 19 N., R. 74 W., Sec. 28, the S. E. ¼ of the N. E. ¼, 40 acres, has been decreed water twice. In Tp. 14 N., R. 75 W., Sec. 70, has 640 acres decreed to Fischer Ditch and same decree also decrees 32 acres to Pioneer Ditch. In Sec. 8 of same township, Fischer Ditch is also given 200 acres and at same time Pioneer Canal is given in same section 640 acres, which as a section only included 640 acres, therefore includes 200 acres in excess and indicates 200 has been counted twice in same decree and given water. In Sec. 9 of same township, 640 acres is counted twice, once to Fischer Ditch

and also decreed at same time to Pioneer Ditch, thus indicating a duplication. Likewise in same township, whole of Sec. 17 has been given water once to Fischer Ditch for 640 acres and once to Pioneer Canal for 640 acres. In Tp. 15 N., R. 75 W., there is also a duplication in Sec. 36. In this case whole section is decreed to the Pioneer Canal Company 640 acres, while besides that, the Last Chance Ditch is given a decree for 115 acres, showing that land has been counted twice. In Tp. 13, N., R. 76 W., Sec. 3, the N. ½ of the N. W. ¼ 80 acres is decreed twice to two different ditches. In Tp. 14, N.,
3357 R. 76 W., Sec. 2 has been decreed 641 acres to Pioneer Canal and 480 acres to enlargement of Parker Ditch, and 160 acres to Parker Ditch, showing whole section has been counted twice in making up decrees. In Sec. 3 of same Tp. there are 45 acres given in N. W. ¼ to Hammond South Ditch and besides that the decree gives 641 acres to Pioneer Canal, showing that at least 45 acres has been counted under both ditches. In Sec. 10, of same Tp., there are 460 acres which includes all of the W. ½ of that section, the S. E. ¼ and the N. W. ¼ of the S. E. ¼. 20 acres of N. E. ¼ of N. E. ¼ which is decreed to the Parker Ditch and to enlargement of Parker Ditch, but notwithstanding that the Pioneer Canal Company has received a decree for 640 acres for same section, showing then a duplication for the corresponding amount. I might say that in most of these cases the duplication of land which is duplicated, was included in decree of the Board of Control while that to the Pioneer Canal Company appears in the last decree as original land. In Sec. 12 of same Tp., there are 400 acres decreed to Last Chance Ditch, this includes all of E. ½ of the section and also the E. ½ of S. W. ¼; but notwithstanding that, the Pioneer Canal received a decree for the whole section or 640 acres. In Sec. 14 of same Tp., the N. ½ of the section was decreed to the enlargement of Parker Ditch, 320 acres, but the decree also gives 640 acres to Pioneer Canal Company or in other words, decrees for whole section including land previously decreed to enlargement of Parker Ditch.

That includes the duplications in the Laramie Plains and it may be that the first summation I gave may be found to be slightly incorrect. The summation is intended to be a summation of
3358 those figures I have given. The discordance will be slight, if any. It will be from fact that in checking them up hurriedly, I suspect some of those may be omitted. Outside of those on Laramie Plains, there was only one case of duplication noticed. That was in Sec. 2 of Tp. 23 N., R. 68 W., which is in the Wheatland country.

Direct examination by Mr. Delph E. Carpenter:

They have never fixed a definition for water rights in Wyoming, so far as I know, and I think one of State Engineers complained that they have never defined it legally. I think that complaint occurs in report for 1908 at Page 73, of State Engineer of Wyoming.

I spoke of no particular method being provided for appropriator to be heard at time of fixing decree. That statement is confirmed in Ninth Report of State Engineer of Wyoming, Page 69. Water

Superintendent of Division 74 includes in his report a recommendation that some method be provided by statute so that holders of older permits could contest if they desire. That is in case where a permit is claiming a larger appropriation than the others think it is entitled to.

In the cases to which I have referred in detail they have recognized different claims.

3359 Under the Pioneer Canal, judging from the country as I know it, it is certainly correct that all decreed land has not been irrigated and also that the decrees would indicate that all of the lands have been included, that is, all of the land beneath the canal has been granted a decree whether it has been irrigated or not.

The State Engineer of Wyoming complained of that fact in the Ninth Report of the State Engineer on page 80, the State Engineer states, "Adjudications have been made and water rights granted where irrigation works have never been completed to reclaim an acre of land." Then that has occurred even in Wyoming, apparently. It has been hinted at by other officers. And there is also quite a statement to a similar effect by Mr. Mead who was State Engineer. In State Engineer's Report for 1891-92 which is first report after Wyoming became a state, by Elwood Mead, he speaks on Page 77 about trouble that has been experienced in trying to apportion waters of Crow and Horse Creeks under existing decrees and goes on as follows:—"Which appear to have no particular basis for the amounts decreed, except that each claimant was allowed all that he claimed, regardless of what effect it might have on other rights."

The same system has prevailed under the permit system in recent years, judging from the duplication in decrees which I have already mentioned. It show sto some extent in the decrees themselves, but I have heard more of it from the officers in other cases. It was somewhat to my surprise, because it had been stated, that such things were not to be found under the Wyoming system. As I understand, it is a fact that state officials of Wyoming have claimed credit in times past for originating the permit system and have claimed that that was the only perfect system known. With increased knowledge and experience, they have found that the assumption was erroneous.

The fact that ditches very frequently appear in Wyoming, where land is apparently still arid and not kept in state of irrigation, has been explained and I have seen some statements in print, attempting to explain that fact. These statements go back largely to time when there was some contest between stock growers and incoming settlers, as a specific case, in the Irrigation Age, Volume 3, Page 91, which was about the time of the so-called stockmen's war in Wyoming, it was stated, and I believe on the statement by a Wyoming citizen, that land had been taken and ditches built to get title to land and for purpose of keeping out the small settlers who might interfere with occupying the land for stock purposes.

State Engineer of Wyoming, under permit system, is authorized to decline a permit in cases where he thinks there is not unappropriated water in the stream.

Where a permit is granted in Wyoming, it is in effect, a declara-

939

tion by the State Engineer that there is water in the stream for appropriation.

3361 It has been found that even in such cases, however, his judgment was too conservative. I think it has been mentioned in some of their reports also that they found such cases. Of course, that is really an illustration partly of the fact I mentioned in my direct examination sometime ago, that water might have a greater use than they anticipated. So that, there have been cases where they have found there was a great deal more water than they have anticipated. Of course a part of that, I presume, is due to the general tendency of people in office to take what they think is a safe view and thus make an estimate or decision that at any rate would be on the safe side. It has even been true on the Laramie and was found that the water they could divert was a great deal more than they had anticipated.

The fact that some areas of land in Wyoming are limited to production of crops of limited value, such as native hay, is asserted in State Engineer's reports for that state. In first State Engineer's report, first volume, report for 1891-'2 by Elwood Mead, he speaks of fact that best results can be obtained only by union of irrigable and pasture lands and that to attempt to cultivate such lands to grow grains or vegetables for market, as is done in valleys surrounding Salt Lake or Denver, and as can be done with irrigable lands along the Platte, Green and Big Horn Rivers, is out of question. This appears on page 34 of the first Engineer's report.

He states as follows on same page:—"Many are of an elevation which restricts production to the hardier crops and all are limited to the growth of those which can be profitably consumed at home."

That same observation applies to Laramie Plains region.

3362 Value of water when used on lands capable of producing heavier crops as compared with use of water on lands used for production of native grasses, has been noted by State Engineer of Wyoming. In Fifth Biennial Report of State Engineer of Wyoming, 1899-1900, at Page 52, the State Engineer states as follows:—"The water supply of the creek is almost entirely employed in irrigating cultivated lands, it being of too great value to be used on native grasses." Thus recognizing that the value for grasses is subordinate to its value for crops. In this case, the creek in question was Owl Creek, in northern part of state at a relatively low elevation, one of lowest parts of the state.

"Best development" under irrigation was declared by State Engineer Johnson of Wyoming in the Ninth Biennial Report at Page 80 as follows:—"By the 'best development' we must always understand, that growth and progress which leads to the support of, and the service to the greatest number of people." That would seem to be a consequence of the doctrine that lands capable of producing heavier and more valuable crops under irrigation are to be given the preference over lands used for the production of native grasses under irrigation.

L. G. CARPENTER.

Cross-examination by Mr. N. E. Corthell:

3362 My knowledge of the legal methods of the system of irri-
gation procedure in Wyoming is not gained from participa-
3363 tion in these proceedings nor from practice in irrigation
matters in that state, but from the reports of the state engi-
neers and conversations with officials and a general observation of
these matters. I do not know to what extent the doctrines of the
state engineers I have referred to have been sustained or have been
rejected by the Wyoming courts, but in one instance I believe the
courts rejected one of the theories.

Cross-examination by Mr. John D. Clark:

3364 I do not know that in 1901 the Wyoming statute regulat-
ing adjudication proceedings provided for notice as in an
original general adjudication when proof is taken upon subsequent
appropriations. The state engineer's report in 1908 contained a
complaint based upon the non-existence of any such statute.
3365 In Colorado the commencement of the survey of a ditch is
the initiation of a water right, which must be followed by
actual construction work within a reasonable time as determined
by the adjudicating court, and the work must be prosecuted with
diligence. Formerly the application of water to beneficial use
3366 was not requisite to the completion of the right, but in more
recent years some district courts have required the beneficial
use as a condition to the perfection of the right, and some have not,
the Supreme Court not having had the matter before it, but until
the court has rendered a decree, neither the appropriator nor any
third person can be positive whether diligence has been used or not,
nor whether the adjudicating court will find that there has
3367 been diligence exercised. The adjudication proceedings in
Colorado are voluntary, and until the appropriator sees fit
to go into court and apply for an adjudication there is no public
record which fixes the time of his commencement of work, although
he must now file his map and claim within sixty days after begin-
ning work. The courts disagree as to whether the filing of this
map and claim is essential to the acquisition of the water
3368 right. Under the Wyoming Irrigation Code, a water right
may be acquired only upon the granting of a permit which
fixes the filing of the application, which fixes definitely the date of
priority if the permit is complied with. The state engineer is re-
quired, in approving an application for a permit, to embody in his
approval the statement definitely limiting the applicant to a certain
time within which to complete the construction work, and a definite
time within which to complete the application of water to a
beneficial use, which may not be more than five years, although the
time may be extended by the state engineer. The permit is a public
record, and its terms are open to inspection by the public, and I
never had any difficulty in examining such permits. Under these

conditions a Wyoming appropriator knows in advance how rapidly he must prosecute the work, how long he has for its completion, and the time within which the water must be applied to beneficial use, and any third person has the same information, so that
3369 the only undetermined matter is whether the work has been performed in accordance with the permit. If work has been performed in accordance with the permit, there can be no uncertainty as to whether diligence has been exercised by the appropriators.

3369 Redirect examination by Mr. Delph E. Carpenter:

Appropriators in Colorado must appear, according to the Statutes, at what is called a general adjudication or be forever barred within two or four years, as the case may be, after the entering of the decree. In speaking of his appearance at such adjudication proceedings as a voluntary act, I had in mind by that that there was no definite time in which he must make application. The application by anyone, however, may force all the others in, but the time at which that application is made is subject to their will and desire.

3370 The granting of extension of time under the Wyoming system by the State Engineer from time to time, is permissible. The State Engineer has the option of doing that. I suppose different things may bear upon his judgment or inclination. If diligence has been exercised, that would undoubtedly be taken into account. In Wyoming, the permission merely amounts to a supervision of the construction from the time of the initiation up to the decree.

Failure of parties to have opportunity to appear and contest claims for their water rights in Wyoming is noted in the Ninth Report of the State Engineer of Wyoming, Mr. Clarence T. Johnston, State Engineer, in which he embodied a report from Mr. Walter B. Dunton, Superintendent of Water Division No. 4, and particularly to matters appearing on page 69 of the official report of the State Engineer.

On Page 69, he states: "There are at present no laws providing for a method of contesting proofs made under permit. This should be remedied, and some similar method provided for such contests as are now provided for contesting proofs made upon original adjudication of the stream. It frequently occurs that an appropriator who has recently taken out a permit for a water right from some stream, is interested in the right to be granted the holder of some prior permit from that stream. He is certainly entitled to be heard if he believes that the prior holder, by his proof upon that permit, is claiming a larger appropriation than he is lawfully entitled to, and some method should be provided by statute for notifying the holder of the later permit, and giving him an opportunity to contest if he so desires, and if he does not contest after such notice, for making the determination of the prior holder's right, binding upon him." That is the matter to which I refer.

3371 Redirect examination by Mr. Fred Farrar:

I do not presume to testify to the intricate details of court decisions affecting laws of state of Wyoming but only testify generally. Same is true of laws of Colorado, except I am naturally better acquainted with details here than I am in Wyoming.

L. G. CARPENTER.

Cross-examination by Mr. John D. Clark:

3371 In the early history of irrigation in Colorado, the courts based their decrees upon the capacity of the ditches
3372 without taking into consideration the amount of water applied upon the land. The appropriators engaged in adjudication proceedings were also more interested in their own claims than in those of the other claimants, and as a result, the courts were overgenerous in their decrees and excessive appropriations were frequently allowed. This is not true of the later adjudications.
3373 I have had occasion to examine some of the decrees of the Wyoming Board of Control, and I do not believe there is much difference between the accuracy of those decrees in uncontested proceedings and the early decrees of the Colorado courts.

3373 Redirect examination by Mr. Delph E. Carpenter:

In the Eighth Biennial Report of the State Engineer of Wyoming for years 1905-6, Clarence T. Johnston, State Engineer, Mr. Walter B. Dunton, Superintendent of Water Division No. 4, in his published report at pages 76 to 80 inclusive and particularly on page 79, calls attention to necessity of providing means of contesting these proofs of permits same as he does in the Ninth Report for 1907-8. It is to same effect but a somewhat briefer statement.
3374 Preliminary filings made in Colorado by various claimants appearing in adjudication proceedings, at least in times past, were seldom used in the final proof before the court in adjudication proceedings or in proceedings for decretal orders of any kind in those proceedings. As indicated in answer to an earlier question, some district courts have rather different practices from others and some courts call for these filings as necessary step before they enter into an adjudication, but that has not been general practice.

Rights of appropriators are protected in Colorado in general adjudication proceedings, even though no statement of claim has ever been filed.

3375 C. P. LINK.

Direct examination by Mr. Charles F. Tew:

Reside at Denver. Previously resided in Park County, Colorado. Have had experience in determining, assessing and fixing values for taxing purposes. First experience was in Park County, Colo., in 1892. Was appointed deputy assessor in that county and for fol-

lowing six years acted as deputy assessor and deputy treasurer. In fall 1899 was elected county assessor and served for 9 years, during which time was member of state board of thirteen assessors. 1901 and following years, served on practically every state committee of assessors. May, 1912, was appointed a member of the state tax commission and am now serving as member of that body.

While acting in capacities mentioned in Park County, it
3376 was my duty to consider valuation of property. When member of state committee of thirteen assessors, was elected by body of assessors of state, all assessors of state met in convention and chose thirteen. At that time it was our duty to assess all inter-county corporate property of state. Did not have duty of fixing equalization between counties. Have attended various conventions of assessors. These conventions were annually held for purpose of comparing assessments of several counties of state and arriving at equal valuation of all classes of property. End being to have all taxes in different counties as nearly equal as possible.

In discharge of my duties in these several services, became acquainted with property values in several counties throughout Colorado. Made quite extensive study of those values.

Prior to creation of tax commission, general practice was to assess at one-third value. Since tax commission law has
3377 been passed and the commission came into being, we have attempted to follow the law strictly and assess at full cash valuation. Since my appointment upon tax commission, have not engaged in any other business. Tax commission consists of three members, a working force, consisting of secretary, assistant secretary, clerk and stenographer, and at times we are given special men to secure data and information in the counties.

Duties of state tax commission are to act as supervisors of assessment and collection of general property taxes in state and also to assess utility corporations in the state. It has duty of fixing assessment upon all public utilities, including railroads, telephone, telegraph, street railway, electric light, gas, water and all other utility corporations and all corporations having business in two or more counties. Commission also has complete supervision over assessors.

There are 63 counties in state. One of objects and duties of commission is to obtain equal burden of taxation upon the property assessed by the assessors of these 63 counties.

3378 Steps taken by commission to obtain information in regard to property valuations throughout several counties are as follows:—First, we have conferred and labored diligently with all assessors; we have gathered all information possible from every source that reflects values of both real estate and personal property in various counties through actual conveyance, record conveyance, of property, properly verified by getting facts from either grantor or grantee or agents connected with conveyance of property; also by comparing loans made by individuals and regular loan and mortgage companies; securing value of water rights where it was possible so to do; gaining extensive information from census enumeration

made in 1910 which was considered one of best sources; talking with actual owners and assessors of various classes of property in counties; securing state records that are officially taken from inheritance tax and any other miscellaneous information that would tend to add to our sources.

We have gathered data personally and by agents in every possible way, to ascertain value of property throughout several counties of Colorado. In this way we have gained and do now possess knowledge of those values. In discharge of these duties, I have made personal inspection and visits to different localities and sections for purposes described. Have made observations and gathered information as to returned valuations of property subject to assessments. We have generally gone over state, and counties not reached personally we have reached by our official appointees.

Am acquainted with territory extending over counties of Larimer and Weld in northern part of state known as the Cache la Poudre Valley. Have made visits to that territory since my appointment on the tax commission. Have had reports from that territory as to sale prices of land. Have made inspections of records as to sale prices and stock values. Have obtained crop reports and data. Have compared report of census bureau for census of 1910, in my study of these values, with report made by assessors in the
3380 Poudre Valley in these counties and elsewhere throughout the state. The census enumeration gives a higher value and more property than found by assessors.

In my duties in equalization, have had my special attention brought to consideration of values in counties of Weld and Larimer. Our investigation has been more scrutinizing and close in those counties than in others throughout state.

Cache la Poudre Valley is very highest valued section of Larimer and Weld Counties. Exclusive of small sections of fruit land, it is highest valued farm property in Colorado.

Weld County has highest value of any farming property in state. The City and County of Denver, only, has higher valuation than County of Weld. It is not a farming value. In farming communities, Weld has the highest value and Larimer has the second. In wealth all told, Weld County is second in valuation.

3381 Major portion of assessed valuation of Weld County lies under ditches. I should think practically 90% of valuation of Weld County lands lie under ditches. The main wealth lies within ditch sections of the county.

The fact also pertains to Larimer County.

$76,988,520 total assessed valuation of Weld County in 1913. That is exclusive of exempted valuation, approximately $1,500,000. These exempted valuations are exemptions allowed householders by statute, $200 to head of each household in personal property and where moneys and credits are assessed, exemptions are allowed on those.

Between $78,000,000 and $79,000,000 was total valuation, both estimated and assessed by taxing authorities of Colorado in 1913, for Weld County.

$32,503,372 total assessed valuation of Laramer County in 1913. I do not have property exempted there, it is something under $1,000,000.

305,612 acres of irrigated land in Weld County in 1913 acording to return made by county assessor. Highest values of land of that total area is within Cache la Poudre Valley. Average value per acre of this irrigated territory, which is in Weld County, is very much lower than average value per acre of that irrigated territory in that part of county known as Cache la Poudre Valley. $25,784,790, approximately, is aggregate assessed value of the 305,612 acres of irrigated land, including improvements, in Weld County.

Assessed valuation of property in Weld County is very much less than that given by census of 1910. Assessed valuation of county by census determination for 1910 was not over 15%. That was at time that values were taxed on basis of one-third value. The same ratio of difference between assessments and census returns for 1910 does not prevail for 1913. Assessors with effort of tax commission have greatly raised and increased assessed valuation for 1913
3383 over 1910. Same ratio is true as to quantity of property.

Almost uniformly assessors find much less property for assessment than that enumerated in census. That pertains to Larimer County as well.

Testimony I have given in regard to high value of real estate, irrigated land, in Cache la Poudre Valley, in Weld County, as compared with other portion of irrigated territory, pertains to Larimer County as well.

111,278 acres of irrigated land returned by abstract of assessment for Larimer County in 1913. A large part of that area was within Cache la Poudre Valley.

$10,918,000 approximately total value of irrigated land in Larimer County, 1913, including improvements.

Lands in Cache la Poudre Valley Range in value from $100 to $300 per acre, including lands, water rights and improvements. Small tracts and areas close to Greeley and other cities in Valley range in price from $400 to $1,000 per acre.

The lands in Larimer County, in the Cache la Poudre Valley, range about the same. The average, in that county, is not quite so high as in Weld County.

In Larimer County there are a number of fruit orchards in the Poudre Valley Value of those lands is very much higher than the agricultural areas I have just described. There are small tracts adjacent to Fort Collins of values similar to those I have described and reach as high as $1,000 per acre.

Cross-examination by Mr. N. E. Corthell:

Valuation I have given for assessment of Weld County for 1913 was finally determined and established October, 1913. It was made part of record of office of State Tax Commission of Colorado at that time.

3385 Redirect examination by Mr. Fred Farrar:

Value I have mentioned was not original valuation made by assessors. It was value as equalized by Colorado Tax Commission and State Board of Equalization. This is the first year in history of Colorado wherein a systematic and definite effort has been made to assess property for purpose of taxation upon full cash value. There has been some trouble and litigation incident to that change in plan. Powers of Tax Commission were at one time questioned, and until recently decided by the Supreme Court of this case.

Redirect examination by Mr. Charles F. Tew:

Acquainted with class and character of horses and mules that are used in tillage of irrigated territory in Cache la Poudre Valley. Animals are of very best farming class in state.

2,017 mules were assessed in Weld County in 1913 according to abstract of assessment. Assessed valuation was $135 per
3386 head. I think that is the fair valuation. Horses, generally speaking, employed in agricultural districts of Cache la Poudre Valley, are of class similar to mules as just described.

3387 JOHN E. FIELD, recalled.

Direct examination by Mr. Fred Farrar:

Using Plaintiff's Exhibit C, a small map showing gauging stations on Laramie River, according to R. I. Meeker, a witness for plaintiff, as a basis, I will designate where other measurements have been taken on Laramie and Poudre Rivers, which will be referred to in my testimony to follow. Gauging station on Cache la Poudre River is between junction of Cache la Poudre River proper and north fork of Cache la Poudre River and town of Fort Collins. On Plainiff's Exhibit C, north fork of Cache la Poudre River is marked "Sheep Creek." Gauging station is perhaps half way between town of Fort Collins and junction of north fork with main Poudre River. It lies just below Poudre Valley Canal. Referring to map attached to corporate Defendant's answer, approximate location is in Sec. 15, Tp. 8 N., R. 70 W., about four miles below junction of the two rivers. There is also a gauging station which will be mentioned, on McIntyre Creek at point almost due west from Glendevey gauging station on Laramie River. This gauging station is 5 or 6 miles above mouth of McIntyre Creek.

3388 Glendevey gauging station on Laramie River is indicated on Plaintiff's Exhibit C by yellow circle, being only yellow circle in State of Colorado on that Exhibit.

There is also gauging station or weather and gauging station on Laramie River about mile south of Colorado-Wyoming line. This gauging station is known as Deckers and is not shown on Plaintiff's Exhibit C, but would be immediately south of yellow circle shown, close to Colorado-Wyoming boundary line and within boundary of State of Colorado.

Upper gauging station which I have mentioned on McIntyre Creek, would be on blue line representing stream due west of yellow circle on Plaintiff's Exhibit C.

There is also a station at mouth of McIntyre Creek, which would be at junction of previously mentioned blue line and blue line representing Laramie River itself. This last mentioned station would be at Gieneyre. This last one is not shown on Plaintiff's Exhibit C.

Temporary gauging stations were established on nearly all of the tributary streams and none of these are shown on Plaintiff's Exhibit C. They were generally near mouth of tributaries or at some convenient place near mouth of these streams.

On Cache la Poudre River, two canals of considerable size, divert water above the gauging station. They are the Poudre Valley Canal and the North Poudre Canal. There are some small ditches
3389 which have not been considered in my analysis of the flow of the Poudre. The North Poudre Canal diverts its water from the north fork of the Poudre. The Poudre Valley Reservoir Company's canal diverts from main stream about 4 or 5 miles below junction of North Poudre and main stream. This Poudre Valley Canal is a part of the system of The Greeley-Poudre Irrigation District. It is indicated on map attached to Answer of corporate Defendants by a red line. Referring also to this map, there appears on the North Poudre River a reservoir designated as Halligan, at a point about 8 or 10 miles immediately south of Wyoming line. The North Poudre Irrigation Company owns that reservoir. The diversion ditch of that company leaves the stream bed 4 or 5 miles down stream from that reservoir and is indicated on map by an ordinary line. This North Poudre system irrigates land lying directly north and northeast of Fort Collins.

Referring to Sand Creek or Divide Canal and its relation to Wilson Supply Ditch, will state that Wilson Supply Ditch was constructed from Deadman Creek to carry water from that stream over into Sand Creek. This ditch is noted on the map attached to the Answer of the corporate Defendants on extreme edge of northerly part of the drainage area indicated as tributary to diversion
3390 system of the Greeley-Poudre tunnel. The water so carried from Deadman Creek into Sand Creek flows down the latter stream a short distance and is diverted into the Divide Ditch. This ditch carries water across the Divide between Sand Creek and the Cache la Poudre River and the water is discharged into a tributary of the Cache la Poudre. This system is variously described by different people. Upper portion is generally called Wilson Supply Ditch. The ditch across Divide between Sand Creek and Cache la Poudre is called the Sand Creek or Divide Ditch. Practically speaking, the Wilson Supply Ditch diverts water from upper reaches of Deadman Creek, puts that water into the upper portion of Sand Creek and Sand Creek is used as a carrier until the head of the Sand Creek or Divided Canal is reached where the water is again diverted and carried over into Sheep Creek, a tributary of the North Poudre.

Sand Creek and Deadman Creek are both tributaries of Laramie River. Deadman Creek reaches Laramie River just above Glendevey

rating station and is intercepted by East Side Collection Ditch of Greeley-Poudre system. Sand Creek flowing northeasterly does not reach Laramie River until it has passed boundaries of Colorado and into State of Wyoming some twenty miles.

Grand River Ditch is a portion of the system of The Water Supply and Storage Company and diverts water from Grand River into Cache la Poudre River.

3391 Sky Line Ditch diverts water from upper reaches of Laramie River into Poudre River and belongs to same company.

The Michigan Ditch, diverting water from Michigan River, a tributary of the North Platte, over into Cache la Poudre River, belongs to what was formerly known as Mountain Supply Company's system, but now forms part of the North-Poudre Irrigation Company's system. Latter company owns Halligan Reservoir and North Poudre Canal.

Grand River Ditch, Michigan Ditch and Sky Line Ditch have been constructed and diverting water for use for irrigation in Cache la Poudre Valley for a number of years.

Headwaters of Cache la Poudre River and Laramie River are close together, as matter of fact, smaller streams which form headwaters of those two rivers practically interlace.

One notable difference between these two streams is that Cache la Poudre River runs directly away from main range of mountains, while Laramie River runs parallel with this range for con-

3392 siderable distance. Divide between Poudre and Laramie drainages is not high and is not broad. The divide or mountain range between Laramie River and tributaries of North Platte is higher than between Poudre River and Laramie River and is more extensive.

Laramie River is fed by a number of tributaries coming in from west in general direction along this divide to west of stream.

Largest tributary of Laramie River entering stream from west is the Little Laramie, which heads in direction of range generally called Centennial Mountains in Wyoming. On other hand main tributary of Poudre River is North Poudre, which heads on east side of this lower range intervening between Poudre watershed and Laramie watershed.

Run-off of Cache la Poudre River must necessarily be considered in connection with run-off of Laramie. I made careful study of Cache la Poudre River, its flow and use of water from the stream, for reason that it is nearest developed area geographically to Laramie River area. Watersheds are somewhat similar and flow in two streams from year to year would follow each other more or less closely.

A high year in Cache la Poudre River would probably also show high run-off on Laramie River in same year, similarly, a low flow of Cache la Poudre would probably show low run-off on Laramie River.

In this case there was a necessity, to my mind, of showing run-off on Cache La Poudre River for three purposes: First, as I said, to make a comparison between flow from year to year of Cache la

Poudre and that of Laramie and to enable me to fill in missing records; also to show use of water and duty of water in Cache
3393 la Poudre Valley. It was also necessary, I thought, to show whether there was surplus of water in Cache la Poudre and, if so how much, and whether there was sufficient water remaining in Cache la Poudre River to serve the Greeley-Poudre Irrigation District or whether supply at present is insufficient to irrigate even that land which is now under ditch, outside of the Greeley-Poudre Irrigation District.

My conclusions, after examining records and studying conditions of water supply now in use, are that there is some water during flood periods which is not now utilized by the ditches in the Cache la Poudre Valley, which might be used. I am assuming of course the demand exclusive of the demand of the Greeley-Poudre Irrigation District and also disregarding the demands of ditches on South Platte River below mouth of the Cache la Poudre.

My conclusion also was that there were areas under some of ditches not now receiving sufficient water to produce best results and that there are periods during certain portions of year when there is scarcity of water and during certain years that there is shortage for entire year under some of the existing ditches. My investigations, study and observations lead me to conclude these to be the facts.

Records of flow of Cache la Poudre River extend from 1884 to 1913, a period of thirty years, which length of record should give very good idea of what average flow of stream is and what the normal condition is, while a shorter record would not be so good.

Ordinarily we assume that 20 year record can be taken with considerable reliance as indicating variations on stream.
3394 There is 1½ months record in 1881 on Poudre River but conditions concerning this year were not well known and it was at time when measurements of rivers were somewhat uncertain and shortness of record itself, being for about 1½ months, renders it without much value except possibly in aiding one in determining average run-off for month of July. Month of July was entirely covered by 1881 record. Even in this case of the July record in 1881, it was a coincidence that the normal run-off as shown by thirty years' records for month of July, is almost exactly same as that recorded for July 1881. Result is it makes no difference whether we use or discard that particular record.

I have table showing discharge of Cache la Poudre River for 30 years and this table I believe covers practically all extant records.

(Table marked Defendants' Exhibit 123.)

(Defendants' Exhibit 123 offered in evidence, table showing run-off of Cache la Poudre River at gauging station mentioned *my* witness, run-off being measured in acre feet for period commencing with 1881 and ending 1913.)

(COPY OF DEFENDANTS' EXHIBIT 123.)

State of Colorado—Engineering Department.

Discharge of Cache la Poudre at Mouth of Cañon. Drainage Area. 1.060 Square Miles.

Run-off in acre feet.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1881.....	.....	.....	.....	.....	.....	.....	53,915	.....	.....	.....	.....	.....	.....
1884.....	.....	.....	°4,100	13,010	155,958	286,356	131,817	48,674	18,151	°12,500	.....	.....	670,566
1885.....	.....	.....	.....	°21,900	87,233	173,200	114,162	40 370	16,210	°12,400	.....	.....	465,475
1886.....	.....	.....	.....	*14,400*	80,487	111,627	44,087	20,783	11,008	°8,000	.....	.....	290,392
1887.....	.....	.....	.....	*10,300*	°90,000	°105,000	44,980	18,760	*10,300*	*7,500*	.....	.....	286,840
1888.....	.....	.....	°6,400	10,590	29,390	°64,800	24,640	13 400	6,250	°6,900	.....	.....	162,370
1889.....	9,516	6,127	3,306	6,718	47 370	79,660	31,420	11,535	4,082	4,282	5,200	3,954	213,170
1890.....	5,042	4,404	5,230	11,900	64.200	76,200	39,844	17,831	6,129	4,919	3 630	4,000	243,329
1891.....	5,655	4,225	3,606	8 545	72.839	113.048	33.298	14,005	8,216	7,285	4,959	4,834	280.515
1892.....	3,940	6,670	4,800	°6,000	°25,000	90,000	45,190	°14 100	*7,800*	*5,700*	.....	.....	209,200
1893.....	.....	.....	.....	*8,100*	°34,400	°107.600	37,730	°15,000	*8,000*	*5,900*	.....	.....	216,730
1894.....	.....	.....	.....	*11,800*	°86 444	122,760	51,390	20,820	9,780	6,450	°5,500	.....	314,944
1895.....	.....	.....	.....	*11,700*	°74,000	°140,000	67,170	30,450	°12 780	*8,400*	.....	.....	344,500
1896.....	.....	.....	.....	*5.800*	35,900	°55.000	28,140	16,700	°16,600	*4,200*	.....	.....	162.340
1897.....	.....	.....	.....	*13,700*	°126,000	°105.000	46,070	°21,700	°9,700	*9,900*	.....	.....	332,070
1898.....	.....	.....	.....	*6,700*	°40,000	°77,900	29,380	°9,720	4 790	°3,800	.....	.....	172,290
1899.....	.....	.....	.....	*15 400*	°75,000	156,610	88,590	34,250	12,640	°7,000	.....	.....	389,490
1900.....	.....	.....	.....	°46,000	172,700	175,080	44,330	16,290	8,870	°7,800	.....	.....	471,790
1901.....	.....	.....	.....	*16,700*	108,030	116,410	°49 000	20,720	9,040	°7,060	.....	.....	326,960
1902.....	.....	.....	.....	*6,000*	*37,300*	°76,000	25,271	10,514	9,878	°9,000	.....	.....	173,963
1903.....	.....	.....	.....	°13,550	47,420	161.450	°58,000	*24,300*	*12,500*	*9,100*	.....	.....	326,920
1904.....	.....	.....	.....	9,406	°75 000	°135,000	64,150	20,140	°10 460	*7,300*	.....	.....	321.456
1905.....	.....	.....	.....	18,863	63,400	161.057	55,830	20,906	9,418	°6,500	.....	.....	335.974
1906.....	.....	.....	.....	°15,000	66.574	98,290	57,500	°17,570	°11,600	°9,000	.....	.....	275 534
1907.....	.....	.....	.....	7,081	39,712	165,328	109,096	29 112	11,181	°8,000	.....	.....	369,510

Copy of Defendants' Exhibit 123—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1908.....	.....	.....	.....	8,039	*34,000	88,839	*44,000	47,098	13,613	*8.580	.....	.....	244,169
1909.....	.....	.....	.....	14 200	43.230	220,300	113,800	28,320	19,720	8,554	.....	.....	448,124
1910.....	.....	.....	.....	*6,000*	*45,000	56,469	16,540	7 870	9,045	9.192	5.891	3,212	159,219
1911.....	2.975	2,410	2,462	4,118	50,363	101,578	46,973	13,426	10,316	7,716	3,876	2,797	249,010
1912.....	2,668	3,015	4,173	3,727	48 241	130.074	75.646	26,394	12,585	10,035	2 795	.....	319,353
1913.....	.....	.....	.....	*6,179	56,568	73,370	32,465	16,294	12,139	11,314	*5,800	.....	214,129
Total..	29,796	26,851	34,077	351,426	2,011,759	3,624,066	1 705,024	647,052	322,801	234,833	37,651	18,797	.....
Mean..	4,966	4,475	4,260	11,714	67,059	120,800	55,001	21,568	10 760	7,828	4,706	3,759	316,896

*Estimated from fractional months.
Figures underscored [italicized] estimated.

Table shows total run-off for each month of which we have record. In original records, some of months were incomplete, only parts of months being shown. I have completed by estimating record for month and these changes from original records based on these estimates are placed in the table and are indicated by asterisks
3395 or stars [*] preceeding the figure. Also, in order to obtain average run-off as closely as possible between months of April and October inclusive, I have supplied missing data, especially for month of April, in two cases for month of May, in one case for month of August, four cases for month of September and in eight cases for month of October. These estimates are shown in red on exhibit. They were made by considering flow for portion of year which was given in record, by comparing it with other years of which we had record, and comparing it with average as shown, and in some cases records on adjacent streams were considered. Out of 244 months only 27 months were so estimated. Those figures preceeded by asterisks [*] are records for month estimated upon partial record for month. Those in red are estimated in other manner which I have described, for month as a whole, they are entirely estimates.

In order to get year's record, or portion of year covered by record, you merely read right across page from left. Total for year covered by record is shown in right hand column. Extreme right hand column shows aggregate flow for months of which we have record and does not represent total flow for year.

There are from one to five missing months, in most cases in different years, in which no attempt has been made to make estimate.

At foot of page appears line indicating totals. Those are
3396 total aggregate discharges for each month during this period of 30 years as shown by records. That line marked total is really not significant. It is merely a convenience for calculating what the mean discharge for several months is. For instance, total for month of January is total for six years as shown, while total under month of June is total discharge for entire 30 years. In one case we have divided total by six to get the mean, and in the other we have divided it by thirty.

315,896 acre feet is the mean annual discharge of the Cache la Poudre River for the thirty year period, so far as we have records.

Year 1884 appears to have been one of unusually large flow, being largest in fact recorded and being first year of which record was kept. The record might be open to suspicion as being possibly in error were it not for fact that tradition has it that it was a year not only of very large flow but one which has never been equalled since. There appears to be no error in the record and there appears to be no reason for discarding it.

Table was particularly designed to ascertain, as I have stated, what was flow from April to October inclusive. Table shows that average run-off for that period was 294,730 acre feet. That is that amount of water passed gauging station. It is probable that discharge for months of November, December, January, February and March was too low for reason that with exception of years 1884, 1894 and 1912, winter records are for years considerably below

normal and even the years 1894 and 1912 are very little above normal. These five winter months, November to March inclusive, appear to give about 7% of total on table. This is probably
3397 incorrect, because winter months shown were as I stated, years of low flow, and because diversions from other water sheds into Poudre water shed, generally speaking, occurred between April and October, and therefore the summer run-off is larger in proportion to winter run-off, than it should be. It is my opinion that average run-off for months of November to March inclusive is probably more than 5,000 acre feet for each of said five months.

These records include flow brought over from other water sheds, as I have stated, and they do not include diversions above gauging station by North Poudre Canal and Poudre Valley Canal, so that, before reaching any conclusion based on these records, one must take into consideration the influence of the four inter-watershed diversions, namely, Sky Line Canal, Divide Ditch, Grand River Ditch and Michigan Ditch, and must also take into consideration amount of water diverted by Poudre Valley and North Poudre Canals above gauging station. After making due allowance for these disturbing influences, we get net run-off at cañon. Gauging station is at cañon, which would show natural run-off of Cache la Poudre uninfluenced by diversions into water shed or by water taken out above gauging station.

Result obtained represents amount of water which passes gauging station, there are no considerable tributaries below gauging station. Very little water reaches river below the station, so that this represents practically the supply of the Poudre Valley at gauging
3398 station. I will speak of lower sources of supply later.

Am able to account for water diverted through these four trans-mountain ditches and to calculate net amount at gauging station after deducting diversions of North Poudre and Poudre Valley Canals. I have prepared table which takes as its basis flow as shown on Exhibit 123 and from flow so shown I have deducted flow discharged into Poudre drainage by Sky Line Canal, Sand Creek or Divide Ditch, Grand River Ditch and Michigan Ditch and I have added amount of water which was diverted by Poudre Valley Ditch and North Poudre Canal. Result being that net run-off of Cache la Poudre River as shown by 30 years' records between month of April and month of October, including those months, is 297,322 acre feet as against an average run-off as shown on Exhibit 123 of 294,730 acre feet.

(Defendants' Exhibit 124, marked and offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 124.)

State of Colorado—Engineering Department.

Discharge of Cache la Poudre (Net Run-off Table—Acre Feet) at Mouth of Cañon from April to October, Inclusive.

Drainage Area, 1,000 Square Miles.

	Cache la Poudre at cañon.	Skyline.	Sand Crk. Ditch.	Grand R. Ditch.	Michigan Ditch.	Poudre V. Ditch.	No. Poudre Canal.	Net run-off at cañon.	Percent of normal.
1884.....	666,466	.....	....	.....	.....	.....	.....	666 466	224
1885.....	465,475	.....	....	.....	.....	.....	.....	465,475	157
1886.....	290,392	.....	....	.....	.....	.....	.....	290,392	98
1887.....	286,840	.....	....	.....	.....	.....	.....	286,840	96
1888.....	155,970	.....	....	.....	.....	.....	.....	155,970	52
1889.....	185,067	.....	....	.....	.....	.....	.....	185,060	62
1890.....	221,023	.....	....	.....	.....	.....	.....	221,023	74
1891.....	257,236	.....	....	.....	.....	.....	.....	257,236	87
1892.....	193,790	.....	....	.....	.....	.....	.....	193 790	65
1893.....	216,730	.....	....	.....	.....	.....	.....	216,730	73
1894.....	309,444	.....	....	.....	.....	.....	.....	309,444	104
1895.....	344,500	.....	....	.....	.....	.....	.....	344,500	116
1896.....	162,340	.....	....	.....	.....	.....	.....	162,340	55
1897.....	332,070	.....	....	.....	.....	.....	.....	332,070	112
1898.....	172,290	.....	....	.....	.....	.....	.....	172,290	58
1899.....	389 490	17,699	....	.....	.....	.....	16,800	388,591	131
1900.....	471,790	18,657	....	.....	.....	.....	21,440	474,573	160
1901.....	326,960	23,805	....	.....	.....	.....	36,000	339,155	114
1902.....	173,963	22,124	1,925	.....	.....	.....	1 722	151,636	51
1903.....	326,920	26 114	1,713	1,707	.....	4,936	42,828	345,150	116
1904.....	321,456	23,434	6,810	1,975	.....	°15,000	11,200	315,437	106
1905.....	335.974	13,291	0	6,170	861	°20,000	26,000	361,652	122
1906.....	275,534	16,693	5,004	11,980	1,923	21 980	18,060	279,974	94

Copy of Defendants' Exhibit 124—Continued.

	Cache la Poudre at cañon.	Skyline.	Sand Crk. Ditch.	Grand R. Ditch.	Michigan Ditch.	Poudre V. Ditch.	No. Poudre Canal.	Net run-off at cañon.	Percent of normal.
1907.....	369,510	15 024	5,400	12,612	3,980	28,210	25,520	386,224	130
1908.....	244.169	17,958	2,092	16,775	4,123	23,546	26,076	252.843	85
1909.....	448,124	12.725	0	15,593	3,752	26,160	43,788	486,002	163
1910.....	150.116	16,435	783	9,883	2 308	15,551	21,256	157,514	53
1911.....	234,490	19,085	4 418	13,442	2.842	2,068	8,840	205,611	69
1912.....	306,702	20,986	2,157	15,741	4,746	9,150	25,500	297,722	100
1913.....	208,329	14,639	0	12,214	3,747	5,670	34,560	217,959	73
Mean								297,322	

°Estimated.

G. L. C. Mar. 4. '14.

The run-off as determined by records direct and without making allowance for trans-mountain accessions or for diversions above gauging station differs less than one would expect from the percentage as determined by making such allowances. The net run-off of Cache la Poudre River after making allowances shows nearly 3,000 acre feet more than if allowances were not made. This is difference, however, of only about 1%. The reason there is so little difference is that aggregate amount coming into Poudre from other water sheds is nearly same as amount diverted by two canals above gaug-
3399 ing station. Without this explanation the coincidence would be remarkable.

Explaining table Defendants' Exhibit 124, in column one is the year, in column two is shown discharge of river for different years or portions of years and is taken from last column of Exhibit 123. Third column headed "Sky Line" is discharge of Sky Line canal for years 1899 to 1913 inclusive, that is to say, it represents amount of water brought from Laramie River to Cache la Poudre River by Sky Line Canal during those years. Fourth column headed "Sand Creek" ditch gives amount of water which has been carried over from Sand Creek or Laramie River drainage, into Cache la Poudre drainage and covers years 1902 to 1913 inclusive. That column does not take into consideration any difference between water from Deadman and water from Sand Creek, it is the total from both those sources delivered by Sand Creek Ditch into Poudre River. In fifth column is shown amount of water brought over by Grand River Ditch from Grand River into Poudre drainage. In sixth column is shown amount of water brought across divide by Michigan Ditch and in seventh column is shown diversion by Poudre Valley Ditch of water above gauging station. In eighth column is shown diversion by North Poudre Canal above gauging station. In ninth column is shown net run-off at cañon and this represents amount of water which would pass gauging station had there been no diversions above and had there been no inflow into Poudre drainage from other drainages.

This net is obtained by subtracting inflow from Sky Line, Sand Creek, Grand River and Michigan Ditches, and adding outflow or diversion through Poudre Valley Ditch and North Poudre
3400 Canal. In last Column is given per cent. of run-off for different years as related to average flow for 30 year period. This column indicates what relative amount of water during different years discharged by Poudre River is to average as shown by 30 years' records.

I take 30 years average as being normal. 1911 amount of water discharged by Cache la Poudre River as compared by determined normal was 69%.

1912 shows 100% and was almost exactly normal.

1913 discharge of Poudre River was 73% of normal.

There is reason why I desire to consider flow of Cache la Poudre River in connection with my discussion of this subject. It is in order to use percentage of run-off for different years so that in examining records on Laramie River which are very much shorter than

records on Poudre, that is, they cover much fewer years, we will be able to tell whether those years covered by such records are
3401 above or below normal. It is to enable me to tell whether the Laramie River records are above or below normal.

From records on Cache la Poudre, Laramie and other streams, it is my judgment that run-off for November, December, January, February and March is about 2% for each month. 2% of total for year. October is perhaps 3% and April 4% of total for year.

On table Exhibit 124 will be found discharge of Sky Line and Sand Creek or Divide Ditch. Figures shown on exhibit will be used in connection with discussion of Laramie River drainage, for reason that this water has been diverted from Laramie River and so has augmented flow of Cache la Poudre River and has decreased flow of Laramie. In discussing, therefore, records of different gauging stations on Laramie, these quantities must be added to give true run-off from water shed above gauging stations, and by such additions many erratic conditions found on records of Laramie River can be explained. In diversion of water from one water shed to another, there is a greater percentage of water supply furnished by district from which water is taken during low year than during high year, that is, percentage of water diverted from Laramie River over to Poudre River during year of low flow is larger in comparison with flow of that year than water diverted in high year is to water flow during that year. For example, amount of water diverted through Sky Line Ditch would be more clearly constant from year to year than would average flow in Laramie River from year to year. Reason is that during year of low flow on Laramie River there would probably be a year of low flow on Poudre, which would create greater demand on Poudre for water and probably greater effort
3402 would be made to bring more water during low year. On other hand in high year, it would probably not be so necessary and the same effort would not be made.

Diversion of any considerable amount of water during a very low year would make a considerable difference in low water records on Laramie, but even diversion of somewhat greater quantity of water in high year would not seriously affect percentage of flow left in Laramie River. This discrepancy between percentage of water diversion and natural flow of stream makes it necessary to take into account amount carried over divide.

In table, Exhibit 124, discharge of Poudre Valley ditch for years 1904 and 1905 was estimated, as I had no records from Poudre Valley Ditch for those two years. These estimates were made after considering quantity of water available during those two years, demands of older ditches and amount of water diverted during years of similar flow. In 1903 we have statement that water was run in month of July. 1904 was second year in which water was run through Poudre Valley Ditch, but I have estimated this flow at only 15,000 acre feet, for reason that it was a new ditch. They would hardly dare carry the full quantity and there would not be full demand. That was reason for making amount diverted by Poudre Valley Ditch in 1904 less than discharge for year 1908, for instance, when

supply was less. In other words my estimate is very conservative. I estimated, taking everything into consideration, what to best of my judgment the amount was and could scarcely say whether it is too high or too low.

3403 Similarly, in year 1905 I estimated discharge as 20,000 acre feet, although in year 1907, a year of somewhat similar discharge, there was more water carried than what I show for 1905. I gave some consideration in this case to fact that it was new ditch, covering comparatively new district where demand would be less and where danger of breaking ditch would be greater.

For purpose for which this table is used, absolute accuracy or exact estimates are not essential. Even a variation of one per cent. would call for a difference of some 3,000 acre feet. Errors, if any, will, I think, be compensating, so that result given in last column is substantially correct.

Table is prepared on a blank form which carries along at top of columns names of months. These have no connection whatever with the figures on the table in this particular exhibit. They really should have been erased.

Figures shown in this table as to amount carried by Sand Creek or Divide Ditch will differ somewhat from figures which will be used in connection with the hydrographic data on Laramie River, for reason that Divide Ditch discharges into Poudre drainage not only water from Laramie River but also water from Sand Creek. Proportion to be credited to each of these streams is not definitely known, but through records of accounts kept in purchase and sale of water in this ditch, I have endeavored to separate Laramie River supply from that furnished by Sand Creek. By Laramie River supply I refer to that diverted from Deadman Creek through Wilson Supply Ditch. As amount diverted, however, is very small, even a very considerable error in any one year would mean a very little difference when merged with other records. Entire consid-

3404 eration of amount diverted by this canal in considering Laramie run-off, might be eliminated without affecting final results materially. A captious person could, with some show of reason, criticize nearly any record of a river, but method of making measurements is reasonably correct.

The hydrographers, generally speaking, have been men of experience and men who were disinterested, had no interest one way or the other in the results of their measurements and their sole object was to ascertain the facts. The measurement of the supply is based upon the cubic feet per second as determined by meter measurements.

In this table I have computed cubic feet per second into acre feet. Records are originally made in cubic feet per second, but in stating total run-off for year it is more convenient to use term "acre feet" as applied to actual volume under consideration. Distribution of canals, duty of water and all other matters relating to use of water for irrigation are determined almost entirely by meter measurements by hydrographers, and if there is any error in method of measurement differences will apply equally to supply, duty and use, so that relation between flow, use and other things connected

with water are relative rather than absolute and for all practical purposes can be taken as correct.

One is justified in casting aside records, if he has knowledge of serious errors or mistakes, or if he has knowledge that records are unreliable. An experienced man might also examine records critically and be able to say that they represent impossible conditions. He might also call into question accuracy of records, if records at adjacent gauging stations are not reconcilable with one under consideration. When I say an experienced man might examine records showing impossible conditions, I am speaking in the abstract and not of my own exhibits. It is a general statement. I will have occasion to question some records later on and therefore make that statement at this time.

3405 Duty of original water of Cache la Poudre River that is discharged by river at gauging station at mouth of cañon, service it performs and duty of return seepage water have been considered by me from different standpoints from what other writers have viewed the subject.

In considering duty of water, attention has generally been given by investigators to duty as applied to small tracts or to a lateral and sometimes to a ditch or an irrigation system. The efforts seem to have been to ascertain requirements of irrigated crops based upon amount of water measured at land, that is, at point of application. In construction of irrigation works, engineer of necessity has had to consider loss in transit, as well as needs of plant and needs at point of application. In this way engineer has rather broadened scope of determining duty of water and covered a larger field. He has considered irrigation project as a whole and so has been forced to determine duty of water in that regard.

Little work has been done to determine what I consider to be real duty of water. "Duty of water" is a technical term used by engineers and irrigators and is generally taken to mean the actual use on each particular tract of land or in the particular section under discussion. In a different sense it might be taken as the accomplishment which might reasonably be expected. Whether or not water does its full duty is question which affects the economics of irrigation.

In a new country, one might ascertain what the amount of water in the stream was, its annual flow, the yearly variations and the discharge during different portions of the year. With the quantity thus ascertained or estimated, and what might reasonably be expected in way of accomplishment from this water, he might predict final limit of development for that valley. The only definite figures under these conditions, which one would have, would be the amount of original water available, and without reference to return seepage, losses in transit, losses in storage, etc. Ascertainment of what this original water would accomplish is of great importance to those districts which are not yet fully developed, such as on the Laramie Plains.

Irrigators in Cache la Poudre Valley, have, I think, reached more nearly real duty of water than in almost any other section. Water of Cache la Poudre, I might say, now performs almost its full duty.

There are some ditches in Poudre Valley which still use more water than is necessary. There is some water which escapes from the district and there is water also which passes out of the valley which cannot be used in valley on account of its location. This is
3407 general except seepage water or return flow. Water which passes out of Poudre Valley into South Platte River is used by ditches heading on South Platte River below mouth of Cache la Poudre.

Questions naturally arising relative to this general subject in Poudre Valley are: First, what is amount of water that enters the valley and second what amount flows out of the valley into other districts and third what is amount of land irrigated in the valley and finally what is relation between amount of original water entering valley and area irrigated after deducting amount discharged from district into other districts.

By original water I mean natural flow without taking into consideration amount which returns to river after having been once used or diverted, that is, water running as waste or seepage. This waste or seepage water is a secondary use and sometimes called a reuse of water and it forms a very important part of the supply, but in determining what might be the area which would be irrigated in any valley, we are almost confined to amount of water which we find entering valley. We do not know what the return seepage will be, but knowing what the accomplishment in other districts has been, expressed in terms of original water, we should be able to predict with considerable accuracy the amount of land which ultimately might be cultivated in the new district.

Streams which issue from mountains onto plains are discharging their maximum amount at time they reach the plains. As
3408 the stream crosses the plains there are few tributaries. These are small and furnish very little water so that the amount of water measured at mouth of cañon or at foothills is more than is found after stream has traversed plains for any considerable distance. On Poudre River there originally was only probably an appreciable loss between mouth of cañon and mouth of river as there are practically no running streams entering Poudre River below mouth of cañon and above the mouth of the river.

Where streams cross plains in arid region they are to be contrasted with streams in regions of greater rainfall in this: Streams in arid region constantly decrease after they leave original source of supply, whereas streams of more humid region as a rule constantly increase.

Further discussing duty of water in Cache la Poudre River, I will state that I have submitted two tables Exhibits 123 and 124 and have shown on these tables amount of water available.

Average amount of water furnished by Cache la Poudre River itself, as previously stated, in a period of 30 years was 297,322 acre feet for the portion of the year between April and October inclusive. I have also previously stated that these seven months furnish about 90% of total annual flow. This would therefore give an annual discharge of 330,350 acre feet, which for purpose of this discussion we will call in round numbers 330,000 acre feet. This quantity, as has

been explained, has been obtained by adding to discharge at gauging station amount of diversions above gauging stations and sub-
3409 tracting amount of water coming in from other water sheds. These are shown in detail on Defendant's Exhibit 124.

On other hand if we take records at gauging station itself and add to them amount of water which did not pass gauging station by reason of diversions above, we get total supply entering valley by way of Cache la Poudre River. I consider it better, in determining duty of water to take flow of river in past ten years, rather than for full thirty years, for reason that I found it impossible to get full records of diversions of North Poudre Canal, amount supplied by Sky Line Canal in its early years was so uncertain also, and as amount of land under cultivation has been constantly increasing, it seems better to consider last ten years rather than whole thirty.

Average flow passing Cache la Poudre gauging station for last ten years, beginning with year 1904, April to October inclusive, was 289,438 acre feet. Flow April to October being 90% of annual flow, annual flow would be 321,600 acre feet. Instead of using 90% as giving yearly discharge, we could add to average flow for these ten years' average flow for the five winter months as shown on Exhibit 123. I would add to the ten year record for the seven months the average winter flow as based on all records which we have.

When I speak of ten year record, I mean average of the ten year record. That is adding for the five months, 4,966 acre feet for January, 4,475 acre feet for February, 4,260 acre feet for March, 4,706 acre feet for November, and 3,759 acre feet for December to the amount 289,438, which would give a total supply of
3410 311,604 acre feet. The difference by the two methods is nearly 10,000 acre feet.

As previously explained, our records for winter months are generally for years of low water and amount determined by using these records would therefore be too low. It appears reasonable to assume an average between the two totals given and to call the normal amount of water available for years 1904 to 1913 inclusive, 316,500 acre feet per annum.

This being the average annual amount passing the gauging station, we must add amount diverted above gauging station by Poudre Valley Canal and North Poudre Canal. North Poudre Canal, during these years, diverted an average of 24,080 acre feet, while Poudre Valley Ditch diverted an average of 16,733 acre feet, making a total of 357,313 acre feet.

Some water enters valley of Cache la Poudre from Fossil Creek by way of Fossil Creek Reservoir and some enters by way of small tributaries on north side of river below gauging station. There is, however, some land outside of district controlled by Water Commissioner which is irrigated by Poudre Valley water and on these streams there are small ditches which consume greater part of water and these areas being not included in estimate of Water Commissioner of amount of land in district, so that excluding both land and water on these tributary streams, eliminates necessity of adding that supply to Poudre supply. Some water, however, does enter district,

amount of which it is almost impossible to determine, it is not great however, and for purpose of this discussion I have called this amount 10,000 acre feet.

367,313 acre feet would be total supply of Cache la Poudre River.

Cache la Poudre Valley is in no way surrounded by moun-
3411 tains or hills after it leaves cañon. These minor tributaries, such as Fossil Creek, which I have mentioned, are merely torrential streams which furnish a very erratic amount of water, if they furnish any to the stream. I allowed 10,000 acre feet of water from those sources.

Amount of water which flows out of the district, that is, is discharged from Cache la Poudre River into South Platte River, as shown by records in office of State Engineer, is about 110,000 acre feet per annum. There is an almost constant discharge at all times of the year at the mouth of the Cache la Poudre of 50 cubic feet per second and at times there is very considerable more water.

It is also necessary at times to send water from District No. 3, the Cache la Poudre District, into District No. 1, and District No. 64, the South Platte Districts, for use in those districts. These districts are down the Platte below the mouth of the Poudre. This sending of water down into these lower districts is especially necessary during that period when reservoirs are being filled on Poudre. Ditches on Platte demand water for direct use as opposed to reservoirs demanding water for storage in upper district.

In addition to amount discharged through the Poudre River itself, there is a considerable amount of water which originates in the Poudre River but is discharged into the Platte River below the mouth of the Poudre. The seepage return which passes out of Poudre River into the Platte, as I say, is 50 cubic feet per second or more. This nearly all originates between the headgate of the

Greeley No. 3 Canal and the gauging station which is a few
3412 miles below the town of Greeley and also a few miles above mouth of river. Headgate of Greeley No. 3 Canal is five miles west and above town of Greeley. I make this statement in order to show how much water might be expected to return in these short distances. The Ogilvie Ditch takes out of the Cache la Poudre River slightly below Greeley and takes a considerable part of this return seepage which accumulates below the headgate of the Greeley No. 3 Canal. The Boyd and Freeman Ditch and the Camp Brothers Ditch, both below City of Greeley, divert portion of this return seepage water, but notwithstanding these diversions, there is something like 50 cubic feet per second being discharged constantly into South Platte River. I do not mean to say that all of the seepage and return to Poudre River reaches the stream below the headgate of the Greeley No. 3 Ditch.

The seepage and return water that reaches the river above the Greeley No. 3 Canal is taken out by various ditches, particularly by Greeley No. 3 itself.

Considerable water reaches the Platte River directly. This water originated in the Poudre River. This amount is not readily deter-

minable. My first estimates are to effect that it was about 20,000 acre feet per annum. In order to be well within any possible error, I have placed this at only 10,000 acre feet per annum. Adding this to 110,000 acre feet which discharges from Poudre, we have total of 120,000 acre feet per annum.

247,313 acre feet is the net amount of water consumed by the lands irrigated by the Cache la Poudre ditches and is the net consumption in the Poudre Valley. It is obtained by subtracting 120,000 acre feet from 367,313 acre feet.

3413 I have reports from official source as to number of acres irrigated in Cache la Poudre Valley. Water Commissioners are required under law to report amount of land irrigated in their districts. The reports of Water Commissioners are compiled in office of State Engineer and published in reports of State Engineer. These amounts as taken from reports of State Engineer for Cache la Poudre Valley are as follows:—1897—166,500 acres; 1898 records are incomplete; 1899 it is stated as about 172,000 acres; 1900 at about 186,000 acres; 1901 about 190,000 acres; 1902 about 97,910 acres, this is obviously an error as there was no falling off of the irrigated acreage in 1902. I think it probable that the figure should have been 197,910 instead of 97,910 acres. It might also be due to fact that Water Commissioner for that year made incomplete returns. Reports for 1903 and 1904 are not given. Report of State Engineer for these years never having been published. In 1905 area is given as 174,742 acres; 1906 about 209,118; 1907 about 200,120; 1908 about 203,890; 1909 about 207,455; 1910 about 212,940; 1911 about 248,480 and 1912 about 224,180 acres. These records, assuming them to be correct so far as they go, are not complete records of irrigated area of Cache la Poudre Valley. There is considerable area not reported on at all. Only those ditches were reported on which water commissioner had duties to perform. Those which are not included, being some of the small river ditches, that is ditches covering bottom lands along the river, but more particularly ditches which used seepage water flowing in gulches and small streams which water never reaches the river. There are quite a number of these last named ditches. In the aggregate there would be considerable area, although under any one of them it would probably be quite small, a few hundred acres.

Figures given are amount of land reported to have been irrigated. Amount of land under ditch was also reported in 1912. In that year it was reported as 376,750 acres. This figure, however, included amount of land in the Greeley-Poudre Irrigation District. By deducting 125,000 acres from amount given by reports, amount of land under ditch outside of Greeley-Poudre Irrigation district was 251,750 acres.

Exact quantity of land irrigated in Cache la Poudre Valley is not known, but it is safe to say that it was between 250,000 and 275,000 acres, probably more even that 275,000 acres. I have assumed something of an average between 250,000 and 275,000 acres and for purpose of this discussion I call the irrigated area 265,000 acres.

Difference between amount irrigated and that under ditch is ac-

counted for by land which, lying fallow, happened from any cause not to have been irrigated for that particular season or was occupied by ditches, reservoirs, roads, corrals etc. Properly speaking these areas should be included in total, as they constitute a part of the irrigation plant, for example, if a man owns 160 acres and ten acres are occupied by rights of way, corrals and other uses such as I have mentioned, it is a part of his plant and we generally say that his entire 160 acres was irrigated. The Water Commissioner, however, in making his report takes actual acreage irrigated in each different crop and aggregate of these he calls total irrigated acres and in this way he misses entirely land occupied by reservoirs, roads etc.

3415 300,000 acres of land are irrigated or irrigable in the Poudre Valley. In my experience, amount of unirrigated land in district similar to the Poudre Valley would be about 15%.

247,313 acre feet was net consumption of water in Cache la Poudre Valley as already shown.

265,000 acres of land are irrigated in the valley as already stated. This is rather a restricted definition of irrigated land. It does not take into consideration the exceptions already noted.

Duty of water in this valley based upon amount of original water entering the valley is less than one acre foot per acre.

To verify this duty of water based on amount of original water entering valley and disregarding return seepage, I might recall testimony of A. A. Edwards, one of witnesses in this case. He testified that under The Water Supply and Storage Company's system, there is about 50,000 acres; average consumption was something over 60,000 acre feet per annum or about 1.2 acre feet per annum. By use and re-use of water made possible through return seepage, duty of the district as a whole as shown is less than one acre foot per annum per acre.

This duty, in my opinion, will rise somewhat and it may be that sometime in the future the duty of water in the district as a whole, measured in terms of original water entering the district, will rise to ¾ of an acre foot per acre per annum in terms of original water entering the district.

3416 Under the present methods of irrigation and the present incentive toward economical use, I believe that one can assume that the duty of water where the rainfall, climate, soil and crops are such as they are in the Poudre Valley, the real duty and accomplishment which might reasonably be expected, will be less than one acre foot per annum per acre and the use and the duty as measured at the headgate of ditches would be not more than 1.25 acre feet per annum per acre.

Under the assumption of elim-ation entirely the 120,000 acre feet, passing into South Platte River from Poudre Valley, and considering only the amount of original water which enters valley, which I have given as 367,313 acre feet, the duty would be about 1 1/3 acre feet per acre per annum. But that hardly means anything, because regardless of what water of necessity passes out of valley, there is still an amount which is forced out of valley, that

is out of District No. 3 for the use of ditches below, at least that quantity should be deducted from amount of original supply, because part of that water which is so forced out of district is original water.

Considering subject from original water suppply alone used in Poudre Valley, duty of water would be less than 1 1/3 acre feet per annum per acre. We speak of it as the duty of water being higher, that is, the accomplishment greater.

I have placed 10,000 acre feet per annum as total inflow into the Cache la Poudre River between the canon and the mouth. A large portion of this is return seepage which comes to stream above the head of Greeley No. 3 Canal. The elimination of this 10,000 acre feet from the total supply of the valley would make very little difference in the ultimate figures. Considering only the original water which enters the valley and is about 357,000 acre feet, in round numbers, the duty would still be about 1 1/3 acre feet per annum per acre. Under the first assumption, to be more correct, duty would be about 1.38 acre feet per annum per acre and in latter case where 10,000 acre feet is eliminated, duty would be 1.35 acre feet per annum per acre. Elimination of the 10,000 acre feet would make a difference of only .03 acre feet per acre per annum.

The figures just given, it will be observed, show a lower duty of water than that accomplished on the system of The Water Supply and Storage Company, according to the testimony of Mr. Edwards. That shows that discharge from Poudre River into South Platte River must be deducted or should be deducted.

Actual practice disproves any idea which might be advanced against discharge of water from Poudre River into Platte, according to experience of Mr. Edwards, as Preisdent and Manager of The Water Supply and Storage Company.

There is a gauging station at Glendevey on Laramie River in Colorado. That station is about nine miles below west portal
3418 of the Greeley-Poudre Irrigation District's tunnel. Records for this station are for 1904, July to October inclusive; 1905, April to October inclusive; 1910, August 15 to November 30 inclusive; 1911, January 1 to November 30, inclusive; 1912, January 1 to November 30, inclusive; 1913, April 21 to October 19 inclusive.

(Defendants' Exhibit 125, Table showing flow of Laramie River at Glendevey, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 125.)

State of Colorado—Engineering Department.

Discharge of Laramie River at Glendevey, Colo., for 1904–05, '10, '11, '12, '13.

Drainage Area, 102 Square Miles.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1904.....	.....	.....	.....	.....	.....	.....	10.140	3,898	1,886	1,636	.....	.....	
1905.....	.....	.....	.....	1,862	14,798	37,310	9,961	3,732	1,101	523	.....	.....	
1910.....	.....	.....	.....	.....	.....	.....	.....	.....	2,499	2,214	1 607	.....	
1911.....	998	714	1,248	2 309	15,096	29,151	8,144	2,323	1,571	2,152	1,174	.....	
1912.....	1,200	906	1,119	1,194	12,619	32,276	16 374	3,298	2,200	2,297	1,468	.....	
1913.....	.....	.....	.....	4,000	12,113	11,840	3,911	1,962	1,654	2,000	.....	.....	
Mean..	1,099	810	1,184	2,341	13,656	27 644	9,706	3,043	1,818	1,804	1,412	1,200°	65,717

° NOTE.—Mean for December estimated.
Table showing average run-off in acre ft. for each month.
Mean yearly flow 65,717 acre ft.—12 plus inches in depth.
Mean yearly flow including Laramie River Ditch 83,790 acre feet—15 plus inches.
Mean yearly flow including Laramie River Ditch and Water diverted through Sand Creek about 86 150 acre feet—15.8 inches.

Defendants' Exhibit 125 is table which I have prepared showing flow of Laramie River at Glendevey rating station. Flow of water is expressed in acre feet. This is shown for each month of the several years of which we have record, together with mean discharge for each of months. Aggregate discharge of all the months, as shown by mean, giving as a result average flow for year at gauging station. It also gives total including diversions by Laramie River Ditch (Sky Line Ditch) and by the Wilson Supply Ditch, the discharge of these two ditches being added to annual discharge passing the station.

Glendevey rating station is on Laramie River at point about 15 miles due south from Colorado-Wyoming line, just below mouth
of Deadman Creek, that is, point where Deadman Creek
3419 enters Laramie River. It is some nine miles below tunnel of
the Greeley-Poudre Irrigation system and about 14 miles north of Chambers Lake. It is below Rawah Creek which is one of larger tributaries of Laramie River. It is about 10 miles above mouth of McIntyre Creek. It is very close to northerly or upper end of East Side Collection Ditch and some 4 miles in due northerly direction from upper or northerly end of West Side Collection Ditch. The station is below all of the inter-mountain diversion systems from the Laramie River, except that diverted from Sand Creek and with the exception of possible diversion from McIntyre Creek which we have generally called The Lower McIntyre Diversion.

The Lower McIntyre Diversion is the only remaining extension of this system which is possible under geographical conditions surrounding it. I should add, that at extreme head of McIntyre Creek there are some 2 square miles of territory which will be tapped by Upper Rawah Ditch. Speaking with reference to drainage areas, the Glendevey station is above this area of 2 miles at head of McIntyre. Otherwise Glendevey station is below all the diversions and all of the water which can be diverted by the Greeley-Poudre system, by the Sky Line or the Wilson Supply or Divide Ditch and all water diverted by these canals will pass this station.

65,717 acre feet per annum is mean flow of river at Glendevey station, as given by Exhibit 125 and as shown by records which we
have. This Exhibit 125 needs perhaps a little explanation
3420 in order to avoid confusion and explanation later. Record
for October, 1913, was estimated from a partial record of that month. Partial record gave 19 days equal to 1,313 acre feet. I have assumed for whole month 2,000 acre feet. Records for June, 1904, are not recorded; record for that portion of that month was so short that I did not feel able to fill out the discharge for that month from so short a record. In 1910 record, although about one-half of month of August is given on original records, I made no attempt to fill out that month. 1911 there is no change in the record. 1912 records are quite complete from January to November inclusive, and no changes were made. 1913, as previously stated, month of October was filled out and also month of April. For last

10 days of April discharge was 1,395 feet, for entire month of April I have given it in round numbers as 4,000 acre feet. Discharge for month of October is generally more than that of September. Amount of water seems to increase as weather gets colder, due in part to loss of evaporation during cooler weather and in part to fall rains.

65,717 acre feet is actual run-off according to this record at this particular point as shown by table.

This discharge record at this station does not include water diverted by Sky Line Ditch of The Water Supply and Storage Company, nor by The Wilson Supply Ditch, which I have previously mentioned.

86,160 acre feet is mean yearly flow of Laramie River at Glendevey rating station, if water diverted through Sky Line Ditch and Wilson Supply Ditch is added to the amount actually flowing past the station. This figure was obtained by adding discharge of those two ditches to 65,717, while previous figure, 83,790 acre feet was obtained by adding discharge of Sky Line or Laramie River
3421 Ditch to 65,717. When on this table, Exhibit 125, I include Sand Creek Ditch, I only refer to the upper portion of ditch which diverts water from Deadman Creek and which is known also as the Wilson Supply Ditch. This table does not show water diverted into Poudre water shed from Sand Creek alone, but does show the portion which comes from Deadman into Sand River Creek and then later into the Poudre.

Explaining the legend "Mean yearly flow, 65,717 acre feet equals 12 plus inches in depth." I will state:—The drainage area is 102 square miles or 65,280 acres, above this station. A discharge of 65,717 acre feet from this area would be a little in excess of one foot or twelve inches per acre. I therefore put it 12 plus inches, indicating that depth of run-off through this period of which we have record over this water shed comprising about 102 square miles was about one foot in depth over entire drainage area. This 65,717 acre feet, however, does not represent total supply furnished by this water shed, part of it having been diverted through Sky Line Ditch and Divide Ditch. Adding amounts that were diverted to amount as shown at gauging station, and on same basis of 102 square miles, the drainage area, we find that the run-off expressed in depth over the entire drainage area including the Sky Line is 15.4 inches, while adding diversions through the Wilson Supply Ditch and the Sky Line ditch the run-off over the water shed was 15.8 inches. This 15.8 inches might be assumed to show as indicated by records given, that this water shed discharges 15.8 inches of water for the entire water shed.

3422 Expressing it otherwise, Sky Line Ditch, or, as noted on the exhibit, the Laramie River Ditch, and the Wilson Supply Ditch, or, as noted on exhibit, the Sand Creek Ditch, would divert a quantity which might be represented by 3 plus inches over the entire water shed. Taking the Wilson Supply Ditch alone, its supply of water diverted from Deadman Creek would be represented by .4 of one inch over the entire water shed. By the water shed I

mean to be understood as referring to the restricted water shed which I before mentioned of 102 square miles.

By referring to measurements on Laramie River and those on Poudre River, for purpose of arriving at basis of normal flow, I will state that years of which we have record at the Glendevey station were probably below normal. The table, Exhibit 124, showing percentage of run-off in Cache la Poudre River, and another table which I will submit later of the flow of the Laramie River at Woods Landing for the different years for which we have record, as compared with average shown by yearly record, indicates that these years when there were records taken at Glendevey, namely 1904, 1905, 1910, 1911, 1912 and 1913, in combination gave an average of 87% of normal based on Poudre records. These years based on Woods Landing records gave an average of 84.5% of normal. The records of this station are not entirely satisfactory. The year 1910 the record was very short, but I have assumed that these years in combination are 85% of normal.

Normal discharge of Laramie River at Glendevey rating station, actually passing that station, would be about 77,000 acre feet per annum, on the basis above mentioned, instead of 65,717 acre feet as actually shown by the records of the years we have.

Estimate of run-off of area above Sky Line Canal and discharge from Sky Line Canal indicates that that canal carries about 75½%
of total supply furnished by watershed above the ditch, from
3423 Laramie drainage into the Poudre. Developments under Greeley-Poudre system will probably be little if any more efficient, although it will be able to divert the winter flow furnished by that portion of drainage area lying above the tunnel.

Winter flow of Laramie River at mouth of tunnel will be about 10 cubic feet per second of time during the winter months. Except under unusual conditions, it will be impossible to carry water through the Collection Ditches during the winter. They will freeze over, probably would entirely choke with ice. Some water might be run, but the delay in opening up in the spring and the danger of such proceeding, in my judgment, would almost preclude possibility of carrying water in winter through those two ditches, so that efficiency of system might be somewhat greater than efficiency of Sky Line and this system might divert from 70% to 75% of water passing Glendevey rating station. This would be with aid of the two Collection Ditches. There is some considerable area below the collecting ditches whose water passes Glendevey station, all of these things considered, about 75% of run-off could be carried to and through the tunnel.

This measures total amount of water which can be diverted to and through the Greeley-Poudre tunnel, with the exception of what might be diverted by possible construction of extension of West Side Collection Ditch to the McIntyre.

Confirming this estimate of 77,000 acre feet of water as the normal
amount actually now passing the Glendevey rating station,
3424 year 1912 is approximately normal. We have records fairly complete for that year and flow as shown by records for that

year was 74,950 acre feet, to which I added 1,050 acre feet as estimated flow for month of December, this would give a total of 76,000 and seems to confirm or at least checks quite closely with other method or timate which gave 77,000 acre feet.

56,000 acre feet, in round numbers, I assume could be diverted through the Greeley-Poudre tunnel. This figure is about 74% of the 77,000 acre feet, and if there is any error I think the figure is perhaps a little high. I have included in this 56,000 acre feet, the diversion from 2 square miles area at the head of the McIntyre Creek.

The extension of the West Side Collection Ditch to McIntyre Creek, according to suggested plan, would tap an area of about 26 square miles or about 15,640 acres. We have records on McIntyre Creek near point where such extension would tap the stream. We also have records at the mouth of McIntyre. I understand that this extension of this ditch to McIntyre Creek is very problematical and that it represents a possibility and not a probability.

The extension of the West Side Collection Ditch to McIntyre Creek, would represent the ultimate and only possible future development and extension of diversions of water from Laramie River to the Cache la Poudre River.

3425 My estimate that 70% to 75% of water at Glendevey station can be taken to and through the tunnel, refers only to water at present passing Glendevey station, after Laramie River (Sky Line Ditch) diversion and Wilson Supply Ditch (Sand Creek Ditch) diversion from Deadman and Laramie River have been made. At this point, in order to make that matter clear, I would say that my estimate for diversion from 2 square miles at head of McIntyre Creek is 3000 acre feet. While this does not represent a total run-off of that area, yet in view of probable lateness of season at that high altitude, limited capacity of Collection Ditches, etc., I think it is about what we could expect to divert from that source.

If Lower McIntyre extension is built, water which had not been diverted by Upper Rawah Ditch, which taps it, would of course be available at lower station. I have estimated that flow of McIntyre at its mouth is 34,250 acre feet per annum. Deducting from this the 3,000 acre feet which will be diverted by Upper Rawah Ditch, we have a net of 31,250 acre feet available at the mouth of McIntyre Creek. The area which will be tapped by the Lower McIntyre extension ditch is about 19 square miles as against 49 square miles for the entire McIntyre. Probably 2/5 of this discharge originates in this 19 square miles or about 20,000 acre feet of water. If this is case we are able to divert 75% of water passing at head of this extension and we would secure 15,000 acre feet in addition to the 3,000 acre feet diverted from the Upper McIntyre. Reason for not giving entire flow of McIntyre, as available to tunnel, is because high water on McIntyre exceeds capacity of proposed extension canal and exceeds at times capacity of West Side Collection Ditch as now planned and partially constructed. It accordingly seems that 15,000 acre feet is as much as could be diverted from the lower McIntyre.

The total ultimate development of the Greeley-Poudre system might therefore reach a diversion of 56,000 acre feet plus 15,000 acre feet or 71,000 acre feet.

This added to what the Sky Land Ditch might divert and also what the Divide (Wilson Supply Ditch) Ditch might divert, 18,000 acre feet in case of Sky Line and 2,000 acre feet in case of Divide, would indicate an ultimate possible diversion from Laramie water shed of 91,000 acre feet, but in all probability this diversion will be limited to 76,000 acre feet. This latter figure is obtained by assuming only 56,000 acre feet as the ultimate diversion through the tunnel instead of 71,000 acre feet.

18,000 acre feet credited to Laramie River Ditch (Sky Line Ditch) is based on what has been done in past, average diversion in past being something less than 18,000 acre feet per annum.

Heard testimony of Mr. Whitting, a witness for State of Wyoming. He gave list of ditches on Laramie River in Colorado. Of these ditches, so far as I know, only the Long Park No. 2, and Link Ditches No. 1 and No. 2 divert their waters above Glendevey

3427 Station.

Next rating station below Glendevey is at Boswell's or Decker's. Boswell's Station is about ½ mile north of Colorado-Wyoming line in State of Wyoming, while Decker's station is about ½ mile south of interstate line. These two stations were supposed to be the same, although there is one considerable tributary called Stuck Creek which comes in to the river between the two stations. They were established, I believe in order to determine amount of water which is passing out of Colorado into Wyoming. Think they were first established by United States Geological Survey, that is to say, the Decker's ranch station in 1904.

In order to utilize both sets of records, it is necessary of course to make allowance for amount of water which enters Big Laramie River between the two stations. We have records of this creek, Stuck Creek, for 1912 and 1913.

3428 Stuck Creek enters river between the two stations from the west and comes from high mountain area constituting divide between North Platte River drainage and Laramie River drainage. The 1912 record of Stuck Creek, was made by Professor L. G. Carpenter and the 1913 records were made under direction of State Engineer of Colorado. Discharge measurements in these two years were made about twice a week, and it is assumed in estimating flow of Stuck Creek, that these measurements represent average amount of discharge between dates of actual measurements. Records made by Professor L. G. Carpenter, cover period from May 27 to July 5, 1912. I have estimated discharge for 1912 on Stuck Creek based on these measurements.

Cross-examination by Mr. N. E. Corthell:

Records on Stuck Creek were made once a week perhaps in 1912 by Professor Carpenter and in 1913 by one of hydrographers of State Engineer's office. These records were made on Stuck Creek. Previous measurements at Decker's and Boswell's stations were made

on river alone. They were in years 1904, 1905, 1906 and 1908, a considerable period before we measured Stuck Creek flow. Concerning Stuck Creek I am testifying about 1912 and 1913 flows.

Direct examination by Mr. Fred Farrar:

In order there may be no confusion, the statement which I have made relative to measurements for 1912 and 1913 refer solely to Stuck Creek. I am not yet talking about measurements made at Decker's or Boswell's. In 1912 measurements on Stuck Creek for month of June were five in number and I estimated flow for
3429 that month as 3451 acre feet. Discharge for May based on two measurements I estimated at 1735 acre feet. Discharge for July, based on two measurements I calculated to be 1435 acre feet, with the result that I estimate the annual flow of Stuck creek for year 1912 to be about 8815 acre feet. In 1913 measurements were made by hydrographer for State Engineer's office of Colorado and in May six such measurements were made. From these measurements I estimate discharge for that month at 2048 acre feet. In June ten measurements were taken and from these ten measurements I estimate discharge for month of June at 904 acre feet. In July ten measurements were taken and from these I estimate discharge for that month was 156 acre feet. Last measurement was made on July 31, when one cubic foot of water per second of time was running and I have called discharge for the month of August one cubic foot per second or 61.5 acre feet for the month. One cubic foot per second would be about two acre feet per day. The aggregate discharge for 1913 May, June and July was 3108 acre feet. Assuming these three months ran 70% of the annual flow, I estimate annual discharge for 1913 for Stuck Creek at 4440 acre feet.

Year 1912 was approximately normal in discharge of water in this vicinity, while discharge for 1913 was only about 51% of normal.

Normal discharge of Stuck Creek, based on 1913 records at 51% would therefore be 8800 acre feet. My conclusion is that this creek discharges normally about 9000 acre feet per annum.

In utilizing records at Decker Station on Big Laramie River, and combining them with those of Boswell Station records, it is necessary to make allowance of 9000 acre feet annually from Stuck Creek and other territory draining into river between the two stations. I have prepared a table giving records of discharge of Big Laramie River at Decker's and Boswell's and this table will be used in connection with discussion of discharge at these stations and across Colorado state line into Wyoming.

(Defendants' Exhibit 126, table showing flow of water at Decker's and Boswell's Stations, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 126.)

State of Colorado—Engineering Department.

Discharge of Laramie River at Decker's and Boswell's Ranches.

Decker's Ranch.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1904.....	.....	.....	.....	.....	.....	.....	12,746	4,067	2,547	2,577	.....	.....	22,537
1905.....	.....	.....	.....	2,981	28,160	69,020	13,040	6,014	2,356	1,703	.....	.....	123,274
1906.....	.....	.....	.....	.....	52,000	51,763	17,954	8,240	6,800	.....	.....	.....	136,763
1908.....	.....	.....	2,500	3,392	15,822	34,402	12,328	8,093	6,200	.....	.....	.....	82,737
Total..	.....	.....	2500	6,373	95,982	155,191	56,068	27,014	17,903	4,280	.....	.....	.....
Mean..	.....	.....	2,500	3,186	31,994	51,730	14,017	6,754	4,476	2,140	.....	.....	116,797

Boswell's Ranch.

1911.....	.....	.....	.....	.....	37,000	47,125	13,684	4,389	2,563	4,185	3,709	.....	112,655
1912.....	.....	.....	.....	4,500	32,783	92,912	34,087	7 545	5,078	5,343	3,405	.....	185,653
1913.....	.....	.....	.....	10,500	31,742	26,214	8,287	3,400	3,004	4,366	3,332	.....	90,935
Total..	.....	.....	.....	15,000	101 525	166,251	56,058	15,334	10,735	13,894	10,446	.....	.....
Mean..	.....	.....	.....	7,500	33.842	55,417	18,686	5 111	3,578	4,631	3,482	.....	132,247

Defendants' Exhibit 126 shows flows at these two stations. Units are expressed in acre feet. Table covers records at Decker's Ranch as follows: 1904, July to October; 1905, April to October; 1906, May to September; and 1908, March to September. Boswell's Ranch records cover following periods: 1911, May to November inclusive; 1912, April to November inclusive; 1913, April to November inclusive.

In estimating from these records, what the normal discharge past these two stations is, it is necessary to take percentages as indicated by Cache la Poudre River for reason that there are no records for 1904, 1905, 1906 and 1908 at Woods Landing. That is, it is necessary to take the percentages of flow based upon the normal. We can, however, use percentages on Laramie River itself for year- 1911,
1912 and 1913. Mean flow based on average for those three
3431 years would not be as safe an estimate of normal as one based on thirty years.

Taking percentage as shown on Poudre and at Woods Landing Stations we find that normal discharge based on this table would be about 155,000 acre feet, to which should be added amount of water which was diverted across divide from Laramie River into Poudre drainage. I assume diversions of those two canals during those periods to average about 20,000 acre feet per year. This is the amount diverted out of the water shed.

After making deductions of 9,000 acre feet for amount of water entering river between the two stations, then I combine records with those at Boswell's and assume that the records were at same point, with the result, as I have said, that the discharge appears to be about 155,000 acre feet per annum. But during these years, I have assumed that there were diversions from Laramie River averaging 20,000 acre feet, which waters were taken out of water shed. Had these not been made, discharge past these stations would have been about 175,000 acre feet.

There is considerable water originating in state of Colorado, which does not enter Laramie River until river has passed into Wyoming. Water from several creeks and particularly Johnson and Beaver Creeks on the west side of Laramie River, head in Colorado but discharge their waters below Boswell gauging station, so that in order to determine amount of water which passes from Colorado into Wyoming, these creeks must also be taken into account. Johnson and Beaver Creeks I have estimated discharge 22,000 acre feet of water per annum, which originated in Colorado.

These creeks derive some water from Wyoming, but in explanation of how the 22,000 acre feet was obtained for Johnson and
Beaver Creeks, I wish to say that we have record of discharge
3432 of those two creeks for 1912 and 1913. These records were taken in manner similar to the ones taken on Stuck Creek. In 1912 the discharge of Johnson Creek, practically all of which originates in Colorado, I estimate at 16,000 acre feet per annum and I estimate discharge of Beaver Creek, based on measurements of 1912 and 1913 at 11,500 acre feet. Larger part of water of Beaver Creek probably comes from State of Colorado, and I

have credited to Colorado 6,000 acre feet of the 11,500 acre feet. In 1913 a number of measurements were taken on these two creeks. On Johnson Creek as follows:—April 28 and 29, two measurements; in May, six measurements; in June, seven measurements; July six measurements; for May, June and July aggregate on Johnson Creek was 2628 acre feet. Assuming that those months yield 70% of the total annual flow, flow for 1913 would be 3755 acre feet. There are, however, on these streams, two ditches which use a considerable per cent. of water, especially in years of low flow. The percentage in years of low flow of course, is actually greater than in years of high flow. On account of these diversions and variances occasioned thereby, in years of low flow, 1913 can hardly be taken as a basis. On the other hand 1912, which I have stated is approximately normal, shows a discharge for June of 4998 acre feet; for July, 3630 acre feet; for August, 1045 acre feet; for September, 310 acre feet; and for May, based on records of last half of month, flow for mouth was estimated at 2263 acre feet. This is flow of Johnson Creek. Making a total for May to September inclusive, of 12,246 acre feet, allowing for missing months, I have estimated discharge at 16,000 acre feet. I do not know exact location of ditches from Johnson and Beaver Creeks. It is my understanding that they are but a short distance above mouth. As Professor Carpenter made these measurements and is more familiar with them, I think he would be able to give that much better than I could, also discription of ditches. These ditches are in Wyoming.

Beaver Creek discharge I have estimated at 11,500 acre feet for year 1912, and that, being a normal year, I take it as approximately a normal discharge. Records of 1912 made by Professor Carpenter indicate discharge for May of 3064 acre feet; June, 2916 acre feet; July, 922 acre feet and it is on basis of these three months which aggregate 6902 acre feet, that I estimate annual discharge as 11,500 acre feet. About 9 square miles of better portion of drainage area of Beaver Creek are in State of Colorado. Map attached to the Answer of Corporate Defendants, Exhibit 1, indicates that there is nearly 9 miles of divide between Laramie and Platte River drainages in Colorado as against little more than 3 miles of such divide in State of Wyoming; so that notwithstanding smaller drainage area is in Colorado, fact that better drainage area is in Colorado leads me to conclusion that at least half of total discharge originates in Colorado. The 16,000 acre feet for Johnson Creek added to the 6,000 acre feet of Beaver Creek water originating in Colorado makes 22,000 acre feet from these two streams, which I have added in order to obtain total amount furnished by State of Colorado making a total of 197,000 acre feet.

This does not take into account any water which might be discharged into Wyoming from Colorado through Sand Creek. This 197,000 acre feet includes the Sky Line (Laramie River Ditch) and Wilson Supply (Sand Creek) Ditch. For sake of completing the record, I might say that in 1913 discharge of Beaver Creek for May, June and July aggregated 2,589 acre feet. Assuming that these three months represent 70% of annual flow, annual flow was 3,700

acre feet for 1913. 1913 was about one-half of the normal and normal as indicated by these 1913 records, would be 7,400 acre feet as against 11,500 acre feet as derived from records of 1912. There are however some ditches on this stream, and in periods of low flow that seriously affects the flow of the stream or rather the percentages of flow at the mouth, so that this year cannot be well used in estimating what the normal discharge of that stream might be.

Estimate of 197,000 acre feet is based upon records at both Decker's and Boswell's augmented by records of Stuck, Johnson and Beaver Creeks. Records at Decker Ranch are very questionable. In fact we have really two sets of records, one kept by Water Commissioner in Laramie River District and one as published by United States Geological Survey. They do not agree. Records as shown by Water Commissioner being very much higher. Station at Decker's was established in 1904 and the hydrographer, Mr. Lamb, who was making measurements in that year, furnished Water Commissioner with a rating table and from this rating table discharge was es-
3435 timated. Mr. Decker kept record of gauge heights at this station and was also the water commissioner. He was considered a very reliable man, and as far as records of gauge heights are concerned, I think there is no question of their reliability. I have taken the rating table as furnished by the hydrographer, Mr. Lamb, to Water Commissioner Mr. Decker, and have made discharge table for 1904, with result that in month of July, 1904, by the Lamb rating table, discharge was 14,193 acre feet as against 12,746 acre feet as published by the Geological Survey. It is published in Water Supply Papers No. 131 and 172 of U. S. Geo. Survey. In August by Lamb rating table the discharge was 5922 acre feet as against 4667 acre feet as published. In September discharge by Lamb rating table was 3453 acre feet as against 2547 acre feet published record. In October Lamb rating table gave discharge of 3403 acre feet as against 2577 acre feet as published. In October Lamb rating table gave discharge of 3493 acre feet as against 2577 acre feet as published. The aggregate for months July to October by Lamb rating table is 27,061 acre feet as against 22,537 acre feet as published.

In table for Decker Station as shown on Exhibit 126 I have used lower or published record. I also used published record for 1905. This I might say was equally an error, reliability of records of that year are certainly questionable.

Examining discharge at Glendevey rating station for July, 1904, and comparing it with published record at Decker's for same month and same year, inflow between Glendevey and Boswell's, according to published records, was only 2606 acre feet. McIntyre and other considerable tributaries enter river between those two stations and it is
3436 certain that a greater amount of water than 2606 acre feet entered river during the month of July, 1904. This to my mind proves unreliability of published records.

I therefore have found it necessary to discard this estimate of normal flow at state line as determined by Boswell and Decker records combined, that is, I have thought it necessary to discard the figure

197,000 acre feet as being the amount even approximately which is contributed by State of Colorado to Laramie drainage.

This discrepancy between the Lamb rating table and the published records occurs through the fact that the rating table was worked out on the ground in all probability and furished Mr. Decker, so that he might have an idea of how much water was passing into Wyoming. The table was something of a preliminary nature, to be sure, but the published records were prepared several years after the date when the records were made. They were prepared in Washington, probably by someone who had no personal knowledge of the locality or the conditions. In a footnote in the published records, statement is made that certain of gaugings were probably too high because of a defective meter. That is a statement but scarcely an explanation. If meter was defective, it would give a lower discharge and amount of discharge should have been raised rather than lowered.

That would be true in all cases of a defective meter, discharge would be given lower than the actual fact. Anything which might happen to meter would cause it to run slower rather than faster. I think that would invariably be case.

Custom was for records to be worked up in Washington by clerks and that very fact has caused considerable trouble to those who have examined Government publications critically and it has cast doubt on the reliability in many instances. I think hydrographer who
3437 made measurements was decidedly better qualified to construct rating curve than someone unacquainted with local conditions or with methods of making measurements, and especially after a year or more had elapsed. Mr. Lamb, the hydrographer whom I have mentioned, was connected with U. S. Geological Survey.

Regardless of what explanation might be made or what theory might have been used in computing figures shown in published record, fact remains that they are considerably lower than rating table made by the hydrographer Mr. Lamb. And, further than that discharges as given, when considered in connection with discharge at Glendevey rating station above, prove conclusively to my mind that the Decker Station records were much too low and I feel justified therefore in discarding the published records.

Exhibit 126, in so far as it relates to discharge at Decker Station, should not be used.

A more accurate method at arriving at an accurate determination of amount of water discharged across interstate line, than that given by these records, would be to take discharge records at Boswell Station proper, eliminating records at Decker Station. I wish to state further in respect to records at Boswell's and Decker's, that years of record at Decker Ranch indicates a discharge of 116,797 acre feet, March to October inclusive, while records at Boswell Ranch April to November is 132,247 acre feet. These are on different
3438 years.

Normal flow of Poudre River, as previously testified, was determined by taking mean for period of 30 years at gauging station at mouth of Poudre.

Normal flow of Laramie River, using Laramie records exclusively,

was obtained at Woods Landing Station. Taking years covered by Decker records, but not those records themselves, those years in combination, so far as flow of Laramie River is concerned, give mean flow of 101% of normal.

Years shown by Boswell records are below normal. Using Cache la Poudre percentages, they were 81% of normal and using Woods Landing records, they were 85% of normal. In other words, eliminating Decker records and Boswell records as shown on Exhibit 126, I mean to state that years 1904, 1905, 1906 and 1908, when taken in combination were 101% of normal.

Years 1911, 1912 and 1913 were below normal and amount to 81% based upon normal as determined by Poudre flow, and 85% as based on normal as determined by Laramie River flow measured at Woods Landing station.

I have made calculation to determine amount of water passing state line in Laramie River. I used several methods for purpose of checking myself and to ascertain what different possible combinations might bring forth. A little later I will take my more detailed discussion of Woods Landing record, but for present I wish to use table which I have constructed relating to Woods Landing Station, as I need this table in determining run-off across state line from Woods Landing records.

(Defendants' Exhibit 127, table showing Woods Landing records, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 127.)

State of Colorado—Engineering Department.

Discharge of Laramie River (Net Run-off in Acre Feet) at Woods Landing (Apr. to Oct.) for 1895–1900 and 1911–1913.

	Woods Landing.	Skyline Canal.	Sand Crk. Ditch.	Net run-off, Woods Landing.	Per cent.	Per cent, normal.
1895.....	220,239	15,787	.....	236,026	109	105
1896.....	108,022	16,282	.....	124,304	58	55
1897.....	251,074	16,897	.....	267,971	124	119
1898.....	117,765	12,790	.....	130,555	60	58
1899.....	390,730	17,699	.....	408,429	189	182
1900.....	248,105	18 657	.....	266,762	123	119
1911.....	138,240	19,085	4,418	161,743	75	72
1912.....	213,407	20 986	2,157	236,550	109	104
1913.....	99,221	14,639	0	113,860	53	51
Mean....	198,545	.....	.....	216,244		

Cache la Poudre same years—96.1 % Normal—225,000 ac. ft.

Unless otherwise noted, all discharges are in acre feet.

C. L. C. M'ch 5, '14.

Exhibit 127 gives discharge at Woods Landing for years for which we have record, beginning with and subsequent to 1895. Woods Landing Station is about 9 miles due north of Colorado-Wyoming line. It is above the Laramie Plains. It is, you might say, extreme southerly end of Laramie Plains on Laramie River. River comes through cañon immediately above this station. From that point down Laramie Plains region begins to spread out on each side of river.

Table Exhibit 127 shows there was a mean discharge for 9 years given at Woods Landing of 198,545 acre feet. That is, the average of the first column on table is equal to that amount. This amount does not take into account either the winter flow or records at Woods Landing for years 1889, 1890, 1891, 1892 and 1893. The reason will be explained later.

3440 Period of year covered by figures on table, Exhibit 127, is for months of April to October, inclusive. I designate these months, November to March inclusive, as winter months. The seven months that I have shown in the table cover the irrigation season that is shown in column one. In column two is discharge of Sky Line Canal. Column three gives discharge of Divide or Sand Creek Canal. Column four is sum of first three columns. Column five is percentage of run-off of different years based on mean run-off of 216,244 acre feet and last column is correction of percentage based on percentage of flows on Cache la Poudre River. The length of these records is not quite sufficient to give mean sufficiently accurate.

Unit of flow, with exception of percentage columns, is expressed in acre feet. Complete records for Woods Landing Station, as far as I have been able to find them, are recorded in another table which I have prepared and in order to make the record complete I desire to refer somewhat to that table also.

(Defendants' Exhibit 128, containing complete records for Woods Landing Station, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 128.)

State of Colorado—Engineering Department.

Discharge of Laramie River (Run-off in Acre Feet) at Wood's Landing, Wyoming.

Drainage Area 393 Square Miles.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1889....	.....	.....	.....	10 000°	35.558	53,730	17 409	8,481	3,699	3,472a	14,400a	26,150a	166,899
1890....	14,198a	15,904a	15,801a	9,118b	56,157	58,278	23,219	11,619	4,890	5,125b	12,360a	7,160a	233 829
1891....	10,106a	15,456a	21,080a	16,440a	54,014	66,831	32,621	16,427	9,591	11,222a	6,840a	7,440a	268.068
1892....	20,900a	17,200a	10,270a	10,350a	27,500	74,500	.....	.....	.....	.....	.....	.....	160 720
1893....	14,651	26,123	.....	.....	.....	80,309	32,138	10,696	7,258a	3,704a	7,924a	7,020a	149.049
1894....	No record.												
1895....	.....	.....	.....	9,722	74,241	78,480	11,870	3,456	438	[illegible]	658	.....	179.440
1896....	.....	.....	.....	12.000	38,400	29,900	7,690	5,870	6,902	7 260	.....	.....	108.022
1897....	4,304	3,888	4,304	7,617	120,762	93,064	16,356	5,718	3,868	3,689	3,868	4,304	271,742
1898....	.....	.....	.....	7 676	39,106	57,659	5,472	2,705	2.380	2 767	6,444a	.....	124.209
1899....	46,116	39,987	44,271	33,977	78,950	191,663	77,044	11,744	3,332	3,997	4,165	9,223	544,469
1900....	10,945	11,718	10,699	7,438	119,286	105,679	7,010	3,074	2,618	.....	.....	.....	278.467
1911....	.....	.....	.....	.....	45,500	56 100	14.900	4,770	1,760	4,650	3,000	.....	130,680
1912....	.....	.....	.....	5,534	40.643	91,874	34,863	7,809	4,641	6,456	4 403	2.644	198,867
1913....	.....	.....	.....	.....	35,847	27,431	9,223	4,610	4,700	5,410	.....	.....	87,221
Total.	121,220	130,276	106,425	129.872	765 964	1,065.498	289,815	96,979	56,077	58,327	64,062	57,941	
Mean.	17,317	18,611	17,738	11,807	58,920	76,107	22.293	7,460	4.314	4 861	6,406	8,277	254,111

April 1 to Dec. 31—200,445 acre feet.
April 1 to October 31—185,762 " "

°Last 15 days was 6,406 acre feet.
aEstimated by Deputy State Engineer of Wyo. from unpublished gauge height records.
bRecords of State Engineer of Wyo.

This table, as I stated, contains all of data that I was able to secure for Woods Landing Station. It will be noted that a number of discharges credited to different months have letter "A" above them. These figures so indicated were estimates made by the then Deputy State Engineer of Wyoming, Mr. Harry True, I think, in year 1911 from unpublished gauge height records in office of State Engineer of Wyoming, and this table was prepared at the instance, I believe, of officers of the Greeley-Poudre Irrigation District, so that they might ascertain as nearly as practicable the run-off on Laramie River at that time.

Table compiled by Deputy State Engineer of Wyoming was furnished me by Mr. John R. Wortham, Engineer of the Greeley-Poudre Irrigation District.

Had all of these records been used in determining annual discharge at Woods Landing, discharge exclusive of diversions by Sky Line and Divide Ditches would have been 254,111 acre feet according to the table Exhibit 126. Previous records of discharge would appear to be that amount. Some of winter records, however, are questionable, and excluding all of winter records, that is months of January, February and March, average discharge for that portion of year exclusive of those months would have been 200,445 acre feet. Excluding, in addition to those months, months of November and December, discharge would have been 185,762 acre feet. That would be amount for April to October inclusive.

Records subsequent to 1894 appear to be more reliable, less open to question. For purposes of calculation affecting amount of water furnished by Laramie River from State of Colorado, I have used only years subsequent to 1894 and furthermore have taken only the records between April and October as basis. Winter records were not numerous and one at least I think was unreliable, discharge for January, February and March, 1899. Those are very much above records for average for those three months. I discarded records giving largest amounts for those three months.

3442 I give this explanation at this time, so as to show my reason for limiting figures on Exhibit 127 to years subsequent to 1894 and limiting them to months April to October inclusive.

Discharge of Laramie River as shown on Exhibit 127 is 198,545 acre feet, exclusive of Sky Line and Divide or Wilson Supply diversions. Months April to October inclusive, as I have previously stated, represent about 90% of annual flow. Average discharge for whole year therefore based on this table would be 220,490 acre feet. All these years in combination represent 96% of normal, as compared with percentages determined on Cache la Poudre River. Normal on this basis would be 230,000 acre feet. To those should be added diversions of Sky Line and Divide Ditches which estimate 20,000 acre feet. Had these diversions not been made, amount passing Woods Landing Station would have been 250,000 acre feet for a normal year.

In discussing Boswell Station discharge, I have stated that there were about 22,000 acre feet coming into river between Boswell's Station and Woods Landing Station. This is water furnished by

State of Colorado. Total inflow between two stations I estimated at 35,000 acre feet. Difference between 35,000 acre feet total inflow and 22,000 acre feet furnished by Colorado, is 13,000 acre feet. Deducting this amount from 250,000 acre feet passing Woods Landing station would leave 237,000 acre feet as furnished by State of Colorado. The figure 198,545 acre feet is not shown on
table, Exhibit 127, but that is average or mean of the first
3443 column

If exact amount of water diverted by Sky Line and Divide Ditches had been added to flow as shown on Column 1 in Exhibit 127, mean discharge including diversions of two canals would have been 216,244 acre feet. These years as previously stated are 96.1% of normal. This would result in a normal in round numbers of 225,000 acre feet which is merely arriving at practically the same point by a different method.

I wish to call attention at this time to amount which I have allowed as winter flow and that shown by actual record on Exhibit 128. Aggregate of winter months as shown by mean on said Exhibit aggregates 68,349 acre feet, while I have allowed but 32,000 acre feet on Exhibit 127. Flow for winter months, November, December for 1912 and January, February and March, November and December for 1913, have been given by Mr. R. I. Meeker in connection with his tables with reference to Pioneer Dam. Discharge for winter months for 1913 aggregates 14,924 acre feet according to Mr. Meeker.

Using 216,244 acre feet as shown on Exhibit 127 as gross run-off, April to October, inclusive, run-off based first on 96.1% with reference to the Poudre and the seven months at 90% of total year we have, discharge for normal year at Woods Landing 250,000 acre feet. Again deducting 13,000 acre feet, amount furnished by State of Wyoming at that point, discharge is again 237,000 acre feet.

Referring again to records at Boswell Station, one may make an estimate of discharge across interstate line from records at that station, omitting Decker Station records. Boswell Station records, April to November inclusive, average 132,247 acre feet, to which should be added 20,000 acre feet for Sky Line and Divide Canal diversions. These eight months represent about 92% of annual
flow. Annual flow therefore, including Sky Line and Divide
3444 Ditches would be 165,700 acre feet. The three years 1911,
1912 and 1913 represent 72,104 and 51 per cent. respectively of normal flow as shown by records at Woods Landing, that is, as shown by last column on Exhibit 127, was in combination 75%. On this basis of 75%, the discharge would be 220,933 acre feet, to which must again be added discharge by Johnson and Beaver Creeks of 22,000 acre feet. We therefore have a discharge across state line of 242,933 acre feet.

Still another method of arriving at this discharge and perhaps confirmatory of the figures already given, is to consider the year 1912, which was approximately normal, at Woods Landing. The discharge as shown on Exhibit 127, after making due allowance for Sky Line and Divide Ditches, for period April to October inclusive,

is 236,550 acre feet. This period again being 90% of the total annual discharge, the annual discharge would be 262,830 acre feet. Perhaps it would be better in this case, however, to take records for winter rather than using 90% as I have done heretofore. If this were done, total discharge at Woods Landing for year 1912 would be 256,396 acre feet. 1912, however, by Exhibit 127 appears to be 104% of normal. Normal therefore would be 246,500 acre feet, from which, however, must be deducted the 13,000 acre feet which passes this gauging station and originates in Wyoming, which would leave 233,500 acre feet as amount furnished Wyoming by Laramie River from Colorado.

Still another method of arriving at this discharge from Colorado will be obtained by taking records at Boswell station again of 182,248 acre feet, amount furnished in 1912 April to October inclusive, and adding thereto amount diverted in 1912 by Sky Line and Divide Ditches of 23,143 acre feet, giving total of 205,391 acre feet. This again on basis of 90% of discharge for that period of year would result in annual discharge being 228,821 acre feet, to which must again be added Colorado water furnished by Johnson and Beaver Creeks, namely 22,000 acre feet, giving total discharge across state line by Colorado water shed of 250,821 acre feet, being total for year 1912. 1912 was 104% of normal, as shown on Exhibit 127. Normal therefore would be about 242,000 acre feet.

These various methods of calculation agree quite closely with exception of results obtained by using Decker Ranch tables which we have discarded for reasons which I have stated.

By other methods of calculation we have 237,000 acre feet, 233,000 acre feet, and 242,000 acre feet, the average of which is 237,500 acre feet. This figure we may assume to be amount which is derived from Colorado exclusive of supply furnished by Sand Creek, they being based on reliable figures.

Sand Creek drainage in Colorado is about 50,000 acres from which run-off should be one-third of an acre foot per acre or in round numbers 17,000 acre feet.

254,500 acre feet is amount of water furnished Laramie River by Colorado, obtained by adding 17,000 acre feet from Sand Creek to the 237,500 acre feet average above stated. Colorado is at present diverting about 20,000 acre feet per annum or 8% through Sky Line and Divide Ditches. A previously stated, Greeley-Poudre Irrigation District may take 56,000 acre feet or 22% more and if Lower McIntyre Extension Ditch development should be added to that now planned, diversion would be 71,000 acre feet or a total of 28% including this development, and a total maximum development possible in all Colorado diversions would be 36% of the supply which the State of Colorado itself furnishes to the Big Laramie drainage. Even eliminating supply which is furnished by Sand Creek, 17,000 acre feet, and on basis of a total diversion of 91,000 acre feet, there would be diverted 38.4% of the amount
3446 furnished by Colorado. This is assuming Sand Creek supplied nothing whatever to Wyoming and assuming that ultimate possible diversions were accomplished.

38.4% would then represent extreme diversion which will be possible under any circumstances from Laramie River in Colorado and assuming in addition thereto that Sand Creek furnished no source of supply to the river whatever. With the flow of Sand Creek estimated as furnishing 17,000 acre feet per annum to the river, the extreme and ultimate possible diversion within Colorado would be 36% of the total flow of the Laramie River arising in Colorado. Without construction of a ditch which would tap the Lower McIntyre in the manner mentioned, the diversion would be 30% of the Laramie River water originating in Colorado.

Reversing the proposition, the fact is that with Sky Line Ditch diversion, Sand Creek or Divide Canal diversion, coupled with diversion through the Greeley-Poudre system, 70% of the water of the Laramie River water-shed rising within the State of Colorado must pass into the State of Wyoming, and that, notwithstanding anything which Colorado might do in future with exception of one extension to the Lower McIntyre. Wyoming is seeking in
3447 this action not only the 70% of the Colorado water which it must and will always receive, but in addition to that, the 22% of the Colorado water which it is proposed to divert through the Greeley-Poudre tunnel.

The year 1912 was approximately normal, determined by examination of 30 years' records on Cache la Poudre. Water sheds of two streams are adjacent and similar and one would expect percentage of flow to be similar. There would be differences in taking individual years, but taking several years, percentages should and did agree quite closely. I also arrived at that conclusion by an examination of the Woods Landing records themselves. Run-off was not 100% of normal, but was, as I have stated, 104% of normal. Had I, however, used Exhibit 122 and all of the records as shown thereon, and had I used records furnished by R. I. Meeker with reference to discharge at Pioneer Dam and confined myself solely to records of Big Laramie at Woods Landing, percentage of 1912 in respect to mean flow would have been 101%.

It seems to make little difference in fact whether one uses Woods Landing records exclusively or uses those in connection with records of Cache la Poudre. There could be but a difference of not to exceed 5%. For instance on Exhibit 127, 1912, or rather for that portion of the year 1912 April to October, is shown as 109% of normal, based on Woods Landing record subsequent to 1894, but it is well known fact and well recognized, that winter flow of year 1912 was considerably below normal. If we did include those winter records which were below normal, percentage would have been less actually than 109% shown. On Exhibit 127 I have this note:—"Cache la Poudre same years equals 96.1%, normal equals 225,000 acre feet." I mean by that that normal amount of flow in Laramie River at Woods Landing according to this table for years given and from April to October, would have been 225,000 acre feet, based upon determination of normal on the Poudre River.

At Woods Landing Station we have records more or less complete and more or less authentic and reliable for years 1889 to 1900 in-

clusive, with exception of year 1894. We also have records for 1911, 1912 and 1913, the only records. Most of them at least are not entirely above suspicion, probably on account of ice conditions and fragmentary conditions of records and lack of sufficient number of actual gauge readings during winter. 1912 record as shown on Exhibit 128, was amount given by R. I. Meeker in his tables showing discharge at Pioneer Dam. These records are from April to December inclusive for 1912. This amount for 1912 given by Mr. Meeker is open to serious question, especially for months of June and July, for reason that amounts given for those months for Pioneer Dam station are less than discharge for same months of that year at Boswell Station, notwithstanding that there is very considerable run-off during those two months from territory lying in between the two stations.

3448 (Defendants' Exhibit 129, table of discharges at Woods Landing 1911, '12 and '13, and for Boswell Ranch Station same years, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 129.)

State of Colorado—Engineering Department.

Discharge of Laramie River (Run-off in Acre Feet) Showing Differences in Flow Boswell's (Decker's) and Wood's Landing. These Differences Represent Inflow Between the Two Stations.

		Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1911.	Wood's Landing.....				7,000	42,600	58,100	15,600	7,100	3,190	4 650	.....	.....	
	Bosswell's Ranch.....				.....	37,000	47,125	13,684	4,389	2,536	4,185	.....	.....	
	Difference (inflow).....				.....	5,600	10,975	1,916	2,711	664	465	.....	.....	22,311
1912.	Wood's Landing.....				6,134	42 497	102,826	39,639	9.590	6 228	6,493	4,305	3,800	
	Bosswell's Ranch.....				4,500	32,783	92,912	34,087	7,545	5,078	5,343	3,405	.....	
	Difference (inflow).....				1,634	9,714	9,914	5 552	2,045	1,150	1,150	900	.....	32,059
1913.	Wood's Landing.....				12,000	35,847	27,431	9,223	4,610	4,700	5,410	3,377	3,246	
	Bosswell's Ranch.....				10,500	31 724	26,214	8,287	3,400	3,094	4,366	3,332	.....	
	Difference (inflow).....				1,500	4,123	1,217	936	1,210	1 606	1,044	45	.....	11,681

Unless otherwise noted, all discharges are in acre feet.

G. L. C. M'ch 5, '14.

Defendants' Exhibit 129 is table of discharges prepared by me, showing discharge at Woods Landing for 1911, 1912 and 1913 and for Boswell Station for same years. Difference in discharge of two stations is given in third line for three years and in last column to right of table is given total difference between discharge of two stations for period of year covered by records. This table is presented to show what the inflow during these years was be-
3449 tween the two stations. In 1911 difference of discharge between two stations was 5600 acre feet for month of May; 10,975 acre feet for month of June; 1916 acre feet for month of July; 2700 acre feet for month of August; 664 acre feet for month of September; and 465 acre feet for month of October, which month ends record for that year. Total difference between two stations for this year, 1911, being 22,311 acre feet. There was that much more water at Woods Landing than at Boswell's. 1911 was year of less than normal flow, in fact, from percentage tables presented heretofore, 1911 is shown to be about 72% of normal for Laramie River. In year 1913 difference between two stations was April 1500 acre feet, this figure however is based on estimates of discharge for that month for Woods Landing, records themselves, however, show that for month of May difference in discharge was 4123 acre feet; June 1217 acre feet; July 936 acre feet; August 1210 acre feet; September 1616 acre feet; October 1044 acre feet and November 45 acre feet, total difference of inflow for period April to November being 11,681 acre feet. This year 1913 was one of about 51% of normal flow.

It appears from records shown on table Exhibit 128, that record submitted by Mr. R. I. Meeker for 1912 for Pioneer Dam Station, is probably more than 10,000 feet too small for month of June and 20,000 acre feet too small for the year. The figures given by Mr. R. I. Meeker appear on a portion of table Plaintiff's Exhibit I.

As I previously stated years 1889, 1890, 1891, 1892 and 1893, on which we have records at Woods Landing, were discarded. A portion of these records was taken from report of State Engineer of Wyoming and balance was obtained as previously stated in 1911 from then Deputy State Engineer Harry True. He also furnished other compilation from unpublished data in Office of State Engineer. These are the ones I stated I discarded from my compilation. The use of that portion of table prior to 1895 does not affect materially final results for portion of year between April 1 and October 31.

Using all records mean annual flow at Woods Landing Station as shown is 254,111 cubic feet of which, as previously stated, 200,445 acre feet was discharged between April 1 and December 1 and 185,272 acre feet between April 1 and October 31. All these figures are shown on Exhibit 128.

If we eliminate very high and possibly questionable records for November, these being for years 1889, 1890, 1891, 1893 and 1895, average for November would be changed from 6406 acre feet as a mean, to 4386 acre feet as a mean. Records for December are also somewhat questionable, but using December, 1897 discharge which

amount was 4304 acre feet and 1889 of 9223 acre feet and 1912 of 2644 acre feet, average discharge in December would be 5390 acre feet inflow and 8277 acre feet if all records were used. It is well known fact that flow for November and December, 1912, was very low. Flow for 1911 in November at this station on Exhibit 128 I have placed at 3000 acre feet. That is also probably too low because records at Boswell station for same month in same year give discharge of 3405 acre feet. If we assume average for these 5 winter months of 5000 acre feet and discharge as shown on Exhibit, April 1 to October 31, of 185,762 acre feet, average discharge at Woods Landing would be 210,762 acre feet, to which we would add the diversions through the Sky Line and the Divide or Sand Creek Ditches, approximating 20,000 acre feet, making total run-off at Woods Landing 230,762 acre feet.

3451 These years are about 90% of normal and normal would therefore be 256,484 acre feet. As records for this station in 1912 given on Exhibit 128 are not to be used, we cannot take that year as basis for analysis. However, even taking these figures for that particular year discharge was 198,867 acre feet, adding 20,000 acre feet for diversion of Sky Line and Divide or Sand Creek Ditches, discharge April 1 to October 31 is 218,867 acre feet and total for year would be 243,180 acre feet.

Returning to Exhibit 129 and referring to year 1911, if we supply difference of 1500 acre feet for month of April, then on basis of 90% we find that difference for entire year would be 26,456 acre feet. This year is shown to be about 72% of normal. The indicated normal therefore is 36,700 acre feet as normal which enters river between Station at Woods Landing and at Boswell's. In 1912 differences were necessarily largely estimated. In fact discharge for Woods Landing Station was based on discharge record at Boswell Station to which records I added discharge of Johnson and Beaver Creeks and discharge of intervening territory. Inflow based on discharge of these and other accretions appears to be 40,000 acre feet, but it was thought best to allow very little run-off for unknown territory outside of Johnson and Beaver Creeks and quantities given in table are conservative. In 1912 differences shown in table were: April, 1634 acre feet; May, 9714 acre feet; June, 9914 acre feet; July, 5552 acre feet; August, 2045 acre feet; September, 1150 acre feet; October 1150 acre feet; November 900 acre feet and a total of 32,000 acre feet, and for April to October 31,159 acre feet, which on a basis of 90% for that period, April to October, total discharge for year 1912 is 34,620 acre feet inflow between two stations.

As confirming estimate for 1913, differences between discharge at Boswell's and Woods Landing made by hydrographer for State Engineer's office of Colorado might be given. Measurements at Woods Landing were made whenever hydrographer was in that vicinity. In May six measurements were made at that station, June seven measurements, July five, August one, September one and October one. With these actual gaugings as basis differences for different months at two stations would be as follows: May, 5547 acre feet; June, 2211 acre feet; July, 381 acre feet; August, 380

acre feet, September, 586 acre feet and adding 1500 acre feet for April and 500 for October, we have total of 11,100 acre feet as differences, which seems to confirm differences as shown on table, that difference being 11,636 acre feet. These records differ as to individual months, but as a whole they are quite close together. Very low flow for months of July and October, 1913, is probably due to fact that most of water in tributaries of stream was being used during those months. I refer to streams entering Laramie River between Boswell's and Woods Landing, particularly Johnson and Beaver Creeks. Year 1913 was a little over ½ of normal and this taken in connection with use of water upon tributary streams, would indicate a normal between 30,000 and 40,000 acre feet. For purpose
3453 of this discussion, however, we have assumed that average inflow between Woods Landing and Boswell's was 35,000 acre feet, although, as stated before, measurements made in 1912 indicate an inflow of at least 40,000 acre feet.

Referring again to list of ditches given by Mr. Whitting, a witness for plaintiff, diverting water from Laramie River and tributaries in Colorado, all of those ditches are above the Boswell gauging station. So that any water that might be used by those ditches above Boswell's gauging station is of course in addition to the flow which I have given at that point. It is not shown by the records which I have submitted. Amount which I have submitted is net run-off after these ditches have been supplied. Only ditches that I have considered or for which I have made correction are the Sky Line Canal and the Divide or Sand Creek Ditch.

(End of Transcript Vol. 7—Defendants.)

3454 JOHN R. WORTHAM, recalled.

Direct examination by Mr. Delph E. Carpenter:

I ascertained by survey location irrigated areas of land in Laramie River Valley in Colorado. Survey started May 9, 1913, and suspended May 23, 1913. Resumed August 17th and completed September 5, 1913. Survey made by stadia method. Had survey party at time I was engaged in work. Consisted of A. I. Akin and Milo Eidson. After survey reduced my notes to maps. Ten sheets were required to make maps and plats of valley as reduced from notes. I have numbered those sheets in order to facilitate testimony in this case. They are numbered Sheets Nos. 40, 41, 42, 43, 43*a*, 43*b*, 44, 45, 46 and 47. I started with No. 40 because it would follow numbering of maps that were introduced by State Engineer under
3457 plane table survey, his last sheet being 39. I refer to plane table sheets contained in Defendants' Exhibit 114, reproduction of Laramie Plains' survey.

(Map consisting of ten sheets marked Defendants' Exhibit 130, Wortham Survey.)

Exhibit 130, consisting of ten sheets, are tracings made from surveys by stadia in Laramie River Valley, State of Colorado, from state line southward as far as any irrigation extended.

(Permission given to withdraw exhibit and to substitute therefor reproduction thereof, similar to Exhibit 114.)

All of Laramie River Valley in Colorado is shown on these sheets. The tributaries shown are La Garde Creek, McIntyre Creek, and a small stream called British Creek. Jimmy Creek and Grace Creek are omitted. I did not make plats showing irrigated lands on those two creeks. There are no other tributaries omitted upon which irrigated lands are situate. These sheets show irrigated lands in
Colorado Laramie River drainage except those on Jimmy
3456 and Grace Creeks. They do not show irrigated area on Sand
Creek and its tributaries in Colorado. Only attempted to show as to tributaries which entered Laramie River in Colorado. Sheets only include Big Laramie River area in Colorado. Some of irrigated lands shown on sheets as lying in Laramie River Valley, receive part or all of their water supply from tributaries of that stream which enter stream in Colorado.

Have designated irrigated tracts by giving owners of land irrigated, together with class of irrigation and acreage in each tract.

There are 2,939.5 acres of land irrigated and cut for hay in the Laramie River Valley in Colorado and the tributaries of that stream, exclusive of Jimmy Creek, Grace Creek, and Sand Creek. Total irrigated sage brush land 204.5 acres. Total irrigated timothy land, 34.6 acres. Total irrigated pasture 98.4 acres, and there are 13 acres plowed that have been irrigated but were not irrigated in 1913. This is located on Grace Creek Ranch. It is on Big Laramie River just below mouth of Grace Creek.

3,290 acres total irrigated acreage in Big Laramie River Valley in
Colorado, exclusive of Grace, Jimmy and Sand Creek areas.
3457 204.5 irrigated to sage brush is irrigated for purpose of
killing sage so that ground will finally become hay meadow. It is land in process of reclamation for native hay. It is not in class designated irrigated pasture (98.4 acres) because what I have classed as irrigated pasture is land that is already grown up to hay largely, but is dotted with plots of willows, jack pines and aspen, which would require removal of these trees in order to make pasture a hay meadow capable of being cut and harvested.

I found 98.4 acres of irrigated pasture out of total 3,290 acres of irrigated land in Laramie River drainage in Colorado, excepting creeks mentioned. This is outside of portion of sage brush land now in the operation of reclamation.

About 640 acres of land is irrigated on Jimmy Creek. A portion of that is irrigated from Big Laramie River. Mr. Mansfield irrigates possibly 320 acres from the Big Laramie River by the Timothy Ditch, and Diamond Ranch Company irrigates remaining one-half of section from Jimmy Creek.

About 320 acres is irrigated on Grace Creek.

4,250 acres would be the total irrigated lands in the Big Laramie Drainage, exclusive of Sand Creek and tributaries, including the
estimated acreage on Jimmy and Grace Creeks as given. Ir-
3458 rigation in Big Laramie Valley is by canals taking water from stream and tributaries. I have not located canals on

Exhibits, although in large measure, they would be located on outer boundaries of irrigated land. They would be on east and west sides of irrigated areas on that stream. Boundaries of various meadow tracts near foothills and mountains may be taken as approximately location of canals. They are all what might be termed "small canals."

Canals do not get more than about 1,000 feet from the thread of the stream as a rule.

Flood irrigation is method used by land owners in Laramie River Valley in Colorado. They turn water through their ditches and onto their meadows and allow this water to run for a period of 60 days. Water is continuously running over land and back into river. This is not in any way similar to the method of flood irrigation used in Cache la Poudre Valley in agricultural sections. In Laramie River Valley water is kept passing over land continuously, whereas in Cache la Poudre Valley it is applied and turned off and applied again for two or three successive irrigations. In Laramie River Valley water is kept circulating across meadows and back into stream, through irrigation period.

3459 On Sheet 43 there is a tract designated "irrigated sage brush flat." Effect of use of water on this sage brush flat was destruction of meadow below by the making of ponds and swamps on lands in river valley. When water on other meadows was shut down so that meadows could dry, return waters from irrigation of this sage brush flat at higher elevation, causes these lands to remain wet for long period, thereby lessening their value for hay meadow.

It would be detrimental to hay meadows to extend irrigation of Laramie River Valley to the flats immediately above and adjacent to present irrigated area. That seems to be general consensus of opinion of irrigators in that valley.

It would be impracticable to get any further irrigation on additional acreages over the present total, 4,250 acres. It is possible, in the valley itself, to clear land immediately next to the river and turn that into hay meadow. Even a major portion of that is so rough as to make it incapable of use for meadow. In upper portions this is especially true. Willows are dotted with beaver swamps

3460 and bog holes. With exception of addition of small tracts along margin of stream, down in immediate river flats, present irrigation development in Laramie River Valley in Colorado, is indicative of possible future development of that region. Acreage I have given would indicate approximate limit of extent to which state of Colorado and its citizens may go in utilizing waters of this, one of its streams. I refer to utilization of water within the valley itself.

(Defendants' Exhibit 130, Sheets of survey of irrigated lands in Laramie River Valley by Mr. Wortham, offered in evidence.)

Water applied to these river bottom lands, immediately adjacent to the Laramie River, all return quickly to the stream.

JOHN R. WORTHAM.

Cross-examination by Mr. John D. Clark:

3460 The Greeley-Poudre Irrigation District acquired from the Laramie-Poudre Reservoirs and Irrigation Company ranches
3461 in the upper Laramie Valley containing 716.1 acres of irrigated land including hay meadows and irrigated sage brush and irrigated pasture, and the district is now farming this land. I do not know the amount of water rights acquired in connection with these ranches. The ditches irrigating the
3462 land so acquired are the Long Park Ditch Number Two, the Link Ditch Number One, the Link Ditch Number Two, the Upper Hills or Upper Smith-Brown Ditch, the Hills Ditch, the Smith-Brown Ditch, the Yelton Ditch, the Homestead Ditch, the Comet Ditch, the Mansfield Ditch, and the Mansfield Number Two Ditch. The majority of the water applied to the land in the upper Laramie Valley returns rapidly to the stream, and there is not a large amount lost to the river from the irrigation of the hay meadows.

3463 Redirect examination by Mr. Fred Farrar:

Owing to the fact that most of the irrigated land in the Laramie River Valley in Colorado follows the thread of the stream, and owing to the fact that water discharged onto these lands returns quickly to the stream, there would not be very much evaporation.

3465 JOHN E. FIELD, recalled.

Direct examination by Mr. Fred Farrar:

Referring to Exhibit 128, concerning Woods Landing gauging station, records for year 1895, which commence with month of April and include April to November, are not correct. The original gaugings were looked up and a curve plotted, and from records of gauge heights, discharge was ascertained, with result that discharge April to November at Woods Landing should be 223,243 acre feet in lieu of 179,440 acre — as shown on Exhibit 128.

As I stated yesterday, Exhibit 128, shows original records as I found them, practically without change or criticism.

Record for year 1895 as shown on Exhibit 128 is portion of record furnished me by Harry True, formerly deputy state engineer of Wyoming. I wished to make this statement in order that there would be no confusion in use of Exhibit 127, which discharge 1895, April to October inclusive, is shown as 220,239 acre feet. That figure was derived by subtracting discharge for month of November of 3,004 acre feet.

Year 1912 is approximately normal regardless of method used in arriving at flow at Woods Landing for that year. There
3466 seems to be persistence, no matter what method of calculation is used. In using discharge of 1912 to have been approximately normal, for example, if I take Exhibit 128 and take

the discharge for 1912, as shown thereon, which amounts were given by Mr. Meeker in reference to Pioneer Dam, percentage of flow based on that record, and based on mean record shown in same exhibit, would be 99 per cent. If on same table I should eliminate high and possibly questionable records of November and December, 1889, and November, 1890, percentage would be 102.7 per cent. That would be percentage for 1912 flow. It thus appears it would not make a very great difference what method is pursued in determining whether or not the year 1912 is normal. Extreme variations seem to be at first from 95 per cent., to 109 per cent., but my final conclusion was that year 1912 on Laramie River was 104 per cent. of normal.

Normal flow of Poudre for year 1912 as shown on Exhibit 124 is 100 per cent.

There is substantial uniformity in percentage of flow based on normal in both streams, that is, that approximate normal occurs same year.

In my testimony relative to Poudre flow I mentioned fact that 1884 was abnormally large, according to table Exhibit 124, and that standing alone record might be subject to question, but that tradition has it that the year was one of abnormally large flow. By tradition I mean that people now living in Poudre Valley all speak of that year as being highest that ever occurred.

3467 They say that water during that year reached higher points than at any time since with exception of time when Chambers Lake Reservoir broke. It is not tradition; it is history, and is within the memory of men now living. It is also historically reported that river not only attained a very high flow but also that it remained at a high stage for a long period of time during that season.

Have compiled records of discharge of Little Laramie River. Have complied tables showing discharge Little Laramie River which I have called discharge at Hatton Station. Records of that stream have really been kept at two stations a short distance apart. Hatton Station is credited with 155 square miles drainage area, while Filmore Station is credited with 164 square miles drainage area. There is little drainage reaching river between two points and two stations might be considered as practically identical for determining flow of that stream. A second table was taken at the second Filmore Station, which I stated is very close to Hatton. There is station at Two Rivers, at mouth of Little Laramie River, where Little and Big Laramies join. There is gauging station on both streams at that point. That has been maintained by State Engineer's office of Wyoming in cooperation with Laramie Water Company, and I believe also at times with United States Geological Survey. These

3468 are the stations used by Mr. Meeker in his report and testimony.

(Table marked Defendants' Exhibit 131.)

(COPY OF DEFENDANTS' EXHIBIT 131.)

State of Colorado—Engineering Department.

Discharge of Little Laramie River at Hatton, Wyoming.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1902	....	....	....	....	....	....	5,600	1,660	2,856	2,828	2,265	....	15,209
1903	....	....	....	8,500	13,650	72,417	12,728	4,400	....	....	....	....	111,695
1911	....	....	....	....	16,500	32,400	7,930	2,400	1,240	2,320	....	....	62,790
1912	....	....	....	....	13,500	54,300	23,200	7,750	4,440	4,750	....	....	107,940
1913	1,045	1,000	1,476	4,554	18,600	20,844	4,851	1,844	1,107	1,562	1,642	1,070	59,595
Total ...	1,045	1,000	1,476	13,054	62,250	179,961	54,309	18,054	9,643	11,460	3,907	1,070	....
Mean ..	1,045	1,000	1,476	6,527	15,562	44,990	10,862	3,611	2,411	2,865	1,954	1,070	93,373

NOTE.—Records from 1902, 1903, 1911, 1912 at May's Ranch; Record for 1913 at Lake Hattie Inlet, plus flow in Belamy Canal, by R. I. Meeker.

Unless otherwise noted, all discharges are n acre feet.

Exhibit 131 gives monthly discharge Little Laramie River at Hatton, Wyoming for year 1902, July to November inclusive; 1903, April to August inclusive; 1911, May to October, inclusive; 1912, May to October, inclusive; and 1913 for entire year. In last column is given total discharge for different years for period covered by records. There is also mean of different months shown based on these records, with mean total discharge as determined by these records. Period for which we have record is rather short. There is but one year which gives winter flow, year 1913, which was a year of very low flow.

Records for 1902, 1903, 1911 and 1912 are records at May's Ranch, and these discharges would include amount of water carried by Bellamy Canal. Record for 1913 is discharge at Lake Hattie Inlet Station with flow of Bellamy Canal added. Record for 1913 was furnished by Mr. Meeker. Bellany Canal is ditch diverting water from Little Laramie River into James Lake Reservoir. In addition to Bellamy Canal, Lake James also has diversion ditch which head on North Fork of Little Laramie, commonly called Loback Canal and so indicated on map attached to answer of corporate defendants.

Hatton Station on Little Laramie is at lower end of Centennial Valley. Station is below Centennial Valley and practically at head of Little Laramie River Valley proper. In taking these
3469 measurements no effort has been made to account for diversions of water from Little Laramie River and tributaries in area known as Centennial Valley. I have not taken into account at all use of water in that valley. There are number of ditches diverting water from Little Laramie and tributaries in that valley. Any water consumed by these ditches, in irrigation of these lands, has to be added to measurement which I will give, if entire flow of Little Laramie River is to be taken into consideration. In other words, my record does not show diversions above Hatton Station.

Use of water from Little Laramie and tributaries in Centennial Valley in Wyoming is similar to diversion and use of water from Big Laramie River in Colorado above Boswell Station and at inter-state line, with exception of diversions by Sky Line and Divide or Sand Creek Canals. General character of irrigation in Centennial Valley and Laramie River Valley in Colorado is similar, that is, irrigation of tracts close to river and raising wild or mountain hay. Return waters reach river very quickly. General methods of irrigation are same. Cannot say what relative area irrigated in two places is, but would conjecture it is not very different, even as to area. In all records, I have not included these small mountain ditches, those in Colorado off-setting, as it were, those in Little Laramie River in Wyoming.

(Exhibit 131, offered in evidence.)

Tabulations shown on Exhibit 131, indicates average discharge for period covered of 93,370 acre feet for entire year. Four of
3470 these years are only partially complete and one year is complete. Year 1913, is year furnishing complete record, and was a very low flow.

Average discharge Little Laramie River shown by table April to October inclusive, omitting records such as we have for five winter months, is 86,828 acre feet. Years covered by these records in combination are considerably below normal. Year 1902 by Poudre records was 51 per cent. of normal. 1903 by Poudre records was 116 per cent. of normal. We have no records at Woods Landing or at other points on Big Laramie for these two years, and therefore we are forced to go to Poudre River for our percentages. Year 1911 by Woods Landing records was 72 per cent. of normal. 1912 was 104 per cent. of normal, and year 1913 was 51 per cent. of normal. These years in combination make 80 per cent. of normal.

Normal flow for period April to October inclusive, appears to be 108,535 acre feet and normal for entire year 120,600 acre feet.

It is well to make comparison between discharge at this station and at Boswell or Woods Landing on Big Laramie, so that we may have still further check on what is probably normal discharge of Little Laramie River at Hatton Station. Discharge at Boswell Station as normal has been given is 220,933 acre feet. With Little Laramie with a calculated normal of 120,600 acres feet, percentage of runoff of Little Laramie as compared with that of Big Laramie at Boswell would be 55 per cent. It would be about 61 per cent. of discharge at Boswell s ıı we exclude Sky Line and Divide Ditches. Boswell flow, exclusive of Sky Line and Divide Ditches, is 194,000 acre feet.

Winter discharge at Boswell's I have estimated during my investigations from examination of Cache la Poudre River on winter flow, to be 4,185 acre feet per month. 55 per cent. of this amount might well represent winter flow for Little Laramie River and dis-
3471 charge would be about 2400 acre feet per month, or 12,000 acre feet for winter months. This added to 108,535 acre feet, previously mentioned, would again give total discharge of 120,-535 acre feet for Little Laramie at Hatton.

That is arriving at total yearly runoff by two methods.

Fortunately we have records on both Big and Laramie rivers during same years, that is, during 1911, 1912 and 1913, and relative flow of two streams can be determined by comparing these years separately.

1911 records cover same period at same stations, Boswell's and Hatton, May to November inclusive. Heretofore we have directed our investigations to period April to October, for reason that was period more completely covered by records and is also irrigation period and period of larger flow. Again taking that portion of the year, assuming 8,100 acre feet as discharge for 1911 for Boswell station for April, and adding the discharge May to November, 112,-605 acre feet, and deducting November discharge, 3,709 acre feet, we have for discharge at Boswell's April to October, 1911, 117,046 acre feet, to which should be added Sky Line and Divide diversions of 23,503 acre feet, giving total at Boswell discharge of 140,549 acre feet. Comparing this with Hatton Station and adding April discharge of 6,900 acre feet to 62,790 acre feet recorded, we have total of 69,690 acre feet which is 50 per cent. of flow at Boswell. In 1912

records can be compared in similar manner with results. That year flow at Hatton was 55 per cent of that at Boswell's.

1912 discharge of Little Laramie at Hatton was 107,940 acre feet, May to October, inclusive. Estimate for April to October is
3472 113,590 acre feet. For Boswell's we have discharge for April to November 185,653 acre feet. Dropping discharge for November, 3,405 acre feet, and adding discharge of Sky Line and Divide Ditches, 23,143 acre feet, we have 205,189 acre feet, which figures show that discharge at Hatton was 55 per cent of that at Boswell.

1913 discharge at Hatton, April to November, was 55,004 acre feet; at Boswell's was 90,935 acre feet, to which should be added discharge of Sky Line and Divide Ditches 15,222 acre feet, giving total of 106,157 acre feet. The percentage indicated by these figures is that Hutton Station discharges 52 per cent. of that discharged at Boswell's Station.

Referring to 1912, discharge at Hatton, May to November, was 107,940 acre feet. Adding six months, which are missing, total would — about 128,000 acre feet. I have calculated that probable discharge at Hatton, based on records and on calculations which I detailed, is 120,700 acre feet per annum as an average or normal.

1912 on Little Laramie River was about 106 per cent. of normal as indicated from foregoing deductions.

Having now treated flow of Laramie River by records as shown at Boswell's, at Woods Landing and flow of Little Laramie River at Hatton Station, I will now discuss further supply of Laramie River below these stations.

One of the objects of presenting information in reference to flow at Woods Landing and at Hatton, was to ascertain
3473 what total amount of water is available for use in Laramie valley and amount which Colorado might divert. To ascertain total annual supply I have discussed somewhat at length duty of water on Poudre River at first with original water available for Poudre valley. Following that same thought, I will now take up total original supply available for Laramie Valley, influence of diversion of water by means of Greeley-Poudre System, and relative amounts of water which can be used by each.

From discussions of water supply at Hatton, Boswell's, and Woods Landing, it appears that waters available for use in irrigation are as follows:

Woods Landing station, 250,500 acre feet, Big Laramie River.

Hatton Station, 120,700 acre feet, Little Laramie River.

Discharge at Woods Landing does not include run-off from area of which Fox Creek is principal stream, area lying between Woods Landing Station and vicinity of Pioneer Dam. This area is 36 square miles, and I have estimated runoff of that area to be 400 acre feet per square mile per annum, or 14,400 acre feet. I was influenced somewhat in this conclusion by study of statement by R. I. Meeker with reference to amount of water which entered Laramie River between Woods Landing Station and Pioneer Dam for month of June. I believe his statement will show that there was 5,871 acre

feet net entered river between these two stations in year 1912. Omitting territory drained by Shell Creek, Antelope Creek, Sand Creek and that area drained directly into the Laramie River from the territory west of Laramie, which we might call Big Hollow country, and that portion of drainage area in Laramie Plains proper outside of mountain area, total supply is 385,600 acre feet.

3474 Total available supply above Wheatland Reservoir No. 2 must include, besides this figure, the runoff from mountain territory at the head of Four Mile, Seven Mile, Cooper and other small streams, heading in mountains north of Little Laramie River on West side of valley. The mountain territory, excluding plains country, is about 60 square miles in extent, or 38,400 acres. On a basis of 1/3 acre foot per annum, yield of this territory would be 12,800 acre feet. Mountain area on each side of Laramie Plains should also be included. Mountain area lying south of point opposite Two Rivers and opposite Wheatland Reservoir. This mountain area is about 60 miles in length and 5 miles in width on average. I have assumed, however, the area to be only 3 miles outside of valley itself. On basis of 1/9 of an acre foot runoff on entire drainage area, yield from this area would be 12,800 acre feet. Some waters enter river from plains area proper. This area is very extensive and in neighborhood of 600,000 acres. Waters which reach river, however, from this area, I think come almost entirely from violent storms or cloudbursts. It is erratic in character, so often of considerable volume. I have not, however, included any runoff in my table for this area.

411,200 acre feet total available water supply of Laramie River above Wheatland Reservoir. This is obtained by adding 12,800 acre feet from the westerly mountain area, and 12,800 acre feet from the easterly to the 386,600 acre feet above mentioned.

Below Wheatland Reservoir No. 2 there is water entering river from tributary streams from mountain area lying principally to north of Laramie River. Of necessity there is a certain amount of water wasted, or which accidentally passes diversion dam of

3475 Wheatland system at tunnel from Laramie River into Blue Grass, and on account of such waste, I have not included inflow into river in that portion of stream.

411,200 acre feet is approximate available water supply of Laramie River and tributaries at tunnel of Wheatland system for use of Laramie Plains country and Wheatland territory. There is also available to the Wheatland project the flow of the Blue Grass and Sybille Creeks. 1913 flow of Sybille Creek for period April to November 22 inclusive was 19,452 acre feet. Some of this water was probably waste or seepage from Wheatland colony, but in month of April discharge from table is shown to be 9,283 acre feet. This quantity was discharged before any water was run from Laramie River to Wheatland lands as shown by records at McGill Station. Apparently first water was diverted, other than that which leaked through valves at reservoirs, about May 3 to 5, so that considerable runoff exists in Sybille Creek itself, above inlet ditches to Wheatland system.

9,283 acre feet for month of April, 1912, for Sybille Creek was

taken near mouth of the stream. Data was furnished me by State Engineer of Wyoming. We might say this entire amount of water was discharged from Blue Grass and Sybille Creek and not from any waste and return waters from Wheatland system.

15,000 acre feet in the year 1913 was probably furnished by the Sybille drainage, exclusive of waste and seepage. This year, 1913, has been previously remarked as being the year of quite low flow, and I think it is safe to assume that the amount of water furnished by Sybille and Blue Grass Creeks would be about 20,000 acre feet per annum on the average.

3476 Total available water supply for the Laramie Plains area and the Wheatland area, exclusive of Sand Creek is 430,692 acre feet. Including Sand Creek flow of 17,000 acre feet, there would be 447,692 acre feet.

Some other water was available for lower Laramie Valley, furnished by the North Laramie and by Chugwater Creek, and other smaller streams entering river below Wheeler bridge in vicinity of town of Wheatland. These need not be considered, first, because they are not available for lands of Wheatland colony, nor for lands of Laramie Plains proper; second, they are required to a very large extent to irrigate lands bordering them. From reports published by State Engineer of Wyoming for years 1911 and 1912, discharge of Chugwater Creek, near mouth of stream, was 18,300 acre feet.

Area irrigated from Laramie River and tributaries below mouth of cañon north of Wheatland, or broadly speaking, area along the Laramie River lying below Wheatland and down to the mouth of the Laramie River, is not extensive. A small but constant supply is about all that is necessary. Natural flow of North Laramie and Chugwater, together with return seepage, will without question supply these lands, so that, considering water supply, we need not consider Chugwater nor North Laramie, nor lands on these streams nor on main stream below Wheatland.

Such a treatment as this simplifies discussion.

We have as result of this analysis nearly one-half million acre feet of water for use by Colorado and Wyoming. Of this supply, 447,692 acre feet, Colorado will take at most 91,000 acre feet, or one-fifth of total supply.

91,000 acre feet is amount of water taken from Laramie River by Sky Line Ditch, Sand Creek or Divide Canal, and the Greeley-

3477 Poudre tunnel and its collection ditches as now partly constructed and also the amount which would be available if projection of West Side Ditch were made around to the McIntyre Creek. If we were to exclude Sand Creek supply, however, on one hand, and improbable development on lower McIntyre, relative total supply to be used by Colorado would be as 432,692 is to 76,000, about one-sixth of the water would be used by Colorado.

When I said 411,200 acre feet would be available to the Wheatland works, I neglected to state that amount included diversion by Sky Line and Sand Creek Ditch from Laramie River. Not only that, that figure is not intended to represent amount which actually passes Wheatland tunnel. It represents amount of water which enters area

known as Laramie Plains and is available for use on Laramie Plains and Wheatland area. Considerable part of this water is of course used on both Big and Little Laramies above Two Rivers Station and above Wheatland Reservoir. A very considerable amount of which is wasted and evaporated, but it represents what I term "original water" which is available for use and, with the information of how much original water is available, we can now make something of an estimate of area which it is capable of serving.

Colorado furnishes from the Laramie drainage 237,500 acre feet annually. Sand Creek furnishes to Wyoming 17,000 acre feet annually, making total from Laramie River drainage in Colorado flowing into Wyoming 254,500 acre feet. Colorado furnishes over 50 per cent. of total supply.

3478 A gauging station was maintained at Uva, located immediately below junction of Laramie River and North Laramie. This station was maintained by United States Geological Survey in cooperation with state of Wyoming. These records were kept for years 1895, 1896, 1897, 1898, 1899, and 1903. Average annual discharge as shown by these records, or rather mean discharge for those years was 174,086 acre feet per annum. Below that point there is very little irrigation from Laramie River. Stream flows through rough country. Valley is very narrow. There are small areas adjacent to river which can be cultivated. There is also some land at mouth of Laramie River which is irrigated. But aggregate is not very great. I think a few thousand acres will probably cover total of land below Uva and below practically all irrigated section of Laramie River drainage.

Referring to main Laramie River in Colorado inflow between Glendevey and Boswell Stations is considerable. Principal tributary of Big Laramie outside of Little Laramie is McIntyre Creek, which flows into Big Laramie River from west between these two points. From east side there is Jimmy Creek and on west side there is Stuck Creek, Grace Creek, Laramie, La Garde Creek, and other small

3479 streams. These are all good sized creeks. The inflow on McIntyre Creek alone is more than one-third of flow at Glendevy station on Laramie River. Total inflow between Glendevy Station and Boswell Station is about one-half or more of the total flow which appears at Boswell Station. This statement is made in connection with reasons for discarding records at Decker Station, and as criticism of those records, showing their unreliability. On these creeks which I have described as entering river between Glendevy and Boswell Station, there is no diversion by any of these inter-mountain streams, with exception of two mile area at upper end of McIntyre Creek, which I have mentioned. Greeley-Poudre System in this one respect, cannot interfere with that flow whatever.

Accurate conclusion of normal flow of a stream cannot be obtained from a record of only two years, unless you have other data on adjecent streams. In absence of records from adjacent streams, it would be of some value, to be sure, but it would be very unreliable.

In seeking to ascertain water supply on a stream, we use every effort to extend period of records as far as psosible, and as a last

resort, we consult weather records. Flow of stream does not follow very closely matter of precipation, but where records are as short as two years, weather records do become of value as indicating whether two years have been above, below, or somewhat near normal. But taking two years' records of themselves, it would be very risky to assume that they would give an average. It would be an accident or coincidence if they did happen to give an average of the real true normal.

3480 Mr. R. I. Meeker took factions of two years, 1912 and 1913, and sought to derive a table of means. I have taken all records that I could find on Laramie River itself and have also examined data on adjacent watersheds, so that my information might cover as many years as possible.

The mean of which I speak is contained on several exhibits, of which Plaintiff's Exhibit "I" is typical. That table was prepared by Mr. Meeker.

Mr. Meeker considered year 1912 as one of abnormally high flow. I have previously stated that year was approximately normal in its discharge. Flow for May, June and July was above normal, while the flow for winter months is shown to be quite a good deal below normal, with result that year as a whole is approximately normal. The impression that this was an abnormally large year, was doubtless derived from fact that in month of June, there was some very high water for a few days. Even this high water was by no means as large as had previously occurred. In year 1897 water was higher in both months of May and June. In 1899 water was higher in May and June. In 1900 there were dates in both May and June when water was higher than at any time in May and June, or at any time in 1912. The published records of United States Geological Survey for 1897 show discharge on May 25 of 3,400 cubic feet per second, some 900 feet more than the highest record at Boswell's in

3481 1912. In 1899 on June 25 records of Geological Survey show discharge of 4,502 cubic feet for that day, and for a considerable period a discharge in excess of 3,000 cubic feet per second, as against maximum at Boswell's in 1912 of 2,570 cubic feet per second, so that as stated, these conditions even with large floods, are not unprecedented or abnormal.

I have taken into consideration amount of water stored on Laramie Plains region during seasons 1911, 1912 and 1913, more particularly with respect to storage in James Lake, Lake Hattie, and Wheatland Reservoir, as given by witnesses for state of Wyoming in this case. I have examined supply and use for those years, particularly of 1912 and 1913, *on* which years records are more complete, and I have constructed maps to show conditions of those two years. Those two years being particularly interesting from fact that in 1912, was so nearly normal run-off, while 1913 was a year of very low flow.

An examination of these conditions in 1912, of use, storage and flow, would give one very good idea of what would obtain during normal and ordinary years, while examination of use, supply, storage, etc., in 1913, would give one very good idea of whether there

was sufficient water in year of extremely low flow, or whether there was insufficiency of water in such years. With reference to 1912, it would indicate whether there was a surplus of water in such a year, and it was for this reason that I made a particular study of these two years.

I first considered in examination of 1912 conditions, amount of water which was stored, particularly amount of water which
3482 was held over from year 1912 to year 1913, and in which had there been a shortage in 1913, this water stored and held over from 1912 would have been available for use.

I wish to recall briefly some figures and evidence previously submitted in this case, and then take up analysis of those figures.

Capacity James Lake has been stated as 41,100 acre feet. The area has been stated as 1,370 acres at high water line, with a storage depth of 30 feet. Mr. Z. E. Sevison, one of witnesses for Wyoming, makes following statements in different parts of his testimony:

"There was 22,000 acre feet stored in James Lake in 1912; 18,000 acre feet in 1909; 10,000 acre feet in 1910; 10,000 acre feet in 1911; and 3,000 acre feet to March, 1913."

Mr. Meeker, witness for Wyoming, makes following statements in his testimony or on Exhibits which were prepared and presented by him; That there was diverted by Bellamy Canal for use in that canal and James Lake in 1912, 24,793 acre feet, and in 1913, 12,310 acre feet.

There was stored in James Lake in 1912, 22,000 acre feet and 24,793 acre feet diverted, which would seem to indicate that Bellamy Canal used 2,793 acre feet.

On Plaintiff's Exhibit "K", I find following statements: July 17, 1912, in storage in James Lake 15,000 acre feet; November 25, 18,400 acre feet; April 25, 1913, 20,400 acre feet; October 30, 19,800 acre feet.

Mr. Sevison states that there was no water carried over from 1911 to 1912, and entire storage was used in 1911, so that deducting the amount in storage November 25, 1912, as stated by Mr. Meeker, of 18,400 acre feet, from diversion made in 1912, we have left 6,393 acre feet, exact use of which is not determinable from evidence,
but which was in all probability used by Bellamy Canal or
3483 lost by evaporation from surface of James Lake.

It appears, therefore, in this practically normal year of 1912, there was an excess of water not only available for James Lake system, but there was actually stored in year 1912, over and above all uses, 18,400 acre feet. No water was held over from 1910 to 1911 in Wheatland Reservoir No. 2, according to testimony of Mr. Elliott, one of witnesses for plaintiff, and none in the reservoir at end of 1911.

119,770 acre feet was flow at Lookout May 27, to December 31, 1912, according to testimony of Mr. Meeker, as shown by his exhibits. Flow past Lookout prior to May 27, must have been considerable, as high water in river begins prior to that date, and I have assumed that flow through the reservoir prior to that date was 6,000 acre feet. Mr. Meeker also states that on May 27, 1912, there were

36,600 acre feet in the Wheatland No. 2 Reservoir. The 6,000 which I have estimated, is in addition to this 36,600 acre feet.

162,370 acre feet went into or through the Wheatland Nos. 2 Reservoir in 1912. 95,653 acre feet were withdrawn from reservoir in 1912, as shown by records at McGill Station, which station is just below outlet of Wheatland No. 2 Reservoir. I have been informed that at one time in month of April in 1912, there was as much as 600 cubic feet per second of time being discharged from this reservoir. We have no records which will show what amount of discharge prior to the McGill record was. I have assumed it was 6,000 acre feet, though in all probability it was considerably more than that, so that total withdrawn from reservoir in this year, if my assumption is correct, was 101,653 acre feet. Subtracting amount withdrawn from reservoir from that which passed into or
3484 through reservoir in 1912, we have 60,718 acre feet. While Mr. Meeker in his Exhibit "K" states that on November 18, 1912, there was 43,000 acre feet left in reservoir, after November 18, inflow in 1912 for December was 3,140 acre feet, and for portion of the months of November from 18 to 30 was 2,400 acre feet, which would indicate a total in reservoir on January 1, 1913, of 48,540 acre feet.

There was loss in this reservoir by evaporation in 1912. I have taken this evaporation as 13,717 acre feet, leaving in reservoir, in round numbers, 47,000 acre feet. Between November 18 and January 1, 1913, some water was doubtless lost by evaporation and escape. If we assume this loss to have been 1,540 acre feet, estimate which I have made and that of Mr. Meeker would be made to conform exactly and would indicate loss from evaporation during 1912 of a little over 15,000 acre feet.

The figures are further confirmed by statement of Mr. Elliott, to effect that at end of season of 1912 there were 40,000 acre feet in this reservoir. Inflow for October, November and December, 1912, was 19,070 acre feet, and outflow was 463 acre feet, leaving amount which should be in reservoir 58,607 acre feet. This indicates a discrepancy between figures given by Mr. Meeker and those given by Mr. Elliott of about 10,000, after allowing for any evaporation, and may be due to erroneous estimates in capacity of reservoir between different contours or in assumption of capacity of reservoir itself.

There is considerable discrepancy in the evidence presented by plaintiffs as to capacity of this reservoir. Mr. Meeker assumes an active capacity of 83,500 acre feet. Mr. Elliot's statement
3485 was, I think, to the effect that capacity was 120,000 acre feet, and Mr. Johnson stated that capacity was 126,000 acre feet. No accurate survey, I believe, has been made of this reservoir, and so far as I know, there is no accurate or authentic record of its capacity.

I have taken the lesser figure of 47,000 as the amount in storage December 31, 1912. The inflow for year 1913 at Lookout Station, is given on records for that station as 78,678 acre feet. In 1913, therefore, total amount of water in or passing through the reservoir was 125,678 acre feet. Of outflow as given by McGill Station record

was 96,318 acre feet, leaving an apparent net remaining in reservoir at end of 1913, of 29,360 acre feet. Evaporation for that year should be deducted. I have taken this evaporation as 15,000, which would leave 14,300 acre feet in reservoir. This figure is confirmed by the figures and statements presented by Mr. Meeker to effect that on November 20, 1913, there were 9,000 acre feet in reservoir. After that date inflow for November was 1,650 acre feet, and for December 3,997 acre feet, and outflow was 123 acre feet, leaving in reservoir on January 1, 1914, 14,524 acre feet, a quantity almost identical with that calculated by the other method.

Mr. Elliot states that in 1912 Wheatland project used 100,000 acre feet. 95,653 acre feet appears to have come from the reservoir during the period of which we have record. The balance may have come from Blue Grass and Sybille Creeks, or may have come from reservoir prior to May 27th. Mr. Elliott is an engineer and at time of his testimony was superintendent of this Wheatland system.

3486 Mr. Johnston, to whom I have referred as stating capacity of this reservoir was 126,000 acre feet, was manager of Wheatland project for many years.

Mr. Meeker was employed by Laramie Water Company, which company is sometimes called the Lake Hattie Company, and is the owner of Lake Hattie system, at times he was making these measurements, and calculations which resulted in his conclusion that there were 83,000 acre feet in the reservoir capacity.

Wheatland No. 1 Reservoir, according to Exhibit K, appears to have stored in 1912, 10,500 acre feet, and on November 20, 1913, there was left in reservoir 2,100 acre feet, showing use in 1913 of 8,400 acre feet, over and above any water which might have been stored in reservoir during year 1913.

On Lake Hattie Reservoir an active capacity is stated as 68,500 acre feet; depth is 28 feet. Area is 2,443 acres and storage capacity at 20 foot depth is 30,000 acre feet. Unavailable or dead capacity was stated as 42,000 acre feet. Statement is also made that water was available above the dead space in June, 1912, also that there was between 10 and 11 feet depth of water available above the floor of outlet in middle of July, 1912. Mr. Bishop, one of witnesses for plaintiff, stated that amount available from Little Laramie River was 20,000 acre feet. Mr. Meeker, in his exhibit, states that amount from Little Laramie River was 14,053 acre feet. Mr. Meeker's statement was based on measurements and seems proper to take that figure. Mr. Meeker also states that water discharged into this lake from Big Laramie River was 69,855 acre feet. Total received by reservoir from both the Big and Little Laramies was 83,908

3487 acre feet. Mr. Meeker also states on one of his Exhibits that on November 20, 1912, amount of water in the reservoir was 18,700 acre feet. The difference between amount in reservoir on November 20, 1912, and statements in reference to inflow for that year, is 83,908 acre feet, minus 18,700 or 65,208 acre feet. The dead capacity, therefore, instead of being 42,000 acre feet, would be 65,208 acre —, less whatever amount might have been lost

through evaporation and seepage. With an area of 2,443 acres and with reservoir only partially filled, and for portion of year between June and November 20th, allowing for evaporation 3,208 acre feet, the dead capacity would appear to be 62,000 acre feet, and total amount stored in 1912 both available and unavailable would be 80,700 acre feet.

April 24, 1913 there was 19,400 acre feet in Lake Hattie Reservoir according to plaintiffs' Exhibit "K." Inflow from Big Laramie River in 1913 was 28,470 acre feet. I am informed there was no inflow from Little Laramie in this year. Total in lake, therefore, exclusive from any losses from evaporation, would be 47,870 acre feet of available water. It is stated, however, that on November 5, 1913, there was 26,000 acre feet in reservoir. It thus appears, that 21,870 acre feet was used, lost through evaporation, seepage, etc., of which possibly 5,000 acre feet is due to evaporation and 16,870 feet was discharged from reservoir. It appears, therefore, that in very short year of 1913, after using or discharging from reservoir 16,870 acre feet, this company succeeded in increasing storage in Lake Hattie 7,300 acre feet without taking any water whatever from Little Laramie River.

3488 Testimony in-duced in behalf of Plaintiff shows Lake Hattie having total capacity of 110,000 acre feet, of which 42,000 acre feet was dead water, that is, water which could not be withdrawn under present system of outlets. I have assumed a larger dead capacity in my calculation. I do not reduce active capacity in accordance with amount which I have increased dead capacity. I arrived at that dead capacity by taking inflow into reservoir up to a certain date, on which date positive statement was made that there was certain amount of water in reservoir. Subtracting inflow during that period from amount so stated as being in reservoir, I thus obtained dead capacity.

By Mr. Delph E. Carpenter:

You are to understand that in abnormally low year of 1913, the Laramie Water Company actually diverted into Lake Hattie Reservoir 28,470 acre feet of water from Big Laramie River. I summarized amount stored in 1912 as follows:

Lake aJmes, 18,400; in Wheatland No. 2, 47,000; in Wheatland No. 1, 10,500; in Lake Hattie, above dead space, active capacity, 80,700; total, 156,600.

156,600 acre feet is amount stored in 1912 in excess of use in that year.

By Mr. Fred Farrar:

In other words, the figure last given represents amount of water left over rather than amount stored. Furthermore, records at Wheeler Bridge for 1912, indicate that there were 10,000 acre feet that passed that point in 1912. As 1912 was year of larger flow than 1913, and as in 1913 there were over 19,000 acre feet of water discharged by Sybille Creek, discharge of that creek in 1912 was certainly as much as 20,000 acre feet. Chugwater Creek in 1912

furnished 18,300 acre feet, as stated. Adding these amounts to amounts left in reservoirs, together with 600 acre feet, which
3489 was probably wasted before May 27th, total remaining in storage and available for use in 1913 and that wasted, is 210,900 acre feet, after allowing 16,825 acre feet for evaporation in the reservoirs.

Water used during this year, 1912, by Wheatland project was stated to be 100,000 acre feet. There were 6,390 acre feet either used or evaporated in James Lake system, and there was used 17,703 acre feet in the Pioneer Canal.

These amounts, added to that held over in storage and wasted, show storage, waste, and use of 341,000 acre feet, or, excluding amount used in Pioneer Canal, 323,303 acre feet, being amount of water for which we have account for this year exclusive of all use of water on Little Laramie River and on Big Laramie River on Laramie Plains.

Amount of water used on Little and Big Laramies I could not obtain except by subtraction. On Plaintiffs' Exhibit J, it is stated that there was used between Number 2 Dam and Two Rivers, 17,245 acre feet. But the testimony also shows that there was nearly 30,000 acres irrigated and use and duty on Little Laramie River of only .6 of an acre foot per acre, which is ridiculous on its face. The evaporation from the surface of the soil alone, to say nothing of transpiration by the plans, would exceed that amount. Meadow lands of Little Laramie River Valley are continuously wet. Evaporation would be very great.

Evaporation from water surface in this valley would amount to 5 or 6 acre feet per annum. Mr. Meeker, witness for Plaintiff, stated that in his opinion it would be 6 acre feet per annum of water surface exposed.

Authorities, study and experiments indicate evaporation from wet soil is greater than that from water surface, so that from this
3490 30,000 acres in Little Laramie Valley, there would be a much greater exaporation than the use shown by these figures.

Same reasoning will apply to Exhibit J for 1913. Mr. Meeker also shows use between Pioneer Dam and Two Rivers to be 29,892 acre feet. On Plaintiff's Exhibit L, there were some 38,000 acres said to have been irrigated in this section.

Duty of water therefore would be considerable less than an acre foot per acre.

Similarly, in 1913, use of water between Pioneer Dam and Two Rivers is stated as 18,917 acre feet, a use of a little over one-half acre foot per acre. This would indicate to my mind that amount stated as passing Pioneer Dam was very much too small. The amount allowed for use between and below that point is entirely inconsistent with amount of acreage claimed to have been irrigated.

Amount indicated by this use is only a fraction of that claimed to be the duty of water on that section. Have forgotten just what the testimony was relative to the duty of water, but assuming it to have been 2½ acre feet per acre, this figure as given would only amount to 1/5 of the actual duty.

Assuming that Mr. Meeker's calculation as to duty of water is correct, it would then be evident that Wyoming has sufficient water to irrigate nearly one million acres.

There might be an explanation advanced for this remarkable array of figures as presented on Exhibits J and L, by the statement that there was considerable inflow into the river between
3491 Pioneer Dam and Two Rivers. In that case, and if such a reason should be advanced, I would have to revise my figures and allow a very much greater inflow between these points than I have allowed. In other words, I would have to allow a larger amount for total supply than I have.

Law of Wyoming permits maximum diversion of 1 cubic foot per second for every 70 acres of land irrigated. Testimony shows that in 1912 100,000 acre feet of water was used on the Wheatland area. Testimony also shows that there was under cultivation an irrigated area in Wheatland tract 31,050 acres of land, including 1,050 acres in Bordeaux tract. If total maximum diversion of 1 cubic foot per second for 70 acres of land were allowed for this 31,050 acres for a season of 90 days, with a diversion to the maximum amount for the entire time, there would only be required, 79,848 acre feet of water for the Wheatland tract. It should be stated, however, in order not to be misled, that use and requirements for a large part of this period of 90 days is much less than this maximum. 90 days' actual irrigation is more than is required on Wheatland tract.

20,000 acre feet in excess of legal maximum allowed by Wyoming law was used by Wheatland project in 1912. If irrigation was
3492 less than 90 days the excess would be still greater. If 1 cubic foot per second of time for each 70 acres of land was more than is reasonably necessary for proper irrigation, then excess would be corresponding. I think an even greater difference is due to the fact that the maximum is required for only a small portion of the 90 days. Maximum demand in Wheatland district would come in month of June and early July. Demand and necessity would decrease after July 1st and it would not be so great prior to June 1st. Maximum as fixed by Wyoming law, as I understand it, is intended to meet even extraordinary conditions, and to meet demand during that period called by engineers the period of peak load, and it is not intended to represent at all the average amount which may be diverted, but rather the maximum which may be diverted to meet the peak load. From evidence introduced relative to irrigation season in Wheatland district and necessity and duty of water, would say that the peak load would probably require that entire area of Wheatland district be covered once, be irrigated once during a period of three weeks in latter part of June and first of July. I believe peak load would not last more than 21 days out of the 90 and that average would be 70 per cent. of peak load, possibly 75 per cent., which would indicate a requirement for the district of 60,000 acre feet, instead of 100,000 acre acre feet, as diverted in 1912.

3493 Examination by Mr. Delph E. Carpenter:

Dead space constitutes following factor in the irrigation development of a community. During first few years of operation on an irrigation project, there is what might be called a period of initial expense. It occupies same position on irrigation projects as initial expense of any enterprise. On irrigation enterprises, initial expense as regards water is amount of water lost in putting system in operation. On Lake Hattie, for instance, there was an initial expense of water in filling dead space. Before reservoir could be operated, of necessity unavailable capacity must be filled. After this unavailable capacity is once filled, it does not have to be filled again, water in unavailable capacity remaining from year to year, so that first year, or first two years, this Lake Hattie was in operation, there existed necessity of drawing from the river an amount of water sufficient to fill dead space, that is, to meet this initial expense of water. Same is true as regards canals. There is an initial expense in operation of new canals; generaly speaking, when canals are new, loss from seepage is very much greater than it is later. If canal is properly constructed, soil on bottom and sides of ditch will become
3494 silted and tighter and less water will be lost by seepage. In year 1912, 62,000 acre feet of dead capacity filled in Lake Hattie reservoir was an initial expense.

This filling of the dead space or initial expense should not be considered as a necessary continuing requirement. When this expense is met once, it is practically eliminated for all time. There is, to be sure, a loss from evaporation from surface of unavailable water, on account of area exposed to times when available capacity of reservoir has been exhausted. That loss of course will be continued and yearly.

It is hardly proper to view operations in 1912, without due consideration of the unavailable capacity of Lake Hattie having been filled during that year. Had that system been in operation for a few years more than it has been, 1912 being, for all practical purposes, first year when reservoir was used, this initial expense would have been previously met, and, if amount of water which was discharged into reservoir in 1912 from Big and Little Laramie Rivers had not been in part consumed in filling this unavailable capacity, reservoir would have been entirely filled during that year and some 12,800 acre feet would have passed over the spillway or been discharged through the outlet gates. This water would have remained in the river for other appropriators.

3495 For purposes of consideration of available flow of Laramie River in connection with Lake Hattie for 1912, total diversion of water into the Lake during that year should be considered as active and available water.

To give an idea of amount of water required to meet this initial expense of water in filling dead or unavailable space in Lake Hattie in 1912, I will state that 62,000 acre feet of water required to fill this space would have served about 62,000 acres of land in the Cache la Poudre Valley in Colorado, if the return seepage is counted. As

direct appropriation, and without regard to use of return water, it would have served 50,000 acres in that valley; for instance, it would have been sufficient to serve 50,000 of the 125,000 acres of the Greeley-Poudre Irrigation District. Assuming a duty of 1.25 acre feet per acre per annum under Water Supply and Storage Company's System in Poudre Valley, this amount of water would have been sufficient to more than irrigate entire tract under the Larimer County Ditch, namely, 45,000 to 50,000 acres.

This dead space should be eliminated from all future consideration of water supply and demands of Big and Little Laramie Rivers, in so far as the Lake Hattie system is concerned, for reason that it is now filled and will never again have to be filled. There is also some dead space in the Wheatland No. 2 Reservoir, but this was filled prior to 1912.

3496 In figuring capacities of various reservoirs, it has been custom to figure available capacity, rather than total capacity, including available and dead space. This available capacity is termed active capacity. It is the useful part of reservoir and that is part of reservoir with which we have to deal and on which we base irrigation project.

Same initial expense had probably been supplied in 1911 and 1912 within James Lake. It is a natural lake, in which unavailable capacity has been filled from time to time by natural flow of Seven Mile Creek.

Have adopted another method of illustration by which I demonstrate conditions prevailing in Laramie River and tributaries during 1912 with regard to water supply. Have prepared diagrams which illustrate and which perhaps will give clearer idea of conditions on Laramie River in 1912 and 1913 than by mere presentation of a mass of figures. These diagrams are called hydrographs and there is one set pertaining to each of years, 1912 and 1913. There is still another one pertaining to the normal at state line.

Referring to 1912, I constructed hydrograph showing water supply in Laramie River to Woods Landing, showing amount diverted by Sky Line and Divide Canals and inflow between head of river and other points such as tunnel and collection ditches, amount between Glendev-y and Boswell's and amount between Boswell's and Woods Landing.

3498 (Defendants' Exhibit 132, a hydrograph, offered in evidence.)

Defendants' Exhibit 132, is technically called a mass diagram and represents amount of water flowing past certain points on Laramie River for different months in year 1912. Outer line represents volume of water passing Woods Landing, including amount diverted by Sky Line and Divide Ditches. Amount of water flowing for any month can be read by reference to scale on left side of plat. Area cross-hatched at bottom of plat, this hatching being from upper left hand corner to lower right hand corner, and designated in legend as Sky Line and Divide diversions, is amount of water which in that year was diverted by Sky Line and Divide Ditches, limits

of this cross-hatched area representing amount diverted during months of June, July, August, Sebtember, October and November. Next above this area is cross-hatched in a diagonal, but in opposite direction as shown in legend, and this area represents amount of water which after Sky Line and Divide diversions have taken place, would be available for tunnel through flow of East and West Forks and delivered to tunnel by collection ditches. Area immediately above this, cross-hatching being horizontal, represents amount of water which enters river between tunnel and Boswell Station. There is something of a coincidence in the flow at G-endevy and that delivered at tunnel. Upper boundary of area representing flow at tunnel and collection ditches being almost coincident with lower boundary line area representing discharge between Glendevy and Boswell's.

3499 There is some water, however, passing Glendevy Station which cannot be taken into the tunnel by collection ditches. This diagram does not show that. The insertion of this difference would complicate the diagram so it would not be so readily understood and I therefore omitted attempt to show details. That part indicating an inflow between tunnel and Boswell's Ranch includes, in fact, some water passing Glendevy Station from drainage above. Area at top of diagram represented by vertical hatching is inflow between Boswell's and Woods Landing. Total of all these areas representing what might be termed natural flow past Woods Landing Station.

Diversions do not appear for Sky Line Canal for month of May during that year for reason that records of discharge of Sky Line and Divide Ditches for year 1912 show that there was but 285 acre feet diverted during that month. This is quantity so small that it cannot readily be seen on diagram, but column marked "May" upon close examination, it will be observed, that there is blue line at bottom of column, indicating this small quantity of 285 acre feet. Space between this blue line and bottom of graph can be seen if you look very close, there seem to be some little dots below horizontal line, these dots are beginning of diagonal lines such as are show- in months of June, July, and August. Owing to the small scale on which the graph was prepared, it was very hard to observe this small amount for that month. I have no record of any diversions

3499 by these canals during April in this or previous years. I have obtained the records from The Water Supply and Storage Company and have checked it by reports of the Water Commissioner.

(Defendants' Exhibit 133, a hydrograph, offered in evidence.)

Defendants' Exhibit 133, shows discharge of Little Laramie River and amount of water used and diverted by several ditches and amount of water passing different gauging stations on river. Diagram is similar to Exhibit 132, except that it is on different scale. On Exhibit 132, point representing 100,000 acre feet is the same as point representing 50,000 acre feet on Exhibit 133. I make this statement so that there will be no confusion in assuming that these

graphs are on same scale. It was necessary to make it on different scale in order to keep graph on sheet.

Area hatched in diagonal direction and at top of diagram for each month as shown by legend, represents amount of water diverted by Bellamy and other canals above Lake Hattie Inlet. This water went to James Lake and other projects. The area hatched by horizontal lines represents water which was taken into Lake Hattie Inlet Canal from Little Laramie River which water was discharged into
3500 Lake Hattie in 1912. Area hatched by vertical lines represents amount of water remaining after deducting diversions of Bellamy and Lake Hattie Inlet Canals, and also amount of water which appeared at Two River Station at mouth of Little Laramie. This difference represented by area on diagram between area representing Two River's discharges and that representing Lake Hattie Inlet discharge, would be loss or use between Lake Hattie Inlet and Two River's Station. If there are any errors in measurement at Two Rivers, Lake Hattie Inlet and Bellamy Canal quantities, it will be reflected in this area. I refer to area marked "loss and use between Lake Hattie and Two Rivers," that representing difference between total supply and that which has been or can be accounted for. Area at bottom of diagram represented by diagonal hatched lines, as shown on legend, represents amount of water which appeared at Two Rivers Station and was measured. Total column appearing for any one month, including several classes of cross-hatching, indicates total flow for that month at Hatton and Two Rivers Stations. It will be noted that diagram does not extend to include months of January, February and March. There were no records for those months. They were, therefore, necessarily omitted. Dash line appearing in columns for November and December represents upper boundary of area representing discharge of Little Laramie River at gauging station at head of Lake Hattie Inlet Canal. I didn't have Two Rivers Station designated on November and December columns. I had no records for those
3501 months at Two Rivers. That same dash line appears in month of April, being upper line of diagram of that month, in month of May, in month of June just above horizontal crossing, in month of July, August, September and October. Each instance represents same thing.

In both Exhibits 132 and 133, top of column represents maximum flow at any point, it is not necessarily at same station. Various classes of cross-hatching simply show distribution of total flow of month.

Defendants' Exhibit 134 is designated as a "Use Diagram, Laramie River, Two Rivers and Lookout, Wyoming." There is a gauging station at Two Rivers and at Lookout which is a point at head of Wheatland Reservoir No. 2. Exterior boundaries of this diagram represent maximum amount of water at one or other of these two stations. During some months in 1912 there was gain in river between these two points, and in other months there was loss. Assuming that gauging records and discharge records are correct, as

represented by witnesses for plaintiffs. Gain or loss is shown by cross-hatched areas. These areas are cross-hatched in opposite directions and as shown by legend. Larger areas represent use and loss between two stations, and this use or loss aggregated 12,000 acre feet. Gain is also shown aggregating 3,000 acre feet. Gain shows not necessarily total gain, but net gain between two stations.
3502 It is obtained by comparison of records of station at Two Rivers and that at Lookout. Scale of Exhibit 134 is on same scale as Exhibit 133. Scale is twice as large as on Exhibit 132.
In each of these graphs scale is shown on extreme left hand side.

(Defendants' Exhibit 134, a hydrograph, offered in evidence.)

Defendants' Exhibit 135 shows graphically condition of Wheatland Reservoir No. 2 for 1912, in so far as there are available records. This diagram was constructed almost entirely from data furnished by witnesses for plaintiff. Upper curved line represents combined flow of Big and Little Laramie Rivers at Two Rivers Station. Second line from top represents flow of Big Laramie River at Lookout station at head of Wheatland Reservoir. Both of these lines represent total amount discharged up to any given date. They do not represent flow at any period, but aggregate amount of flow up to any date. Third curved line marked "inflow less outtake" is obtained by subtracting outflow as recorded at McGill Station from inflow as recorded at Lookout Station. Blank area between second and third lines represents outflow or outtake. Cross-hatched
3503 area between first and second lines represents loss or use between Two Rivers Station and Lookout Station, or it may represent any errors in measurements at these stations. Bottom line designated as "quantity reported in reservoir R. I. Meeker" was plotted from data furnished by Mr. Meeker, Engineer for The Laramie Water Company, and if such data is correct, would represent amount of water remaining in reservoir as determined by observations of height of water in reservoir at different dates, and it is independent of either inflow or outflow data.

There is an inconsistency in position of last two lines, in that quantity reported by Mr. Meeker to middle of June was greater than amount reported by him as in reservoir May 27th, plus inflow between May 27th and middle of June.

In connection with this diagram I wish to call attention to fact that it was plotted on assumption that capacity of reservoir is 83,550 acre feet, which is capacity given by Mr. R. I. Meeker. The capacity, as I have intimated before, is an uncertain quantity. It is not definitely known. Amount of water in reservoir May 27th is also a quantity open to question and is not based on any definite or accurate knowledge of capacity of reservoir at different gauge heights. This figure, 36,600 acre feet, which marks initial points for plotting diagram, is amount of water stated by Mr. Meeker to have been in the reservoir May 27, 1912. If capacity of reservoir is in fact greater than 83,550 acre feet, as assumed by me, it would
3504 have effect of moving diagram as a whole upwards in vertical direction, which, in connection with flow of 1913, I have pre-

pared a similar diagram for Wheatland No. 2 Reservoir for that year, and that diagram illustrates change which would be made under such assumption. I have not made double diagram for 1912 for reason that it would be confusing.

(Defendants' Exhibit 135, a hydrograph, offered in evidence.)

Referring further to Exhibit 135, if capacity of reservoir is 120,000 or 126,000 acre feet, as has been testified by officers of the Wheatland Company, diagram would be changed very materially in its position on plat. There might be difference shown as much as 30,000 acre feet in reference to initial point of beginning of diagram. This diagram, as I have stated, was constructed almost entirely from data furnished by plaintiffs. For purpose of this graph, I have taken the active capacity of the Wheatland reservoir.

Defendants' Exhibit 136, is mass diagram showing in a different manner from graphs heretofore presented, flow of river for year 1912 at different points. It also shows use of water during that year, upper line on diagram representing supply and lower line
3505 representing use. Upper line was constructed by laying off on sheet acre feet on left hand margin and at bottom platting differences very approximately of several stations on Laramie River from Head of Laramie Valley in Colorado, Sky Line and Divide locations being three miles northerly from extreme upper end of valley. Glendevy Station is shown at about twelfth mile and represents its approximate distances from river. Similarly Boswell Station is shown at about thirty miles, Pioneer Dam as forty miles, Two Rivers as eighty miles, and Lookout Bridge as 100 miles. Distances are by no means accurate and represent relative rather than absolute distances, but for purposes of diagram answer purpose.

Upper line was constructed by starting with discharge of Sky Line and Divide Ditches, of 23,143 acre feet. Discharge or inflow at Glendevy Station, 76,150 acre feet were added to this amount, and discharge of Glendevy Station plus Sky Line Diversion was platted for Glendevy Station. Similarly inflow between Glendevy Station and Boswell, between Boswell and Woods Landing, between Woods Landing and Pioneer Dam, were also platted. Supply furnished by Little Laramie River as indicated by records at Hatton, were then added to supply as shown at Pioneer Dam and aggregate supply of Two streams, Big and Little Laramies were platted as all at Two Rivers Station. At station marked "Lookout Bridge," which is point at head of Wheatland Reservoir No. 2, I have added quantities which in my opinion represent something near inflow into river between Pioneer Dam and Lookout Station. Crediting Sand Creek with 17,000 acre feet, drainage area from east 12,800 acre feet, and drainage from west 12,800 acre feet, discharge for Sybille
3506 Creek for this year assumed at 20,000 acre feet, was then added to total, as was also discharge of Chugwater Creek, 20,000, with result that aggregate flow from all sources mentioned, exclusive of what might have drained into river from large area constituting Laramie Plains proper, amounts to about 480,000 acre feet. But, after having shown supply from Laramie River as repre-

sented by upper line, use of water was then taken into consideration and diagramed. This is shown on lower or second line. As supply of Sky Line and Divide Ditches was taken out at head of valley, that amount was deducted and after such deduction initial point of lower line was fixed at same station as previously used for Sky Line and Divide Ditches. Deduction was maintained, resulting in line parallel to first line until we reached Pioneer Dam. No diversions are shown between head of cañon and Pioneer Dam. As previously stated, these have been omitted in all cases.

When Pioneer Dam is reached, diversions occur at that point to Pioneer Canal and Lake Hattie. This diversion is represented by vertical line, and after this diversion, as well as that of Sky line, have been allowed for, we find we have left 159,989 acre feet. Now turning to Two Rivers Station we find from records for that station that amount which passed the station in 1912 in Big Laramie was
3507 126,068 acre feet. The difference between that and the 159,989 acre feet represents loss or use betwen two stations. This is according to records of two stations extended to cover entire year.

I allowed 69,855 acre feet diverted into Lake Hattie and 17,703 acre feet into Pioneer Canal proper. Those two amounts are indicated on vertical line immediately above words "Pioneer Dam" at head of bottom of plat. Loss or use was 33,921 acre feet. This amount does not include any inflow which might have come into river between two points. Actual loss or use between two points would of course include that amount. This figure, 33,921 acre feet represents amount of water passing Pioneer Dam, which was consumed before Two Rivers Station was reached and is shown on horizontal line marked "loss and use", 33,921 acre feet. It is difference between 159,989 and 126,068 acre feet. At this point in use curve, amount of inflow from Little Laramie River at Two Rivers amounting to 56,838 acre feet was added, showing available amount at that point after uses and losses mentioned have been deducted from total flow, 182,898 acre feet. Between Two Rivers and Lookout Bridge, there were losses, uses, and possibly some errors in that data. Net difference between Two Stations being 20,553 acre feet and amount 162,345 acre feet shown on plat for Lookout Bridge Station is amount passing that point for year 1912. As previously stated in my testimony, there is some loss from evaporation in Wheatland
3508 Reservoir No. 2 shown on plat at 14,092 acre feet.

There passed Wheeler Bridge, according to records, 10,000 acre feet. This would show use between McGill Station and Wheeler Bridge, disregarding any inflow between two points, of 128,253 acre feet. Below Wheeler Bridge Station Sybille Creek enters river in amount 20,000 acre feet. Also below Sybille Creek Station, Chugwater Creek discharges 20,000 acre feet into river.

This completes curve, showing use and disposition of water for year. Point showing amount after Chugwater Creek enters river is on line representing 20,000 to 50,000 acre feet. This 50,000 acre feet then being amount which passed down Laramie River below Chugwater Creek in this year, and, as far as Laramie Plains or Wheatland tract are concerned, is lost, and that amount or more, properly

speaking, represents amount of unused water below mouth of Chugwater Creek. The difference between this final point and final point on upper curve is about 430,000 acre feet. It represents use, loss, waste and stored amount for that season. On right side of plat I have caused to be placed vertical column showing different uses to which water was put. This column is derived from two curves previously described. Beginning at bottom of right hand column we find words "Wheeler Bridge loss." This is amount of unused water which passed that point. Just above these words we find "stored Wheatland No. 1." In year 1912 there was stored in Wheatland Reservoir No. 1, 10,500 acre feet.

Next notation reads "Stored Water Wheatland Reservoir No. 2." This portion of column is cross-hatched by diagonal lines, and represents amount of water remaining in storage in Wheatland Reservoir No. 2 at end of year 1912. Use of water by Wheatland district, excluding amount stored, is shown by vertical hatched portion of column and is marked "Use Wheatland" in amount about
3509 81,000 acre feet. Next notation reads "Loss in Wheatland Reservoir." This represents amount which was lost in Wheatland Reservoir by reason of evaporation. Last notation on right hand column reads "Loss and Use Two Rivers to Lookout," and represents loss and use between those two points.

After this point it was necessary to break column on account of inflow from Little Laramie River at Two Rivers. This break is same break noted on use graph at Two Rivers Station. Beginning with this second column first notation at bottom is marked "Loss and Use Pioneer to Two Rivers." This represents amount of water consumed by use or other losses between those two points. Above this is notation "Pioneer Canal." It represents amount diverted and used by that canal.

Next notation reads "Lake Hattie Dead Space Evaporation and Use." This represents amount of water which it took to fill dead space in Lake Hattie and supply any waste from evaporation in Lake. We have above these words the words "Net Left of Big Laramie." This is solidly covered blue area and represents amount of water which was taken from Big Laramie River for Lake Hattie, over and above necessary amount to fill dead space and to supply losses. The two areas, that hatched in a diagonal direction and that marked "Lake Hattie Dead Space Evaporation and Waste," and solid area marked "Net Left in Big Laramie" combined represents flow from Big Laramie into Lake Hattie.

Next notation reads "Sky Line Canal." This area represents quantity of water diverted by Sky Line and Divide Ditches.

Next notation is "Little Laramie to Lake Hattie" and this area represents amount of water diverted from Little Laramie to Lake Hattie.

3510 Next area marked "Bellamy Canal" and represents amount of water diverted into that canal and above that is amount supplied to James Lake. These two combined represent total diversion for year into Bellamy Canal, and part of which I have charged to use in Bellamy Canal and part to storage in James Lake.

Solid blue area opposite words "Discharge at Two Rivers" represents amount of water discharged at Two Rivers Station from Little Laramie and taken into connection with next area above marked "Loss and Use Lake Hattie to Two Rivers" represents amount of water which passed Lake Hattie Inlet Station on Little Laramie River Station.

Next area is marked "Use Between Dam and Two Rivers Additional." This represents estimated inflow from Sand Creek from drainage on east and drainage on west side of valley and discharge of Sybille Creek, as shown on next area and at top is graphically shown discharge at Chugwater Creek, the area being marked "Loss."

Scales indicating amount of water are same on columns and on graphs. Chart is based on records of 1912.

3511 A. V. OFFICER.

Direct examination by Mr. Delph E. Carpenter:

Manager of the Greeley, Eaton, Windsor and the Fort Collins factories of The Great Western Sugar Company. Manager of four factories since March 1, 1913. Originally located at Loveland from fall of 1900 until fall of 1907. Loveland factory was first constructed in northern Colorado territory. Was first manager of factory and promoted it. Located at Scotts Bluff, Neb. investigating territory August, 1908.

Thirteen years' experience in growing of sugar beets for manufacture of sugar. During that time have become familiar with business both from an agricultural and manufacturing standpoint in general way.

During time was at Scotts Bluff, Neb. had occasion to contract sugar beets at Wheatland, Wyoming. We undertook to develop that territory and tried it out as possible locality for sugar beet culture. At time of considering this territory in first in-
3512 stance, I made personal inspection of Wheatland area. My recollection is that was during summer of 1909, summer and fall, though it is very possible it might have been late winter of 1909.

1910 was our initial or experimental year in the actual growing of beets in Wheatland, Wyo. territory. Have been familiar with district and its returns since that time. Beets grown at Wheatland have always been worked at Fort Collins factory. Beets for first year, that were grown in 1910, were contracted for Scotts Bluffs factory. We were late in completion of the plant that year and in order not to delay harvest we diverted crop to Fort Collins. Beets grown at Wheatland during years 1911, 1912 and 1913 were shipped to Fort Collins factory for manufacture.

Tonnage of sugar beets harvested at Wheatland, Wyo. area during years 1910, 1911, 1912 and 1913 are as follows: 1910, 4235 tons; 1911, 3078 tons; 1912, 3073 tons and 1913, 3941 tons.

3513 Our first year, 1910, yield was less than it has been since. Conditions was probably due to a number of causes. My observation has been that first year growers are not always, in new

locality, really abreast of their work and planting may not be properly done.

Our records show the following for the Wheatland area:

1910, 1060 acres with average yield of 4.09 tons per acre;

1911, 338.6 acres with average yield of 9.09 tons per acre;

1912, 294.05 acres with average yield of 9.97 tons per acre;

1913, 535 acres with average yield of 7.6 tons per acre.

Am manager of Eaton Sugar Factory, among others. Yield of Eaton factory in tons per acre is as follows:

1911, average yield per acre 13.76 tons;

1912, average yield per acre 15.40 tons;

1913, average yield per acre 13.13 tons.

Wheatland, Wyo. yield for 1911 was about 65% of Eaton yield per acre.

3514 Wheatland yield for 1912 was about 64% of Eaton yield per acre;

Wheatland yield for 1913 was about 56% of Eaton yield per acre.

Sugar content of beets raised in Wheatland territory for 1911 was somewhat higher and also 1912, than Eaton factory, but for 1913 was a trifle lower than that of Eaton territory. Wheatland district average sugar content for respective years is as follows: 1911, 17.93% sugar; 1912, 17.79% sugar; and 1913, 15.6% sugar. In Eaton factory sugar content for respective years was as follows: 1911, 15.84% sugar; 1912, 16.84% sugar and 1913, 15.64% sugar.

Difference in per cent of sugar during years 1911 and 1912 in favor of beets in Wheatland area, so far as revenue to growers is concerned, is not sufficient to offset difference in tonnage in favor of Eaton district for same years. It would not cover a considerable portion of difference so far as growers are concerned.

Aggregate tonnage of beets grown and furnished Eaton, Greeley and Windsor factories for years 1911, 1912 and 1913 are as follows:

Eaton factory, 1911, 61,930 tons; 1912, 160,965 tons and 1913, 217,899 tons. I want to qualify that for years 1912 and 1913 with supplemental statement that we received in Eaton territory in 1912 and '13 small tonnage from Campbell, Nebraska, territory. It

3515 was insignificant, probably about 3000 tons. Practically all beets for Eaton factory are raised within radius of 15 miles of factory, with exception of Campbell, Nebraska, territory where we took a few beets. The tonnage of latter points is very insignificant.

Greeley factory is as follows: 1911, 84,487 tons; 1912, 121,727 tons and 1913, 137,484 tons.

Windsor factory as follows: 1911, 58,446 tons; 1912, 138,931 tons and 1913, 172,876 tons.

Territory of Eaton and Windsor factories most nearly corresponds with lands that go to make up Greeley-Poudre Irrigation District.

1913 tonnage for Fort Collins Factory was between 150,000 and 160,000 tons. Yield was trifle under 12 tons per acre. This tonnage included 3941 tons from Wheatland area.

A. V. OFFICER.

3516 Cross-examination by Mr. John D. Clark:

I did not visit the Wheatland District in 1913, but from the conditions in Colorado and the reports from that district I should believe that the falling off in the production and in the quality of beets at Wheatland was due to climatic conditions. I do not know whether there was any complaint of shortage of water. In the main we have always been able to supply sufficient help for beet culture at Wheatland. In 1910 we paid $4.50 a ton for beets at Wheatland and in 1911 $5 a ton, and in 1912 and 1913 have paid the
3517 same scale as in Colorado less 40 cents a ton for freight, in 1912, however, guaranteeing a minimum of $5 a ton and paying the same minimum in 1913. We had canvassed the Wheatland district for contracts for the year 1914, and expect to operate there if sufficient acreage is subscribed. As in Colorado the reduction in the price we offer has probably influenced the acreage subscribed, and the Wheatland yield of 7.36 tons per acre in 1913 may have a like effect. I believe we will have 600 acres subscribed in the Wheatland district for 1914 with the price reduced to $4.50 a ton irrespective of sugar content. In 1913 the Wheatland beets averaged about .35 of one per cent higher in sugar content than the general average of beets at Fort Collins. For the year 1914 we have contracted for sufficient beets to give us a 100-day campaign
3518 at Greeley, a 90-day campaign at Windsor, and a 140-day campaign at Eaton, from which territory we will divert beets to Fort Collins and Loveland, and we expect an additional acreage of about 10% to be subscribed. The length of the campaign is based upon the estimated yield in the Eaton territory of 14 tons per acre and in the Windsor territory of 13 tons per acre, and in the Greeley and Fort Collins areas of 12 tons per acre.

3519 Redirect examination by Mr. Delph E. Carpenter:

Term "campaign" represents period that factory is actually engaged in slicing beets from which sugar is made. Factories are able to slice and manufacture into sugar during each 24 hour period the following tonnage: Greeley factory, campaign 1913, daily average slicing capacity was 1003 tons which was maintained through campaign; Fort Collins factory it was 2050.6 tons; Windsor factory about 1100 tons and at Eaton factory about 1088 tons.

Campaign over given period of days would be campaign consuming tonnage of beets obtained by multiplying capacity of factory per day by number of days of campaign. Tonnage I have given you as harvested tonnage in respective territories, is not necessarily tonnage that would be sliced by individual plants, for reason that we divert beets from Windsor and Eaton factories and sometimes from Greeley factory to Fort Collins and Loveland factories. For campaign 1913 ran number of days at Greeley factory with average of 1003 tons per day. To ascertain total tonnage manufactured at factory, multiply the length of campaign by daily tonnage.

3520 Cost of producing an acre of sugar beets under irrigation throughout territory with which I am familiar varies according to conditions of grower. Cost of producing an acre of sugar beets outside of use of land and water, assuming that to be present for production of all crops, I would estimate at from $37.50 per acre up to probably $45. per acre. It would be necessary for farmer to receive that amount of return per acre before he would be able to derive any profit from use of his land and water from growing beets, based on prevailing price for hand labor and team work. Price paid for hand labor, team work, tonnage delivered and length of haul all enter into difference in cost per acre. It costs more to deliver heavy tonnage with long haul than the same tonnage with a short haul. Aside from haul, another factor which must be figured is question of fertilization of land.

Assuming land is not fertilized, I should think it costs about as much to raise an acre of beets producing 15 to 18 tons as it does an acre producing 9 tons, outside of hauling, unless you were planting alfalfa lands where it was necessary to do two plowings. If
3522 conditions are same, if there is no fertilization, same cost of preparing ground obtains it would be safe to say that it would cost as much to produce an acre of 9 tons of beets as it would an acre of 16 tons beets, outside of transportation of crop. The 1914 labor contract, however, is based somewhat on crop yield. Difference is small. 1914 contract provides for payment of $18. per acre with an additional payment of 25 cents per ton on each ton above average yield of 12 tons per acre. Below 12 tons per acre full price of $18 per acre for hand labor will prevail.

Small returns per acre in Wheatland area has had a discouraging effect to contracting of beets in that section.

Growing season Wheatland area is about 2 weeks later than growing season Poudre Valley area. I judge from observations there in spring of 1910 and from reports from our agriculturalists. That is in spring of year. Season closes a little earlier in fall but they have ample time within which to complete their harvest.
3525 I think Wheatland area is adapted to production of sugar beets, perhaps not quite so profitably as to grower in Colorado. Soil is not uniform and as extensive in that area as it is in the Poudre Valley. They have good deal of very fine soil in Wheatland territory and also some soil that is not so productive. I think some of soil there, from observations and investigations made, was rather shallow in some localities. I am of impression that the western portion of area was the less productive.

With return of the potato crop in the Cache la Poudre Valley, acreage of sugar beets planted in 1914 will be less. In certain localities there will be more potatoes. That applies principally to Eaton territory and small portion of Windsor territory. There
3523 will be more potatoes planted in 1914 than in 1913. As I understand 1913 acreage of potatoes was about 25% of 1910 acreage. There was corresponding large increase of acreage of sugar beets in 1913.

It is problem for farmer in Wheatland district to realize cost of

production from his sugar beet crop, with average production of about 9 tons per acre with price of 1914. His margin would be comparatively small based on team work at $4.50 per day for 2 horse team. If farmers were only to realize the 1913 average of 7.36 tons per acre, margin of profit would be correspondingly reduced. If he hired all of the work done, I question seriously whether he wou'd realize cost of production or any more than break even.

In final analysis difference between Eaton area and Wheatland area, in production of sugar beets, lies in aggregate net return received by farmer so far as community interested is concerned.

Average tonnages of any of factories refers to measured acreage harvested and delivered to factories. We have yields in all territories varying probably from 9 to 25 tons per acre. I refer to Colo-
rado territories. In Wheatland territory I presume there
3524 would be a similar proportioned variance. Undoubtedly there are people there who have operated at a loss and some of them at a profit.

3525 Redirect examination by Mr. Delph E. Carpenter:

Difference of yields following differences of precipitation particularly applies with regard to spring precipitation. On account of fact that at that critical growing period, plant requires rainfall. Irrigation at that period does not supplant rainfall. The sugar beet plant at that stage of growth, is good deal more fragile than it is later. Other factors enter, such as condition of ground, and diseases of some sort are apt to develop and reduce both sugar content and yield.

After first year farmers have usually obtained sufficient experience to qualify them to grow sugar beets with proper degree of success, with assistance they are given from our experienced agriculturalists. We hire experts who make it their special business to assist growers in proper culture of their beets. Same condition has prevailed in Wheatland territory in that regard. We have had field men there every year since we have occupied that territory.

Fall rains tend to reduce sugar content of beet crop. If
3526 we have heavy storms after September 25 and heavy precipitation after that time, beet would drop in sugar content and if it continued wet for a week or two, it is questionable whether beets would ever get back to normal.

Sugar beet harvest commences September 25.

JOHN E. FIELD, continued.

3527 Direct examination by Mr. Delph E. Carpenter:

Flow of Laramie River and tributaries for year 1913, has been to some degree considered. This year, 1913, is of interest because it is a year of extreme low flow. Probably no year of which we have record had so small a run-off, unless it was 1902. Percentage of 1902 run-off on Poudre was about 51% of normal. Of all years of which we have records at Woods Landing, 1913 is lowest with 51%, next lowest being 1896 with 55%.

Therefore, if it is shown that this year, 1913, furnishes sufficient supply of water, there could be no question relative to supply, especially with reservoir systems now constructed and more particularly with Wheatland Reservoir No. 2 occupying as it does a very strategical position near northern end of Laramie Plains, where all of water, whether waste, seepage, flood or low flow is intercepted.

Other reservoirs in valley are filled by inlet ditches from stream. These inlet ditches necessarily are of limited capacity and it is impracticable to build them large enough to carry the stream floods. These extreme conditions might occur but once in five years and so large an investment would not be justified by amount of water caught at these rare intervals, but with reservoir across channel of stream as in case of Wheatland Reservoir, without extra expense these additional waters can be conserved and used.

3528 Same is true in cases of breakage of inlet canals for the upper reservoirs. Any canal which breaks or any reservoir which discharges water, any waste or escape water from different sources, will be intercepted by Wheatland Reservoir. It is a reservoir of large capacity and will be able to conserve all of the flood waters except possibly such abnormal conditions as obtained in year 1909. Use of reservoir is to equalize flow in river and to permit owners to conserve surplus waters of one year for use in subsequent years of lower flow. Reservoir lies not far distant from point of application and outflow can be controlled with considerable efficiency, and with Reservoir No. 1 on the Wheatland area, any surplus water which might be turned into river, or which on account of torrential storms, waters of which come into reservoir and tunnel or which fall on water sheds of Blue Grass and Sybille Creeks, can be carried through inlet canals and, if not needed for immediate use, can be stored in Wheatland Reservoir No. 1. So that practically all water available is controlled, even that which comes in below Wheatland Reservoir.

Referring to James Lake Reservoir and to storage of water during 1913 and the use thereof, Mr. Sevison, witness for plaintiff, among other statements thought that there were 3,000 acre feet stored for March, 1913. Mr. Meeker says on plaintiff's Exhibit K and L that there were 18,400 acre feet in the reservoir November 25, 1912; 20,400 acre feet April 25, 1913 and 19,800 acre feet October 30, 1913, showing a gain for this reservoir of 2,000 acre feet over and above all uses and losses. Records also show that inflow into Lake James in 1913 was 12,310 acre feet. These figures indicate a use and loss during season of 10,910 acre feet.

3529 I have discussed incidentally the 1913 conditions for Wheatland Reservoir No. 2 in my statement for 1912, but it is perhaps well to repeat a portion at this time and make other statements.

Figures given in discussion of year 1912 showed there were 47,000 acre feet in storage in Wheatland Reservoir No. 2 at end of year 1912. This amount was available for use in 1913. Inflow as shown by records at Lookout Station was 78,678 acre feet, making total supply for 1913 of 125,678 acre feet. Outflow as shown by

records at McGill Station, was 96,318 acre feet and there should therefore be left in reservoir 29,360 acre feet and there was probably this amount left less losses during year from evaporation. Making allowance for evaporation, I estimate that amount left in reservoir at end of 1913 was 14,360 acre feet. This agrees almost exactly with figures given by Mr. Meeker in his Exhibit K, wherein he states that on November 19 there was 9000 acre feet. Inflow and outflow between November 19 and end of the year, increased this amount until January 1, 1914. Amount is shown to be 14,525 acre feet. Mr. Meeker says further on Plaintiff's Exhibit K, that on April 29, 1913, there was 76,000 acre feet in reservoir. On May 5, I visited this reservoir and observed height of water surface. It was within
18 inches of extreme high water mark made by big flood
3530 of year 1909, in which year dam was threatened with destruction and only utmost efforts on part of owners succeeded in saving dam to prevent water from passing over it.

Capacity of reservoir, as I have previously explained, is 123,000 acre feet, that being average between capacities as stated by Mr. Elliott and capacity stated by Mr. Johnston. Under assumption that high water area of reservoir was 7000 acres, amount of water in reservoir on May 5, can be figured. The 18 inches which reservoir lacked of being full would mean about 10,000 acre feet less than full. This would indicate that amount stored May 5, was 113,000 acre feet.

Between April 29, date of Mr. Meeker's report, and May 5, date of my visit, inflow by records of Lookout Station was 6000 acre feet. Adding this to Mr. Meeker's estimate, amount in reservoir on May 5 should have been 82,000 acre feet as against 113,000 acre feet, showing a discrepancy in amounts stated to be in reservoir of 29,000 acre feet. Inflow after April 29, shown to be 51,000 acre feet and basing amount of water on Mr. Meeker's figures, there would have been in or passed through reservoir during season 127,000 acre feet. McGill Station shows an outflow of 96,000 acre feet, which would indicate that there was left in reservoir 31,000 acre feet less evaporation.

Allowing 15,000 acre feet for evaporation, there would be left 18,000 acre feet in reservoir at end of year, as against amount recorded by Mr. Meeker of 9000 acre feet on November 18. However, after that date, 6500 acre feet was amount of inflow between November and December 31, which leaves difference of but 500 acre feet, so that relative amounts between two dates seems to agree although
actual total amount disagrees on account of different assump-
3531 tions as to capacity of reservoir.

In year 1913 notwithstanding fact that company ran an abnormal amount of water and there was 19,492 acre feet escaped down Sybille Creek, there was left in Wheatland Reservoir No. 2, for use of Wheatland tract, 16,000 acre feet of water available for use in 1914. So that, even very dry year of 1913, did not exhaust available supply in this reservoir.

Wheatland Reservoir No. 1, is reported to have had in November 2nd, 1913, 2,100 acre feet remaining. So that in this very dry year, even its reservoir supply was not exhausted. Wheatland Reservoir

No. 1 is located in midst of Wheatland area and near town of Wheatland. It is so situate as to be able to impound waters flowing from Sybille Creek as well as from Laramie River.

Water stored and used in Lake Hattie in 1913. It was reported that in April, 1913, there was 19,400 acre feet in the reservoir and in November 26,000 acre feet, a gain above uses and losses in this year 1913 of 6,600 acre feet. It has been previously stated by me that 16,870 acre feet were used in 1913 and 5,000 acre feet evaporated, so that in 1913 company controlling Lake Hattie reservoir was able to increase its storage, 7,300 acre feet, this 7,300 acre feet being for entire year, while 6,600 acre feet was from April to November, inclusive. On November 20, 1912, it has been stated by plaintiff that there were 18,700 acre feet in storage. On Plaintiff's Exhibit I, we find that 28,470 acre feet were run into Lake Hattie in 1913, making total of 47,170 acre feet available from reservoir in addition to this 13,504 acre feet, which were carried through Pioneer Canal proper, making 60,674 acre feet available for this system 1913.

3532 In practice, even under good ditches, a short supply once in 5 or 10 years is to be expected, with a short supply one year in three the project is still feasible and percentage of crop production will equal percentage of crop in humid regions. It is not practical to limit irrigation development to those projects which have absolutely sure supply in years of extreme drouth. Furthermore in this project more water could have been stored in 1912 had works been in condition to receive such water and had efforts been made to secure a larger supply. No water whatever being run from Little Laramie River in 1913, as has been previously shown, practically 62,000 acre feet of dead space was filled in 1912.

This 62,000 acre feet of dead space, filled in 1912, should be considered active when considering the available water in Laramie River. If this water had not been placed in dead space but on contrary in active space, reservoir would have been entirely filled and there would have been a surplus of some 12,000 acre feet, which would have remained either in river or passed over spillway.

Adding this 62,000 acre feet to what was actually available, 60,674 acre feet, we have a total available of 122,673 acre feet or enough to irrigate probably 100,000 acres.

Records of flow at mouth of Sybille Creek, as I have stated, in 1913 was 19,482 acre feet. The greater part of this water should have been conserved and would have relieved drought on river

3533 by that amount. At Wheeler Bridge below Wheatland Reservoir, on east side of Laramie Mountain, discharge in 1913, April to September inclusive, and for 25 days in October and 22 days in November, was 6,913 acre feet. For entire year discharge was probably in excess of 10,000 acre feet.

There are no records for Chugwater discharge for year 1913 nor for North Laramie River. They all probably did not discharge a great amount of water and it would be my judgment that discharge of Chugwater would be similar to its discharge in 1911, about 2,000 acre feet.

On account of increased storage effected during 1913, it is appar-

ent that there was no shortage in this year, although there was carried over from 1912, 94,600 acre feet. This is exclusive of the 62,000 acre feet held in dead space in Lake Hattie Reservoir.

Even in years of extreme shortage, and assuming that Colorado was diverting all the water she could by physical conditions divert, there is still a means of supplying any possible deficiency of water supply in the Laramie Valley.

It is well to call attention at this point to fact that State of Wyoming has it is disposal a considerable water supply that will make up any possible deficiency in years of very low flow on Laramie drainage.

This possible deficiency can be made up by means of ditches diverting water from Douglas Creek, a tributary of North Platte drainage. The Laramie Water Company is already providing itself with such a supply and has commenced construction of ditch from Douglas Creek, which will bring waters from North Platte across divide into Laramie drainage, through construction of Bell Supply Ditch No. 2, commonly known as Douglas Creek diversion. This water will first be discharged into Little Laramie River and then diverted from that stream and will be available for Lake Hattie System, thereby overcoming any possible shortage that might
3534 exist in years of extreme low flow. Construction of this Douglas Creek diversion may have been contemplated by projectors of Lake Hattie enterprise, owing to fact that they already well knew of notorious and open construction for many years previous of Greeley-Poudre system on upper reaches of Laramie drainage in Colorado. I think more likely, it was due to a lack of appreciation of large amount of water in Laramie River which was available for their project. These caused them to seek this other supply. The very dry year of 1913 might influence supply of water for 1914. 1914 promises to be a year above normal, so that although amount of stored water at end of 1913 was not as great as it was at end of 1912, there is no possibility of a shortage in 1914.

Percentages which I have already given and which represent the Colorado diversions made by the Sky Line Canal, the Divide or Sand Creek Canal and the Greeley-Poudre Systems during normal years, will presist in years of low flow. In years of high discharge the percentage diverted by Colorado would probably be less. Diversion by Colorado in 1913 by Sky Line Canal was 15,000 acre feet, about
75% of what it had been discharging annually, and about
3535 2/3 of what was carried across divide in 1912. In 1913, there passed Lanning Bridge (which is situated about 1 mile below mouth of tunnel of Greeley-Poudre Irrigation District and is across Big Laramie River and is about 1 mile below west fork of river), May 1 to July 1, 5600 acre feet. In 1913, April 21 to October 19, there passed Glendevey Station 34,368 acre feet, all of the 5600 acre feet could have been diverted and probably would have been diverted by the Greeley-Poudre System, diverted through the tunnel, and a percentage of balance which passed Glendevey Station would have been diverted. It is not probable that more than 30,000 acre feet would have been diverted, than was actually diverted that year. I refer to

the actual diversions by the Sky Line Canal. If the tunnel had been operated not more than 30,000 acre feet additional would have been diverted.

This 30,000 acre feet is less than the amount stored during 1913, and only about ½ of amount carried over from year 1913 to year 1914. Amount carried over from year 1913 to 1914 was as follows: Wheatland Reservoir No. 2, 15,000 acre feet; Wheatland Reservoir No. 1, 3000 acre feet; Lake James, 19,800 acre feet; Lake Hattie, 26,000 acre feet; totaling 63,800 acre feet, or as I have said, there was carried over more than twice the full amount which would probably have been diverted by the Greeley-Poudre System in year 1913.

In speaking of the 30,000 acre feet probable diversion by the Greeley-Poudre system on the Laramie River in a year like 1913, I refer to that system without the addition of the Lower Mc-
3537 Intyre Extension. I stated that in normal year the diversion of that canal would be about 15,000 acre feet. In this year, 1913, amount diverted by possible extension to Lower McIntyre I believe would have been approximately 9,000 acre feet. During months of June to September inclusive, discharge of Upper McIntyre gauging station was 8,923 acre feet. That station is located a short distance below point of diversion of possible extension of Lower West Side Collection Ditch of The Greeley-Poudre System. A part of this quantity would have been diverted by the Upper Rawah Ditch from the Upper McIntyre, but water would probably have been running in month of May in anticipation of a shortage, so that I believe it would have been possible to have gotten 9,000 acre feet more by such an extension in this dry year.

I included in this 9,000 acre feet additional, what little water would enter canal from intervening streams between McIntyre and Rawah Creeks, and which would be intercepted by Lower Extension.

Percentage of possible diversion by intermountain ditches and tunnel in Colorado, will remain about same in dry years as it will be in wet years, in low years as well as in high years, especially with reference to diversion by the Greeley-Poudre System. That is not true, I think, with reference to Sky Line Canal. In year of low flow they would make an extra effort to get more water, as
3537 they have in past; but that extra effort on their part would result in decreasing amount which Greeley-Poudre system could divert in low year, so that new diversion which is proposed by Greeley-Poudre system would be about same expressed in percentages for high years, normal years and low years.

When I gave 90,000 acre feet as the maximum possible diversion for all time from Laramie River in normal years by various intermountain diversions in Colorado, I did not intend that that amount in acre feet should be deducted from the Colorado Laramie River flow in all years. To better illustrate perhaps impossibility of diverting so large a quantity of water, I call attention to flow at Glendevey in 1913, between April 21 and October 19, which would be a period when ditches could be operated. Flow at Glendevey was 34,388 acre feet. Greeley-Poudre system could not have obtained

even all that supply. There would have to come out of that supply the diversion for the Divide Ditch (Wilson Supply Ditch) and amount which comes into river below Collection Ditches and necessary losses from seepage and from limited capacity of collection ditches. Even this year, it is probable that Collection Ditches could not carry all of water which might be discharged from drainage area. Average discharge during day does not represent peak of flood. There is a very considerable fluctuation during the day itself, and, through accidents and otherwise, some water would get away and not reach mouth of tunnel. I refer to some of the water which, theoretically, might be diverted.

I stated that it would be necessary to deduct from the 1913 Glendevey flow, the Divide Canal diversion, for reason that canal
3538 did not carry any water across divide into Poudre that year. It is fair to assume that the Divide Ditch will carry water in other years and therefore deductions should be made as I have stated.

I have prepared diagrams or graphs for year 1913, similar to diagrams prepared for water flow in Laramie River and tributaries for year 1912.

(Defendants' Exhibit 137, mass diagram, offered in evidence.)

Exhibit 137 is mass diagram, showing condition at several stations on Big Laramie River between Sky Line Canal and Woods Landing, Wyoming, for year 1913.

Exhibit 137 should be considered in connection with Exhibit 132, for purpose of comparison between years 1912 and 1913. The two exhibits are similar and were constructed on same basis.

In Exhibit 137 diagonal hatched area at the bottom of graph, as shown by legend and marked "Sky Line and Divide Diversions" represents diversion by Sky Line Canal for that year. Area cross-hatched by diagonal lines immediately above that one, shows run-off tributary to tunnel and through Collection Ditch system of Greeley-Poudre development. Horizontal hatched lines represent amount of water coming into river between tunnel and Boswell Ranch Station, and area hatched by vertical lines represents graphically amount of water which flows into Big Laramie River between Boswell Ranch Station and Woods Landing Station. Columns as whole represent total supply of river at Woods Landing Station.

(Defendants' Exhibit 138, a hydrograph, offered in evidence.)

3539 Exhibit 138 is similar to other hydrographs which have been introduced, and in explanation would say that lower and unhatched areas in which words "Lake Hattie and Two Rivers" appear, is area representing amount of water passing those two stations. In case of January, February and March, amount passing two stations was practically identical and is therefore marked and credited to both stations. In April, it was credited to Lake Hattie, that being larger area. In month of May, words "Two Rivers" appears on unhatched area for that month, represents discharge at Two Rivers for May. The same is true for month of June. Discharge

of Two Rivers is shown also for months of July, August, October and November. In December amount is credited to both Two Rivers and Lake Hattie Stations. I don't mean to say that this area represents amount of water furnished Lake Hattie, but the amount which passed gauging station at head of Lake Hattie Inlet No. 2, the canal from the Little Laramie River. Area marked solid blue is loss of water unaccounted for between head of Bellamy Canal and station at Lake Hattie Dam No. 2. The next area which is hatched in a diagonal direction and is shown by legend, represents loss and use between Lake Hattie Inlet Station and Two Rivers. This area was obtained by taking total flow at gauging station at Filmore and deducting from it amount of water at Two Rivers Station and amount of water which was supplied to Bellamy Canal. Area is ob-
3540 tained by process of subtraction and does not represent direct measurements. There is a small area marked first with horizontal lines and then with diagonal lines stated on legend to represent gain between Filmore and Lake Hattie Inlet. In this connection I will state that at times there appears to have been a gain between Filmore Station and Lake Hattie Inlet and other times a loss. There will also be observed an area where diagonal hatching is in both directions, making a diamond shaped appearance in the area. This, according to legend, represents increase between Bellamy Canal headogate and Lake Hattie Dam No. 2. The area with horizontal cross-hatching represents gain between Lake Hattie Dam No. 2 and Two Rivers, while area at top of diagram for April, May, June, July and August represents diversion by Bellamy Canal itself and part of which water was discharged into James Lake. The outer boundaries of the diagram for months of May and June, do not represent graphically total supply of river unless one should take into account fact that there is an increase between Bellamy Canal and Lake Hattie Canal as shown by double hatching. This area should be used twice to give total supply.

(Defendants' Exhibit 139, a hydrograph, offered in evidence.)

Exhibit 139 or diagram is a use diagram. That is, it is supposed to show what becomes of water and waste of Laramie River between Two Rivers and Lookout. This diagram shows particularly use and losses and gain between those two stations, this being for year 1913.
Legend shows that use and loss between two stations for this
3541 year was 2,650 acre feet and gain between two stations for this year was 2,000 acre feet. This is net gain and represents gain over and above use which might have been made of waters of river between those two points at the time shown. This 2,000 acre feet of gain is in months of April, May and August. It is quite small in August, due in all probability to fact that more water was used in that month than during month of April or May. Absence of gain in months of June and July is accounted for and fact that a loss appears in those two months is probably due to use of water between stations.

(Defendants' Exhibit 140, a hydrograph, offered in evidence.)

Defendants' Exhibit 140 is diagram similar to Exhibit 135 and was constructed in same manner. Principal difference being I show on this Exhibit 140 difference which would appear if 123,000 acre feet was assumed as capacity of Wheatland No. 2 reservoir instead of 83,000 acre feet. In designating the difference, the portion of diagram based on capacity 123,000 acre feet is represented by upper diagram, the lines of which are indicated by B′ and C′ and lines marked B and C represent conditions under asumption that capacity was 83,000 acre feet. On original drawing of this diagram, lines marked B′ and C′ were drawn in red. In making blueprint red shows same as though it were black ink, necessitating use of letters B and C and B′ and C′ to distinguish them. Upper line marked B and B′ represents inflow into Wheatland Reservoir No. 2,
3542 according to records at Lookout Station. Lines C and C′ represent outflow as shown by records at McGill Station. Dotted line represents amount of water reported in reservoir. Lower of two dotted lines showing position according to report of Mr. R. I. Meeker. Upper dotted line was placed by making correction for difference in assumed capacities. A portion of diagram is cross-hatched between B and C′, this cross-hatching was placed on diagram to call attention to overlapping of two diagrams and has no other significance.

(Defendants' Exhibit 141, a hydrograph, offered in evidence.)

Defendants' Exhibit 141 is a mass diagram for 1913 and, similar to Exhibit 136 for the year 1912. Upper line represents accumulating supply. Lower line represents use and disposition of water. Total supply being about 235,000 acre feet for this year. It will be noted that any reference to Chugwater Supply has been omitted for reason that we had no records on that stream for 1913. In fact Chugwater supply does not affect areas which we have under consideration except as it supplies diversions for water on land below the mouth of Chugwater Creek. There is shown on upper line quantities entering river between various stations. In this year it is shown that 15,222 acre feet were diverted by Sky Line Canal; that 42,095 acre feet were diverted by Pioneer Canal for Lake Hattie and Pioneer Canal itself. That loss and use between Pioneer Canal Dam and Two Rivers Station was 22,682 acre feet, in addition to whatever inflow might have occurred between those two points. Quantity furnished by Little Laramie River at Two Rivers was 25,300 acre feet and loss or use between Two Rivers and Lookout Station was very small amounting to
3543 about 623 acre feet. This very small amount resulting in an almost horizontal line between the two stations. I have shown on this exhibit something that was not shown on Exhibit 136, namely, amount of stored water which was held over in Wheatland Reservoir No. 1 and Wheatland Reservoir No. 2 in amount 57,500 acre feet. This quantity is shown because it was available for year 1913. There was discharged out of reservoir 95,992 acre feet, there appears on lower line between McGill and Wheatland Stations figures 7,500 acre feet. This represents amount of water

which was used out of Wheatland Reservoir No. 1. There also appears a bracket with an arrow pointing to words "Storage and waste in Reservoirs Numbers One and Two end of 1913." Amount of water passing Wheeler Bridge is also shown opposite that station in amount of 10,000 acre feet and inflow through Sybille Creek is also shown in amount of 20,000 acre feet. On right side of exhibit are two columns. These represent in another way the same things that are shown on the graphs, and on lines in main part of diagram, and these columns show clearly amount of water which was used from Wheatland No. 2 Reservoir and also amount which was used from Wheatland No. 1 Reservoir. It shows amount of stored water which was used not only in 1912, but also that which was stored in 1913.

Sybille Creek supply is charged to loss as that amount of water passed down river unused. Amount which passed Wheeler Bridge is also marked loss. In amount these two are 30,000 acre feet or about amount which would have been diverted by Greeley-Poudre Tunnel had it been in operation.

(Defendants' Exhibit 142, a hydrograph, offered in evidence.'

3544 Defendants' Exhibit 142 shows graphically the supply and use of waters of Laramie River in so far as it relates to total supply of river and to diversions being made from Laramie River to both Cache la Poudre by Sky Line and Divide or Sand Creek diversions and by the Greeley-Poudre District diversion.

It represents a normal year, supply being for amount supplied by Colorado alone and it does not include supply which originates in Wyoming. The column marked No. 1 represents average diversion of Sky Line and Divide or Sand Creek Ditches. Column 2 represents diversion by Greeley-Poudre District system, which it will make when its system is in full operation along present plans. Column 3 represents diversions which may occur if Lower McIntyre diversion is completed while Column 4 represents sum of diversions by Sky Line and Divide or Sand Creek Ditches and amount which may be ultimately diverted when the lower McIntyre diversion is completed.

This gives to the eye a representation of relative appropriations and diversions and amount supplied by Colorado. Amount supplied by Colorado is represented by solid blue area in Column 5. Cross-hatched area at top of Column 5 represents 17,000 acre feet which Sand Creek furnishes. Column 4 shows graphically diversion possibilities of all works either constructed or now under construction or planned within Colorado areas and represents not only those but all future or possible diversions.

3545 Scale at right of diagram is based on supply exclusive of Sand Creek supply. Total supply represented being 237,500 acre feet.

Scale at extreme left represents acre feet but scale at right represents percentages as indicated. To illustrate, when I speak of scale to extreme left I mean figures appearing on extreme left of sheet.

Percentage scale is indicated by broken line and by words "Percentage Scale Diversions of Total Mean Run-off Colorado-Wyoming line."

Same general percentage will prevail even in years of less than normal run-off. This may be taken as graphic illustration of diversions in various particulars illustrated.

3546 It is necessary to consider exhibits introduced by the plaintiff, particularly those having to do with tabulated water discharge records, etc., in order to properly show relation of those exhibits to actual water flow of Laramie River as exhibited by tables I have already introduced and also to consider possibly the exhibits which were produced by plaintiff and more particularly by R. I. Meeker, that were identified on cross-examination which have not yet been introduced in evidence. I think it is necessary to review the statements made on some of these exhibits and I have taken up part of them with idea of ascertaining wherein their possible values lie in connection with the case.

General criticism of those having to do with alleged normal flow of Laramie River and tributaries is that records used are confined to 1912 and 1913 almost entirely and conclusions are drawn from records of those two years only. Some of records were incomplete at time evidence was introduced, records were subsequently obtained, and therefore corrections should be made.

3547 Plaintiff's Exhibit I, showing Laramie River run-off 1912 and 1913 will first be considered. First criticism that I would make is that run-off at Pioneer Dam is stated on exhibit as 207,000 acre feet is entirely too small. Records at Boswell's for 1912 show 205,678 acre feet. Inflow from Johnson and Beaver Creeks is 27,500 acre feet and there is other miscellaneous drainage bringing the total up to 239,697 acre feet as against 207,000 acre feet, a discrepancy of over 32,000 acre feet. The error appears to lie particularly in discharge for month of June. At Boswell's for June by records made by State of Colorado discharge was 92,912 acre feet. Inflow between Boswell's and Woods Landing that month was 9,914 acre feet, making total of 102,826 acre feet, while Mr. Meeker reports in records which he furnished, a flow at Woods Landing for month of June, but which I believe has not been introduced as an exhibit, 86,003 acre feet, so that there is an error of 16,823 acre feet for month of June alone.

Difference in discharge for year indicated by Boswell records and that indicated by Mr. Meeker's records, is 32,697 acre feet for that year. As table Exhibit I is based almost entirely on total discharge of river for 1912, results are necessarily in error and practically without value. Discharge or amount of water carried by Pioneer Canal is 17,703 acre feet, and that charged to Lake Hattie Reservoir, 69,855 acre feet, I have no means of checking; but amount "Wheatland Reservoir Number Two and intermediate ditches below Two Rivers, 89,550 acre feet" is open to question. Discharge at Two Rivers by records of United States Geological Survey was 94,700 acre feet from April 5 to October 31 inclusive. This discharge would indicate an annual discharge of 120,000 acre feet as against Mr. Meeker's esti-

mate of 89,550 acre feet, or a difference of 32,450 acre feet.
3548 5150 acre feet of this amount is due to slight discrepancies in records and balance is probably due to winter flow not having been taken into account. We may therefore add water which has been accounted for and deduct it from total supply. We have Pioneer Dam 17,703 acre feet, Lake Hattie Reservoir 69,855 acre feet and Two Rivers 120,000 acre feet, a total of 207,550 acre feet accounted for. I have already stated that I have no means of checking the figures given for Pioneer Dam or Lake Hattie respectively. For purpose of last statement I took figures given by Mr. Meeker. Those records were in his exclusive possession. This leaves over 32,000 acre feet unaccounted for, which amount, if we follow process followed by Mr. Meeker in his Exhibit I, would be amount of water used between Pioneer Dam and Two Rivers.

In 1913, which is second table in Exhibit I, total run-off is given, January to November 30, as 106,600 acre feet. This figure is an error also as the record for Pioneer Dam 1913 is given as 109,593 acre feet. This difference, however, was due to incomplete records at time exhibit was presented.

Last column is an error as to amount of water given at Two Rivers at 45,709 acre feet. Geological Survey for this year shows discharge of 54,001 acre feet. Discrepancy is 8,292 acre feet.

We therefore have for 1913 Pioneer Canal 13,503 acre feet; Lake Hattie, 28,470 acre feet and Two Rivers, 54,001 acre feet or a total of 95,975 acre feet. Subtracting this quantity from 109,593 acre feet, we have the use between the Dam and Two Rivers of 13,618 acre feet, not counting inflow between those two points.

The third table on Exhibit I is an error as to practically entire statement in regard to discharges of 1912 and also in regard
3549 to discharge for months of November and December, 1913, as explained above. Aside from any errors, however, shown on this table, third column in table 3 purports to give a mean for 12 months. The mean is obtained by taking actual discharge for year 1913 for January, February and March and for month of December. By taking actual discharge for December, 1912, balance of year has an average between discharges shown for different months of 1912 and 1913.

As I previously stated, year 1912 is very seriously in error but more than that it is misleading to average two years and call it a mean, unless it is definitely understood that it is merely the mean of the figures given and that is thoroughly understood that it is not a mean of the discharge of the river.

The year 1912, as has been stated previously, was one of approximately normal flow, while 1913 was one of only about ½ of normal flow. It is obvious therefore, that any result of adding discharges of these two years would not give mean of discharges of the river.

From Exhibit I, record given by Mr. Meeker which I believe is correct, we are to understand that even in the year 1913, which I state was 51% of normal, 28,470 acre feet was diverted into Pioneer Canal from Big Laramie River. That is in addition also to the amount of water shown to have been diverted for use through the Pioneer Canal

proper. Putting it in another way, diversion of this Lake Hattie and Pioneer statement shows diversion of 28,470 acre feet more water than the 13,504 acre feet diverted and used under Pioneer Canal.

3550 Throughout table Exhibit I, uniform criticism is that flow of water of Laramie River is underestimated by exhibits presented by plaintiff.

Plaintiff's Exhibit J is intended to show same for Little Laramie River as was shown by Exhibit I on Big Laramie River. Records of Geological Survey of 1912 on Little Laramie River April 21 to October 31, give discharge as 109,000 acre feet. For portion of April given discharge was 1,300 acre feet. Discharge therefore, May to October 31 was 107,700 acre feet. This would be about 84% of normal discharge, indicating an annual discharge of 128,000 acre feet. Deducting discharge of Bellamy Canal given on Exhibit J, as 24,793 acre feet, leaves 103,207 acre feet. In order to compare the records with those of Exhibit J, it is necessary to confine ourselves to period June 1 to December 31. The Geological Survey, as I have stated, gives discharge April 21 to October 31, 109,000 acre feet. Deducting May and June flow, we have June to October equals 94,200 acre feet. On Exhibit J we find that discharge June 1 to December 31 was 91,667 acre feet and on tables furnished by Mr. Meeker discharge of November and December aggregated 3,760 acre feet, leaving for period June to October 89,807 acre feet as against 94,200 acre feet recorded by Geological Survey, there being a difference between the two records of 4,393 acre feet for period June to October inclusive, which period is covered by both records.

The amount "The Wheatland Reservoir and intermediate ditches between Two Rivers 37,556" also appears to be an error. Discharge at Two Rivers as shown by Geological Survey records April 1

3551 to October 31, is 42,600 acre feet. Deducting April and May discharge of 7,060 acre feet, and adding for November and December 7,000 acre feet, discharge June 1 to December 1 appears to be 42,540 acre feet, a difference of 5,000 acre feet.

We have therefore for distribution of 1913 on Little Laramie River, Bellamy Canal and James Lake Reservoir, 24,793 acre feet; Lake Hattie Supply Canal, 14,053 acre feet; at Two Rivers, 42,540 acre feet or a total of 81,386 acre feet. Total supply of Little Laramie in 1912 has been given as 128,000 acre feet. Subtracting 81,386 acre feet from this, we have 46,614 acre feet as amount consumed between Filmore Station and Two Rivers exclusive of amount sent to Bellamy Canal and to Lake Hattie Supply Canal. This discrepancy is doubtless in part due to fact that Exhibit J covers the period from June 1 to December 31 only, instead of the entire year. (See correction, p. 3556 as to 46,614 acre feet.)

Tabulation on this Exhibit for 1913 is an error slightly in some respects. Records show supply to have been 59,595 as against 58,361, due to incompleteness of records at time Exhibit J was presented. Flow at Two Rivers is shown to be 24,300 acre feet as against 23,797 and Bellamy is shown to be 12,268 acre feet as against 12,310, leaving for ditches between No. 2 Dam and Two Rivers, 23,027 as against

22,254. These differences, however, are immaterial. The last table on the exhibit is an error on account of the serious discrepancies in records of 1912 and for reason as explained before, that last column of third table can scarcely be considered a mean of the discharge of the months as only two years were used, and in fact only a part of the year 1912.

Exhibit L gives a summary of 1912 and 1913 storage. I would first criticise this exhibit from the fact that amount shown on November 20, 43,500 acre feet, does not represent total amount
3552 stored during that year. As previously stated, I have estimated storage held over from 1912 as 47,000 acre feet. Amount credited to Lake Hattie Reservoir November 20, is 18,700 acre feet. I have no criticism to make of that particular quantity but it should be plain that this is active capacity entirely and that there was, as a matter of fact, diverted into the reservoir 62,000 acre feet besides this amount, which filled dead space and made initial expense at it were.

This water, not accounted for, which went to fill dead space would have been available as active water in that reservoir in any other year than first year of filling. It just happened that year 1912 was first year in which this dead space was filled in Lake Hattie. So that total volume stored in 1912 more correctly speaking would be 156,600 acre feet rather than 91,100 acre feet.

Table referring to storage of 1913 is approximately correct except that it does not show total amount at end of year 1913 but on November 20. If the end of year had been taken amount would have been increased by nearly 5,000 acre feet. Total as I have figured it being 62,254 acre feet. These figures represent of course net storage after all losses from seepage and evaporation have been deducted.

Particular criticism of table Exhibit L lies in fact that allowance was not made for the 62,000 acre feet which was diverted from Laramie River and placed in Lake Hattie to fill the dead space.
3553 Exhibit M is intended to show relative run-off of Laramie River at Glendevey and at Woods gauging stations. Records quoted for 1911 and 1912 are approximately correct, if not entirely so, but year 1912, as previously stated, is seriously in error as to Woods Landing records. This being true, attempt to arrive at percentages results, of course, in incorrect results. Woods Landing records for 1912 to which I refer are those which show a much less flow of water than actually passed that station according to Colorado records. Consequence is that when the low record, Meeker record for 1912, is taken, you are unable to arrive at the correct percentage. Further, in getting a percentage of run-off as between two stations, confining the observations and calculations to three years is apt to lead to erroneous results. That is especially true where two low years and one normal year are taken, which is case in Exhibit M. Years 1911, 1912 and 1913 are taken. 1911 was a low year but not so low as 1913. 1912 was approximately normal. 1913 was very low year. It appears that in order to get percentage of run off it would have been better to take normal discharge at the two stations and compare them. This I have done with result that relation is 77,000

acre feet for Glendevey Station and 215,500 acre feet for Woods Landing Station.

This relation shows that run-off at Glendevey would be
3554 35% of that at Woods. If we had included in these averages the discharge of Sky Line and Divide or Sand Creek Ditches, at both stations, the percentage of run-off at Glendevey would have been 41% of discharge at Woods Landing. This relation is shown by total discharge including Sky Line and Divide Ditches of 97,000 acre feet for Glendevey and 237,500 acre feet the normal discharge as calculated for Woods.

I have already stated that it will be impossible for Colorado to divert all water passing Glendevey Station.

The statement appearing in note at bottom of Plaintiff's Exhibit M and particularly that portion which reads: "Run-off at Woods, Wyoming, for July, August and September represents substantially the entire run-off of the Laramie River basin except the surplus from Little Laramie River basin in occasional years and in considerable amounts produced by summer freshets," is not true. It does not include the amount diverted by Sky Line or Divide Ditches, and the statement "except the surplus from the Little Laramie River basin in occasional years" I think is incorrect, because there is a discharge from Little Laramie River basin in practically all years, not in occasional years. That would be especially true if Lake Hattie people did not divert large quantities of water from that stream. It would also be true if James Lake people did not divert large quantities of water from Little Laramie River.

If these two brand new projects would leave the water of the Little Laramie River alone, there would be considerable run-off every year going down the river toward Wheatland No. 2 Reservoir.
3556 Use of water from Little Laramie River is very wasteful. It is allowed to run over meadows at random and is not taken care of and surplus waters are not re-conducted to channels and in this way a very large amount of water is wasted through evaporation. One reason there is no more water shown to appear at Two Rivers Station on Little Laramie is because of carelessness in failing to return water to channel at earliest possible time. Little Laramie Valley is kept continuously wet and result is that evaporation of water is excessive and waste to a considerable extent is net loss.

To say the least the note just quoted, appearing at bottom of Plaintiff's Exhibit M, is quite misleading.

I desire to give a figure with relation to Exhibit J, which will be comparable and which I did not do this morning. I compared this morning, referring to Exhibit J, amount of water which on Exhibit J was charged to "Ditches between Number Two Dam and Two Rivers, 17,245 acre feet" and which covered period of year June 1 to December 31 only, with figures 46,614 as referring to entire
3556 year. I wish to withdraw the figure of 46,614, so that a comparison can really be made. I stated this morning that total amount of water accounted for as discharged or used by Bellamy Canal, Lake Hattie Supply Canal and as shown at Two Rivers was 81,386 acre feet. Discharge of Little Laramie River for

period June 1 to December 31, is 102,200 acre feet as shown by U. S. Geological Survey records. By deducting flow for April and May, as shown on those records, and adding 8,000 acre feet as discharge for November and December, by subtracting 81,386 from 102,200, leaving 20,814 acre feet as amount used between June 1 and December 31, between Lake Hattie No. 2 Dam and Two Rivers. No. 2 Dam is dam for the Little Laramie Inlet to Lake Hattie. This as against 17,245 acre feet on Exhibit J.

Exhibit K is a résumé of information given on previous Exhibits, and criticism made to those exhibits is of course applicable to this exhibit. In reference to Wheatland Reservoir No. 2, on May 27, amount of water is stated as 36,600 acre feet. This is on assumption that active capacity is about 83,000 acre feet instead of 123,000 acre feet as stated by other authorities. Further, we have no record of amount of water which flowed out of Wheatland Reservoir No. 2 prior to May 27. I have been informed that at one time there were 600 cubic feet per second of water discharged from reservoir in month of April, 1912. I could not ascertain length of time discontinued and could find no records which gave me definite information. Beginning with May 27, which is well along in season, and is date after considerable water had passed down river, leave records incomplete to an extent that makes data not as reliable as it should be.

Statement in regard to Lake Hattie Reservoir on Exhibit K, is open to criticism which I have previously made, that no mention is made of amounts stored in dead space of Lake and which, had it not been first year which Lake had been filled, would have been available for use.

I have prepared a table showing discharge of Laramie River in acre feet at Two Rivers, Wyo., for Big Laramie River for all or portions of years 1909, 1910, 1911, 1912 and 1913 and also showing mean for those years taken as a whole.

(Defendants' Exhibit 143, a tabulation of discharge at Two Rivers, introduced in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 143.)

State of Colorado—Engineering Department.

Discharge of Laramie River (Run-off, in Acre Feet) at Two Rivers, Wyo.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1909	....	....	....	6,720	21,198	104,854	91,390	8,996	9,900	4,230	5,324	10,292	262,904
1910	12,369	13,585	....	....	18,090	9,930	758	522	468	....	....	....	55,722
1911	....	....	....	....	17,200	28,900	3,410	403	367	1,380	....	....	51,700
1912	....	....	....	6,000	11,100	49,200	16,700	6,640	1,780	4,290	....	....	95,710
1913	2,650	2,355	3,296	11,500	7,133	8,152	2,564	1,629	4,016	3,160	4,300	3,246	54,001
Total ...	15,019	15,940	3,296	24,220	74,721	201,036	114,822	18,190	16,531	13,060	9,624	13,538	....
Mean ...	7,509	7,970	3,296	8,073	14,944	40,207	22,964	3,638	3,306	3,265	4,812	6,769	126,753

Years 1909, 1910, from unpublished records of State Engineer of Wyoming.

Unless otherwise noted, all discharges are in acre feet.

Defendants' Exhibit 143 is a tabulation showing discharge at Two Rivers, on Big Laramie River, for different months and giving, as explained in note at foot of table, records for years 1909 and 1910 from unpublished records in office of State Engineer of Wyoming.

Mean annual run-off, as compiled from those figures, is shown to be 126,753 acre feet.

Referring to Exhibit 136, I will state that that figure does not appear on that exhibit for reason that Exhibit 136 pertains to year 1912 only. It is remarkable, however, that amount shown on chart as amount passing Two Rivers Station on Big Laramie River, is 126,068 acre feet as against mean shown on table of 126,753 acre feet, which seems to confirm the previously made statement that year 1912 was approximately normal.

3558 I have compiled similar table for Little Laramie River near Two Rivers, Wyoming.

(Defendants' Exhibit 144, table of discharge of Little Laramie at Two Rivers, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 144.)

State of Colorado—Engineering Department.

Discharge of Little Laramie River (Run-off, in Acre Feet) at Two Rivers, Wyoming, for 1909, 1910, 1911, 1912, *and* 1913.

Drainage Area, 421 Square Miles.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1909	....	....	....	4,244	8,042	51,390	24,648	11,366	9,618	7,688	....	....	116,996
1910	....	....	....	....	3,278	2,430	1,446	1,292	1,112	....	....	....	9,558
1911	....	....	....	....	189	10,100	566	0	0	738	....	....	11,600
1912	....	....	....	6,000	1,990	18,500	8,360	2,530	2,610	3,540	....	....	43,530
1913	1,045	1,000	1,476	4,000	4,864	8,390	461	572	149	953	1,300	1,090	25,300
Mean ...	1,045	1,000	1,476	4,748	3,673	18.162	7,096	3.940	3,372	3,230	1,300	1,090	50,132

NOTE.—Years 1909, 1910, from unpublished records of State Engineer of Wyoming.

Exhibit 144 is tabulation showing discharge of Little Laramie River at Two Rivers Station. The mean as determined from these tables being 50,132 acre feet. We have, however, in this table but one record for the months of November, December and January, February and March, these being for year 1913, a year of very low flow. It is remarkable in this case also that the mean as determined from these years is within 7000 acre feet of the amount shown for 1912. A difference in all probability comes in mainly from fact that we have but one record of winter months and that obtained in a low year, 1913.

(Defendants' Exhibit 145, table of discharge of Laramie River at Uva, offered in evidence.)

(COPY OF DEFENDANTS' EXHIBIT 145.)

State of Colorado—Engineering Department.

Discharge of Laramie River at Uva, Wyoming.

Drainage Area, 3,179 Square Miles.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1895	....	....	....	....	37,200	....	12,052	2,214	892	1,045	....	....	
1896	....	....	....	6,300	14,758	15,471	1,722	3,689	536	....	....	....	
1897	6,149	5,554	9,223	42,367	76,185	62,479	2,460	6,702	714	922	89[illegible]	922	
1898	922	833	1,844	4,522	24,900	38,916	1,660	135	119	154	536	1,107	
1899	6,149	6,109	7,993	58,731	72,432	161,018	94,445	12,482	3,273	4,427	7,141	9,838	
1903	....	....	....	....	13,835	9,699	7,993	1,291	774	676	....	....	
Mean ...	4,407	4,165	6,353	27,980	39,885	57,513	20,055	4,419	1,051	1,445	2,857	3,956	174,086

Table showing average run-off in acre feet for each month.
Unless otherwise noted, all discharges are in acre feet.

Exhibit 145 is table showing discharge of Laramie River at Uva, Wyo. Uva is just below town of Wheatland and station was just above mouth of Chugwater Creek and below mouth of North Laramie. It is also below station previously referred to as Wheeler Bridge.

This exhibit is presented to show amount of water which
3559 passes down Laramie River. Unfortunately records are not of as long a period as is desired, but they give an average mean discharge of 174,086 acre feet per annum. There might be some difference if these years were weighed and compared with discharges at other stations on Laramie and on Poudre, for same period. But it indicates, that a very large amount of water indeed passes down Laramie River.

These records were all made subsequent to inception of a large part of the development of the Wheatland area, and after Pio[illegible]er Canal had been built. These years would be applicable to present time, except for some increased development on Wheatland area and for the very recent construction on the Laramie Plains. Other than these, there has been little change since these records were made.

As compared with Poudre River these years in combination are 119% of normal. I have already stated that taking of 2 or 3 years' discharge of a stream is not a proper basis for determination of normal flow of that stream. Also that in making the Poudre table, Exhibit 124, I took 30 years' records that were on that stream. Referring to discharge of Poudre River, discharge for irrigation season of 1884, gives illustration of remarkable variance that might occur in runoff of any stream during period of only 2 or 3 years. The discharge on Poudre River that year was more than double that of the same time in 1886 and almost equal to combined discharges of 1885 and 1886.

3560 As I have previously stated, the year 1884 was the year of largest flow of which we have record on Poudre River. I have statement of Mr. E. S. Nettleton, State Engineer of Colorado for a number of years, to substantiate this statement. His statement is found in Third Biennial Report of State Engineer of Colorado, on page 57. It reads as follows:

"It will be observed from the above, that the volume discharged during the irrigating season in 1884 was more than double that of the same time in 1886, and almost equal to the combined discharges of the two succeeding years. Whether this decrease has any connection with the destruction of the forests that cover the water shed of the river, it is too soon to determine. The probabilities are that it is accidental, or rather the normal variation in volume which we may expect from season to season. The year 1884 was one of unusually abundant water supply, the largest of which we have any record. Whether we have reached the opposite extreme is to be doubted; the prevailing impression in the district being that there has been seasons of smaller discharge than the last, since irrigation began here."

The volume is dated Denver, Colorado, December 1, 1886, and was probably written in fall of 1886.

The wide fluctuation described in the above statement of Mr. Nettleton, would apply pretty generally to streams of the west. It is a fact that water flow in Cache la Poudre River was lower in years following 1886 than it was during 1886. 1888 was a very low year. The volume discharged during that year April to October, being less than ¼ of that discharged in 1884. The year 1902 was
3561 lower than either 1888 or 1896. There were some high years following that of 1884. Highest year according to Exhibit 124, and covering a period April to October only, was 1909, a year of very large flow having 163% of normal or a little over 2/3 as much as in 1884. Year 1900 was one of very large flow, being also about 2/3 of that of 1884.

Year 1909 was likewise a high year on Big Laramie River.

Inspection of Exhibit 124 will fairly illustrate fluctuation that may occur from year to year in flow of streams in Wyoming-Colorado district.

Relative to duty of water on Laramie Plains Region and in Laramie River drainage in Wyoming, I have shown that normal volume of water available in Laramie River is about 450,000 acre feet per annum; that there will be diverted, when the Greeley-Poudre Irrigation District takes what water it can through the tunnel, 76,000 acre feet. This does not include the extension of the lower West Side Collection Ditch around to McIntyre Creek. If that is included the quantity would be 91,000 acre feet for all Colorado diversions.

3562 Lower McIntyre diversion was estimated at 15,000 acre feet.

After diversion of 76,000 acre feet is made, there would normally remain in the Laramie River for use of Wyoming, 374,000 acre feet of water.

Use of water on the Laramie Plains has not reached high duty that it has in the Poudre Valley, nor has it reached the high duty which we might reasonably expect. Bulletin 67 of the Experiment Station of Wyoming says:

"The time is not distant when present practices must give way to more advanced methods." Again continuing, "the economy in using water of any appreciable value in producing hay crop upon these lands is also doubtful."

In Bulletin 72 of the Experiment Station of Wyoming at page 16 we find the following: "It is probable that a duty of a little under 20 inches of water will give the best results for field peas."

Latter statement is an index of what might be accomplished on almost any crop. This statement relative to 20 inches of water, means that the aggregate depth over the field of the several irrigations during the year would cover the land 20 inches deep or a little over 1½ acre feet per acre.

The methods as stated in the quotation which I made from Bulletin 67 still obtain in Laramie Valley and statement that must give way to more advanced methods is true. They must give way. It cannot remain in the condition it is if water is to be put to use and to attain its greatest good.

3563 It has been my experience that wherever there is no necessity of a strict control of the distribution of water that there is a great abundance, a great surplus of water. Whenever any scarcity begins to be felt a necessity of a careful administration arises. The necessity for putting in proper headgates and controlling works; the construction of waste and return ditches is necessary and these are constructed. Water is no longer allowed to pass down the ditch to some indefinite point below and not used, but waste ditches are made and water is returned to the river at the highest practicable point. This is necessary in order to do justice to the other ditches in the river and to prevent waste.

The prevailing custom of every ditch owner helping himself to water from the stream without supervision is indicative of a large and liberal supply of water. I do not know at what date this custom ceased on Poudre River, but as early as 1876 scarcity began to be felt and this necessity of careful administration and fixing of rights of respective ditches and ditch owners is shown by passage of law of 1879 and 1881, which provided for an adjudication of rights upon the river. There has been very great development and extension of development on Cache la Poudre River since 1876. I have not ascertained what irrigated acreage was in 1876, but as late as 1887 there was, according to report of State Engineer of that year, 108,895 acres of irrigated land or less than ½ of what is irrigated at the present time.

3564 There were claims of shortage of water in Cache la Poudre River as early as 1876. That is, it was thought to be a shortage and there were predictions that the development of irrigation upon the Poudre River had reached practically its maximum, and that no other ditches should be built and it was predicted that those ditches which were inaugurated at that time and constructed, would meet with failure and disaster by reason of lack of water.

The feeling among appropriators on the Cache la Poudre River in 1876 is thus described by Mr. E. S. Nettleton, then State Engineer, in Second Biennial Report of State Engineer of Colorado:

"In 1876, the greater portion of the residents in the lower part of the Cache la Poudre Valley declared that no more new canals should be built, or more water taken from the river. It is a very noticeable fact that new appropriations for canals every year, have been made since 1876 from Cache la Poudre River, and yet no greater alarm exists at the present about scarcity of water than was felt eight years ago. The subsidence of this cry of alarm is also noticeable in other districts."

The above report was for the year ending November 30, 1884 and the letter of transmittal is dated December 1, 1884.

In the Third Biennial Report of the State Engineer of Colorado, at page 57 we find the following:

"Nearly the whole of the discharge of the present season was utilized and needed for cultivation of crops, and, as there are large areas of unoccupied lands under several of the existing canals, the era of beneficial canal building on this stream has probably passed.

Aside from the expansion of the irrigated area, by bringing
3565 the unoccupied lands, situated below existing canals, under cultivation, we must rely on reinforcing of such streams as can be so increased, or by the construction of reservoirs for the further extension of the agriculture of this district."

He was speaking of the Cache la Poudre Valley and of the year 1886.

The above statements of Mr. E. S. Nettleton may be taken as typical of the sentiment prevailing in the Cache la Poudre Valley in the latter seventies and in 1886, which was the time of the last quotation.

The present conditions on the Laramie Plains, the method of use of water, is comparable to the methods of use and distribution prevailing in the Poudre Valley in the late seventies, and is certainly no more advanced than in the very early eighties. I find on page 34 of the Second Biennial Report of the State Engineer of Colorado, a statement which is applicable to the Laramie Plains today and which would seem almost to have been written in reference to the use of water in the Laramie Plains.

"The Water Commission reports that in 1883, he was employed only three days in dividing the water, not having been appointed until late in that year. In 1884 he was employed 12 days, five complaints having been made, all coming from the lower end of the district. The first one, coming about August 1, found some of the ditches in the upper end of the district running full, while those in the lower part of the district had not enough to irrigate their crops. The Commissioner also says, that he had great difficulty in dividing the water before measuring flumes were put in the
3566 ditches, since which time, by using rating tables, he has been able to divide the water to the satisfaction of all concerned. Measuring flumes have been put in nearly all of the ditches in this district, and nearly all of these have been rated, and their discharges tabulated. The division of water in times of scarcity is giving general satisfaction under the law of 1881, although it has hardly been put in full working condition yet."

The similarity between this year of 1883 (and this quotation) with the present condition of the Laramie Valley is apparent, as the testimony heretofore reduced in this case has shown that only a few days were spent by the Water Commissioner in distribution of water on the Laramie Plains in the year 1913, in fact in the last few years. The reference to measuring flumes and their having been put in, shows that the Poudre Valley in 1883 was somewhat more advanced than the Laramie Plains region is today, where very few rating flumes or headgates are found in the ditches.

The irrigated area in the Cache la Poudre Valley has kept on increasing from year to year, regardless of this alleged shortage in the seventies and eighties. It has not increased very greatly in the last 4 or 5 years and what increase there has been appears to have come more from strict economy practiced and careful distribution. The further extension of the irrigated areas in eastern Colorado to my mind is dependant very largely on further economy of use.

I have already stated that economy has so reduced the quantity of water consumed, that there is used at present something less that one acre foot per acre measured in terms of water originally entering the Poudre valley.

3567 There is at present something like 100,000 acres of land irrigated in Wyoming on the Laramie Plains from the Laramie River, including also the Wheatland area, and, as I have stated, the net supply is 374,000 acre feet of water. It has really been more than that up to the present time. That is the supply that will be left after all Colorado diversions have been made. The supply at present time would be about 420,000 acre feet which has been available for Wyoming. Excluding Sand Creek water, in round numbers, supply was something over 400,000 acre feet, in a normal year. Duty of water on Laramie Plains and at Wheatland has been investigated somewhat, but these investigations have referred more particularly to actual use, regardless of what might be accomplished.

In terms of original water entering Laramie Plains and other regions on Laramie River drainage, duty would be about 4 acre feet per acre per annum if all water was used. It is not all used. There is a very considerable waste in the valley. There is considerable water passing out of the valley and there is a great deal of water which is wasted and evaporated without having performed its duty.

3568 Water which is used in Upper Little Laramie and on Big Laramie in Colorado is run on ground during almost entire growing period of hay, and it runs, of course, very quickly back to river and loss from evaporation is not very great. This is method of use in Colorado and in Centennial Valley in Wyoming.

In Laramie Plains District water is taken out of river whenever irrigator finds he wants it. It is not usually given to him by Water Commissioner. He goes and takes it. The water is run out onto the land and there is very little attention paid to the distribution and especially very little attention paid to it during the night. The water is not returned to the river at the nearest point. There may be a requirement under the laws of Wyoming that this be done, as there is such a law in Colorado, but on Laramie Plains it is practically a dead letter. The water, after having been turned into the canal, and if not used, passes on down the Canal and runs into sink holes or lakes and there remains until it is evaporated.

I refer to lakes or depressions without outlets. The waters which are run into them do not return to the river. The Laramie Plains are covered with these depressed areas. The topographic maps prepared by the United States Geological Survey, show very clearly these depressed areas. The map is very small, and the scale is small, so that only a general idea is had from these maps. The entire area is such that one might expect to find depressed acres almost any place. There are some very remarkable depressed areas such

3569 as Big Hollow and Big Basin. Lake Hattie was a depressed area originally and the same is true of Lake James. Cooper Lake is a depressed area where water accumulates, and Hutton and

Creighton Lakes are depressed areas. Small ponds, from a few acres up to 30 or 40 acres are scattered over the plains area and it is in these smaller depressed basins that these waste waters from ditches are discharged or accumulate.

I have caused to be made a computation of the areas contained in these ponds and lakes throughout the irrigated sections of the Big and Little Laramie areas. From what maps I could obtain I had an estimate made of the area of these lakes. There were a great many of them and in the aggregate those which we could locate contained something over 6,000 acres in superficial area. There were a great many that we did not get and we did not take those areas which were wet but did not contain water. We did not take those that did not carry a permanent exposed water surface.

This 6,000 acres of exposed water surface does not include the exposed water surfaces on Wheatland Reservoir No. 2, Lake Hattie, Lake James or other active bodies of water which are being utilized for storage and distribution of water for irrigation. We made an effort to exclude all bodies of water which were used in connection with storage of water for irrigation. It is my judgment that, if we could have gotten all of the small lakes or those lakes which contained water for any considerable time, the area would have aggregated 10,000 acres. It was impossible from our records to get
3570 this quantity exactly and it is also impossible for us to tell what amount of wet land there was from which water evaporates.

Taken as a whole the methods employed in Laramie Plains region are very wasteful. The duty of water in that region is very low. I mean that a given quantity of water serves a comparatively small area of land. It serves a smaller area than experience in other regions demonstrates could be irrigated from the quantity.

The irrigation conditions on the Wheatland area are somewhat different than those on the Laramie Plains area. They have their water supply controlled and there is some effort at having water better administered. Ditches carry very large amounts of water. It is a new co-ntry and naturally demand is quite large and methods have not attained perfection which they will. There is an abundance of water there and economy has not been necessary. Ditches are on rather a steep grade and loss from ditches is probably very great. Duty as shown by amount of water which is claimed to be diverted and used on tract is quite low. It appears that duty at present time on Wheatland area is about 2½ acre feet per acre, which I consider a very low duty.

In the early development of the Cache la Poudre Valley the duty of water was very much lower than that in the beginning. I have examined some ditches where as much as 5 acre feet per acre
3572 were used. Later, as economy became necessary, the duty of water increased.

I would expect that if strict economy ever became necessary in the Wheatland District, the quantity of water used per acre would not exceed 1½ acre feet per acre, that is, measured at headgates of canals. There need be no increased diversion of water from Laramie River

in order to irrigate the original tract contemplated by the Wheatland enterprise. Economy can be practiced on Wheatland area very nicely. As I stated, they have two reservoirs situated in very advantageous positions and there will be no occasion for them to demand any great amount of water. They will only have to demand water when they actually need it and when it can be put to best use.

I did not observe on Wheatland area such waste of water as I did in Laramie Plains region. While there is quite an area of land in the Wheatland tract which has become seeped and wet, the slope of ground is such that surface water does not accumulate in sinks to same extent that it does on Laramie Plains. In older cultivated portions of Wheatland District, I think it is apparent that an excess of water has been used, which is shown by land which has become wet.

3572 If even reasonable economy were practiced on Laramie Plains area the duty of water would rise. The duty would become much higher if reasonable economy were practiced. I think, without any particular effort, that the duty on the Laramie Plains would rise to 2 acre feet per acre per annum. This could be accomplished with scarcely any effort.

Comparing methods on Laramie Plains with those in Cache la Poudre River, water in latter district is under control of the Water Commissioner at all times. The Ditch Companies and Reservoir Companies co-operate with him in trying to make economical use of water. Waste is not tolerated. Wherever there are any depressions in which seepage water accumulates, it is used. Since electric power lines have been put through district, most of water which accumulates in such depressions is pumped out and re-used. Prior to introduction of electric power they used whatever power was available but development along this line has been quite marked since electric power entered district.

In Poudre area water is watched day and night during distribution. The irrigator does not allow it to run to waste. Water is too valuable to permit it to run to waste at night. Such a method does not prevail at all in the Laramie Plains area.

3573 The principal crop irrigated in the Laramie Plains region is native hay, which is grown along river bottoms. There is some grain grown but principal crop is hay. There are some attempts at raising native hay on uplands under Pioneer Canal. These lands, if sufficiently irrigated for two or three years, become covered with growth of grass.

Amount of water necessary to irrigate these hay lands would depend on soil and irrigation season, which is much shorter on Laramie Plains than in Poudre Valley. If water were taken care of and thoroughly and carefully distributed on hay lands on Laramie Plains region, greater economy of water would be accomplished. There is a great waste of water, especially on Little Laramie River. There the valley is broad and flat. The river is divided into several channels. There has been no effort to have a good straight channel or to keep water confined to a single channel, for water is run out of river and is allowed to go into bayous and sinks and there remains.

The ground under Little Laramie River Valley is continuously wet and often in winter it is almost impossible to cross Little Laramie Valley except at certain places. The ground is very wet and evaporation from this wet surface is very considerable. In other words, the Little Laramie River is simply turned loose and permitted to run wild over this bottom from sheep mountain down to the mouth of the stream. Distribution is aided to some small degree by
3574 ditches and by utilizing the numerous channels of the stream.

I saw no evidence on Laramie Plains region of concerted or well defined efforts on part of water users to return waste water to stream from whence it came. I found neither concerted nor individual efforts in this behalf.

I have already stated acreage in aggregate of waste ponds where water is allowed to accumulate and pass off by evaporation. Evaporation on Laramie Plains is quite high, due particularly to high wind velocity, and, while temperature is low, which would retard evaporation somewhat, it is more than made up by high wind velocity and by shallowness of bodies of water. As reported in Experiment Station Bulletin No. 81, some experiments were made both at Laramie and Fort Collins for determination of evaporation from exposed water surface.

Total evaporation for four months from exposed water surfaces at Laramie is given as 27.84 inches. At Fort Collins it is 20.29 inches for same period of four months. This is about what one might expect and the bulletin goes on to say that difference in loss is probably due to wind, which is greater at Laramie, the humidity being about the same, though temperature is lower at Laramie. Losses from evaporation from exposed water surfaces in different parts of arid region are given by numerous writers. A recent publication is by Newell & Murphy, called: "Principles of Irrigation Engineering." In that book they give the amount of losses in different states. In Nebraska 65.57 inches over a period of one year. In Idaho 79.6 inches. It does not give evaporation in Wyoming or on Laramie Plains.

3575 From other data however, which I have consulted, I would state that the evaporation on the Laramie Plains is probably in vicinity of 5 feet per annum or more. Bulletin No. 52 of Wyoming Experiment Station, 1902, gives evaporation from water surface for months from May to September inclusive as 32 inches. The mean for five months being .162 inches per day. This bulletin further says: "It appears that when the water was full in the ditches, within six inches of the top, the evaporation was about one-tenth of that from the water surface," showing that if the water is a short space below the surface of the ground, the evaporation is very much less.

Unnecessary evaporation loss from 6000 acres of exposed water surface on Laramie Plains would be about 30,000 acre feet per annum, if evaporation from water surfaces is 5 feet per annum.

Evaporation from wet areas and from small ponds which we could not measure, and of which we have no record, would probably increase unnecessary loss in valley by an equal amount. In referring

to wet areas I did not refer to the areas wet in usual process of proper irrigation but to other kinds of wet areas where water is wasted on lands in those ponds and depressed areas. Where water remains but short time, loss from such areas on Little Laramie River I have not included. Neither have I included that loss from areas on Big Laramie Valley where hay meadows are irrigated.

Unnecessary loss from evaporation on Laramie Plains is equal to or greater than the proposed diversion by the Greeley-Poudre Irrigation district from the Laramie River. This proposed diversion, under the present construction, I stated is about 56,000 acre feet per annum in normal years. 60,000 acre feet per annum I calculated to be the unnecessary loss and waste of water by methods employed on Laramie Plains.

3576 Amount of evaporation from wet surfaces is rather surprising. Mr. Samuel Fortier, who is at head of the Bureau of Irrigation Investigation of the United States Government, in Bulletin 117 at page 46; says:

"The table shows that the loss of water by evaporation from heavily irrigated orchard soils while the surface is quite wet, may amount to over four inches per week or double that from the surface of water similarly situated and two feet deep. The loss from soils containing sufficient moisture in the top layer to nourish a vigorous growth in orchards is about one inch per week. Soils that are fairly dry on top lose about one-quarter inch per week. This indicates that the evaporation from wet ground may be even more than from water surface."

So that, those wet areas, if kept wet the year around, might easily evaporate fully as much as though they were actually exposed water surfaces.

If Wyoming appropriator would eliminate the unnecessary waste in Laramie Plains region alone, it would result in a saving of more than enough water to supply the entire diversions of the Greeley-Poudre system from the Laramie River.

Wind has the effect of increasing the evaporation from exposed water surfaces. I have made a quotation from the book of H. M. Wilson entitled "Irrigation Engineering" in which he states that evaporation experiments show that wind of velocity of 30 miles an hour gives 6.3 times more evaporation than in quiet air from lakes and reservoirs. This will give an idea of what a great influence the movement of air in contact with water has on evaporation.

Examination by Mr. Fred Farrar:

I quoted from Bulletin published by Experiment Station of Wyoming to effect that best results were obtained by using 20
3577 acre inches for irrigation of field peas. Field peas are used for feeding sheep, lambs and cattle, for fodder.

The Laramie Plains have better natural facilities for storing of water than exist in the Poudre Valley. The reservoir basins on Laramie Plains are larger, will contain more water and the inlet ditches are not as long nor as difficult of construction. The basins

on the Laramie Plains are fully as numerous as those in the Poudre Valley. Basins on Laramie Plains lying rather high and ditches taken from the bottom of these reservoirs cover a considerable territory. The Wheatland Reservoir No. 2 is very unique, being a very large reservoir and one which was very economical to complete. The same is true of Lake Hattie and Lake James. The Hutton and Creighton Lakes are natural basins, and it would require very little work to convert these into useful reservoirs for irrigation purposes.

There are, as I have stated, numerous small depressed areas in Laramie Plains throughout the area which might be farmed, that is, which lie under canals which would be available for collecting of waste and seepage water and from which water could be withdrawn without great expense for use on lands lying below. Reservoirs on
Laramie Plains, in my opinion, would not seep as much
3578 probably as they do in the Poudre Valley. The soil in these
depressions in Laramie Plains seems to be such as to make it quite impervious. Reservoirs seep very little and it is this character of soil which holds water without its sinking into ground and so by that means come back to river but is held on surface and there evaporated.

Assuming three principal factors going to make successful reservoir construction, that is, first, water supply; second, mechanical construction and third, location with respect to sources of water supply and land to be served, except with respect to cost, there is very little marked difference between the Poudre Valley and the Laramie Plains. But in regard to cost, cost on Laramie Plains is very much less and size of reservoirs is much greater. There are no reservoirs in Poudre Valley to compare in size with Wheatland Reservoir No. 2 or Lake Hattie. In Poudre Valley, Windsor Lake is one of the largest and its capacity is given as 17,689 acre feet. Fossil Creek Reservoir is next largest and derives its supply from the Poudre River and has capacity of 12,050 acre feet. Timnath Reservoir, which is considered very large and valuable, has a capacity of 8,309 acre feet. Terry Lake, one of most noted lakes in Poudre Valley, has capacity of 7,461 acre feet. Halligan Reservoir, which has been completed within last two years, and which is in channel of North Poudre River with a masonry dam about 100 feet high, has capacity of 6,408 acre feet. The combined capacities of all of reservoirs which I have named, which are the
largest of the valley, are not equal to the capacity of Lake
3580 Hattie alone. While I am not familiar with the exact
cost of the reservoirs in the Poudre Valley, I will state that the cost was very much higher on those reservoirs, particularly on Halligan Reservoir, than on Wheatland No. 2 Reservoir or on Lake Hattie Reservoir. The Fossil Creek was also more expensive. It cost more money to construct the Windsor Reservoir than it did the Wheatland No. 2 Reservoir. The matter of rip rap as well as construction of the dike itself has been a matter of considerable expense.

3580 W. L. PETRIKIN, recalled.

Direct examination by Mr. Delph E. Carpenter:

I have with me additional information requested for counsel for plaintiffs at former examination. This information is in form of statement; a tabulation. It is part of tabulation from which I read at previous testimony. I have simply added new information.

(Defendants' Exhibit 146, tabulation, offered in evidence.)

Exhibit 146 is statement I just referred to as a tabulation. Data therein appearing is obtained from records of The Great Western Sugar Company. This statement and tabulation is correct according to those records. Tabulation is as follows:

3581

1902.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	3,534	3,750	.....	.....
Tonnage	30,062	37,958	.....	.....
Paid to Farmers	150,226.84	170,810.02	.....	.....
Sugar, per Acre	1.27	1.47	.....	.....

1903.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	5,759	4,634	3,234	6,669
Tonnage	47,895	47,922	40,128	67,536
Paid to Farmers	242,236.86	212,950.86	196,432.70	310,039.88
Sugar, per Acre	1.25	1.62	1.94	1.66

1904.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	2,851	3,478	3,005	6,018
Tonnage	34,705	45,516	29,517	78,731
Paid to Farmers	173,977.59	227,581.16	147,602.47	*393,653.45
Sugar, per Acre	1.89	2.22	1.63	2.15

* Approximate.

1905.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	4,683	8,083	5,449	10,023
Tonnage	61,180	76,587	69,039	120,405
Paid to Farmers	305,901.72	382,931.19	345,198.61	602,033.66
Sugar, per Acre	1.92	1.41	1.91	1.81

1906.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	5,892	8,080	5,933	11,062
Tonnage	101,920	111,750	94,160	157,660
Paid to Farmers	511,362.59	562,029.84	471,312.94	789,597.37
Sugar, per Acre	2.59	2.10	2.47	2.24

3582

1907.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	4,227	10,810	6,728	13,580
Tonnage	66,449	128,218	90,066	162,336
Paid to Farmers	335,072.98	650,650.22	457,094.11	623,870.79
Sugar, per Acre	2.66	2.11	2.37	2.08

1908.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	5,187	8,613	7,182	14,682
Tonnage	61,228	85,480	79,930	143,676
Paid to Farmers	310,278.94	434,523.21	406,268.57	724,140.98
Sugar, per Acre	1.67	1.51	1.59	1.34

1909.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	5,136	10,532	6,721	15,622
Tonnage	61,421	99,092	66,263	154,270
Paid to Farmers	312,914.64	505,405.92	337,908.63	785,280.96
Sugar, per Acre	1.79	1.48	1.46	1.41

1910.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	4,081	5,384	5,248	8,018
Tonnage	51,886	65,515	64,285	73,090
Paid to Farmers	284,205.33	361,182.56	351,681.94	392,215.27
Sugar, per Acre	2.05	2.01	1.95	1.43

1911.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	4,501	6,340	4,908	8,087
Tonnage	61,930	84,487	58,446	88,131
Paid to Farmers	336,696.77	474,106.37	320,883.07	487,957.41
Sugar, per Acre	2.19	2.21	1.90	1.78

2585

1912

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	10,451	10,089	10,326	12,348
Tonnage	160,965	121,727	138,931	149,232
Paid to Farmers	958,444.73	739,253.91	821,364.27	875,478.83
Sugar, per Acre	2.55	2.05	2.20	2.01

1913.

	Eaton.	Greeley.	Windsor.	Ft. Collins.
Acreage	16,597	11,489	13,401	14,392
Tonnage	217,889	137,484	172,876	158,174
Paid to Farmers	*1,237,945.36	*778,215.60	*975,819.89	*875,698.72
Sugar, per Acre	2.04	1.84	1.97	1.69

* Total of 4 factories.

1910.

Number Laborers	3,247		
Number Factory Employes	987		
No. of Livestock fed on by-products (Cattle)	12,168		
Tons Pulp Sold	60,841		
Avge. Price per ton	.65		
		Local.	East.
Tons Molasses Sold	3,775	2,004	1,771
Avge. Price per ton	10.53	8.99	12.27
Tons Sugar Sold	31,326		
Avge. Price per ton	$90.30		

1911.

Number Laborers	3,405		
Number Factory Employes	1,012		
No. of Livestock fed on by-products (Cattle)	14,223		
Tons Pulp Sold	71,118		
Avge. Price per ton	.67		
		Local.	East.
Tons Molasses Sold	4,527	2,435	2,092
Avge. Price per ton	$7.59	7.62	7.55
Tons Sugar Sold	37,792		
Avge. Price per ton	$103.44		

3584 1912

Number of Laborers	6,173		
Number Factory Employes	1,031		
No. of Livestock fed on by-products (Cattle)	26,597		
Tons Pulp Sold	132,985		
Avge. Price per ton	.60		
		Local.	East.
Tons Molasses Sold	4,534	3,003	1,531
Avge. Price per ton	7.46	6.67	9.01
Tons Sugar Sold	67,864		
Avge. Price per ton	$81.43		

1913.

Number of Laborers	7,982		
Number of Factory Employes	1,087		
No. of Livestock fed on by-products (Cattle)	*28,820		
Tons Pulp Sold			
Avge. Price per Ton			
		Local.	East.
Tons Molasses Sold	10,937	6,903	4,034
Avge. Price per ton	8.20	7.75	8.97
Tons Sugar Sold	73,097		
Avge. Price per ton			

*Estimated.

On Exhibit 146 after the heading "Tons Molasses sold" appear two words "Local" and "East" as heading two columns on right hand side of sheet. "Local" refers to tonnage sold to feeders in locality immediately adjacent to factories and term "East" refers to amount that was shipped to eastern manufacturers, and same applies to price per ton as to local and east.

Figures given under headings "Tons pulp sold," "Average Price per ton," "Tons Molasses Sold," "Average Price per ton," "Tons Sugar Sold," "Average Price per ton," include production from Eaton, Greeley, Windsor and Fort Collins factories. For
3585 illustration, where after title "Tons Pulp Sold," 1910, the figures 60,841 appear, that represents total number tons of pulp sold for four factories that year. Same obtains throughout tabulation.

Under year 1913 word "Estimated" with star indicating reference

to figures 28,820 as number of livestock fed on by-products for year 1913, represents number of cattle that could be and presumably were fed on total tonnage produced at the four factories mentioned. It is an estimated amount. Total number of livestock fed on by-products refers to cattle throughout tabulation.

Figures included under any one year, for illustration 1910, all pertain to beets raised in year 1910, for instance tons pulp sold which is given as 60,841 tons, is pulp sold from beets raised in 1910.

3586 Value of by-products obtained for sugar factories can be compared in a general way with products of agricultural lands in this way:—I have a number of times made and am now willing to make, on account of having been connected with live stock end of the company, the statement that after an acre of sugar beets has produced on an average of 3,000 pounds of human food, we still have by-products equal to average acre of corn in State of Iowa in 1913, which was 43 bushels to acre, for production of livestock. This includes pulp, molasses and beet tops.

An acre of sugar beets produces by-products equal to an average acre of corn in Iowa, insofar as production of livestock is concerned.

Growing season in Cache la Poudre Valley is not unnecessarily long for sugar beets. I know of no territory where there is a season unnecessarily long, but I can say that it is not too long. Whether or not all of the growing season is required for the profitable growing of sugar beets in that vicinity is only comparable with the degree of profit. The entire growing season is utilized in growing of sugar beets in that valley.

I know of no territory having a shorter growing season than what I term northern Colorado, where sugar beets can be grown with security and profit sufficient to grower to justify continuation of the industry.

3587 I would consider it hazardous at present price of the raw product, to attempt to grow sugar beets in a region having a growing season thirty days later in spring and from two weeks to thirty days earlier in fall than the season in the Poudre Valley and having much lower temperatures during the growing season than in that valley. The production of sugar beets would at least be very materially decreased per acre.

Cross-examination by Mr. N. E. Corthell:

These figures which I have given cover entire history of sugar beet industry in Cache la Poudre Valley District, with exception of year 1901 of which I do not have data to supply the information. Just one factory, Loveland, was in operation that year. None of these factories were in operation in 1901. So far as this district is concerned, and these four factories, this covers entire history of their operation. Prices given by me in this table are net cash prices at factories.

3588 JOHN E. FIELD, recalled:

Direct examination by Mr. Delph E. Carpenter:

The lakes which are mentioned in connection with my testimony of enormous waste of water occasioned by present methods of irrigation prevailing in Laramie River drainage area will of necessity finally be drained and the wasting of water into them will be prevented. The land will be reclaimed.

Seeped lands in Poudre Valley have been reclaimed to large extent. Water drained from those lands is utilized by other ditches, in some cases it has been sold, in other cases it has been developed for the use of the water itself and reclamation of land has been an incident to the work. Object in many cases has been to secure water.

3589 Reclamation of wet lands and recapture of waste and seepage water greatly increase the duty of water used in terms of original water in Poudre Valley. Same thing will result when Laramie Plains people realize necessity of water, whenever there is a scarcity the reclaiming of water will be brought about. Some of those natural lakes will be drained and doubtless some of them will be converted into useful irrigation reservoirs, as has already been done with Lake James.

James Lake, prior to construction of irrigation reservoir on that site, was a natural reservoir into which waters flowed and there remained and evaporated to large extent. All the work required to make this water useful, was to build a cut through the rim of the Lake so that the water might be drained off.

On some of the waste water lakes it may be that pumping plants may be installed as they have in northern Colorado and water will be pumped out of them. There are numerous instances in northern Colorado, where water is pumped from natural reservoirs. There is one of which I have been advised, but which I never visited, east of Greeley, where a gasoline pumping plant has been installed for purpose of taking water from Greasewood Lake. I am informed the lift is 70 feet from the water in the lake to the ditch by means of which the water is utilized. This lake is situate about 30 miles northeast of Greeley. In vicinity of what is known as Pawnee Buttes.

3590 Drainage and utilization of this water from these waste lakes on Laramie Plains would not be profitable under present condition of agriculture in valley. There is an abundance of cheap water there, that can be used, and there is an abundance of land and until there is a demand for either water or land, these more expensive developments will not be made. At any rate, this water, under present methods, remains each year subject to re-use if they will only make an attempt. Their failure to re-use this water results in absolute loss to all agriculture.

It is necessary to replenish the water annually by waste or seepage, in order to maintain water in these waste lakes, unless water flows into these lakes, and unless a water supply is furnished, they

would dry up. Consequence is that there is a constant waste with a constant replenishment throughout each irrigation season.

Running of water through ditches in large quantities during winter season for alleged watering of stock is considered a wasteful use in well established irrigation communities and is not permitted in Colorado, at least. Within the last year or two I have had occasion to shut off domestic supply which was being taken into ditches in winter time and also to close down valves in one channel reservoir and to prevent natural flow from going down the river, notwithstanding it was demanded for stock water purposes by
3591 party living along the creek. These parties thus far have made no provision to substitute the water thus shut from them, but they will ultimately have to provide themselves with reservoirs or wells. Such use is so wasteful that it cannot be permitted. In the particular case of which I speak, for purpose of watering a few head of stock, 25 cubic feet of water per second was required to pass down channel of the river and that water was entirely lost for irrigation use. I consider it a very wasteful use and for that reason we had the valves of the reservoir closed down and permitted the reservoir to store the water. This was during winter months.

Where water is run from river through ditches in other than irrigation season, it is returned as soon as possible to the stream. Our laws in Colorado require that it be returned to stream at highest point practicable.

Any appropriator would have a right to complain if other appropriators ran water from stream to ditches for alleged stock use and then wasted it into sinks and waste lakes from which it had but one final outlet, evaporation. He could invoke services of water commissioner to prevent that waste. Such practice would not be tolerated under Colorado police administrations of streams where there was scarcity of water.

Mere digging of shallow wells throughout most any irrigated region, will afford sufficient water for livestock.

3592 Largest U. S. Reclamation Service canal, construction of which I supervised, is called The Interstate Canal, heads in North Platte River in Wyoming and was designed to cover 160,000 acres of land. In designing that canal, I provided for a maximum carrying capacity of 1,400 cubic feet per second, which amount would meet maximum demand and meet peak load. That would mean that the maximum demand under that system would be one cubic foot for 115 acres.

On Orchard Mesa Project in western Colorado, on which I was consulting engineer, we made plans which provided for one cubic foot of water for each 120 acres. This project is located near Grand Junction, where rainfall is only 8 inches on average and about the same as it is in Laramie Plains, although temperatures there are very much higher and the seasons are considerably longer.

Also designed and constructed canal in San Luis Valley at altitude of about 7,500 feet. Project included about 34,600 acres. Capacity as designed for main canal was 300 cubic meet per second or 115 acres per cubic foot per second.

Wyoming unit of 1 cubic foot per second for 70 acres would meet greatest demand for any kind of crop or any kind of
3593 soil and would represent only those conditions where maximum amount of water was necessary. It is probable that there are districts where that amount of water measured at headgate, for service of land, might be necessary and not unreasonable. But as a general rule, I would consider that very low duty, unnecessarily low. But, as law was formed to meet most adverse conditions, very properly they fixed maximum at 70 acres for one cubic water per second of time. This unit refers to a flowing stream of one cubic foot per second.

The Interstate Project of the United States Reclamation Service was completed. Experience of use of water on that project was that the water seems to have been too abundant. A great deal of the land has become seeped and wet. Drainage has become necessary. With a less use of water, I think there would not have been so much land destroyed and made useless by reason of this seepage. Not so much of it would have become wet. The Reclamation Service has contracted to furnish 2½ acre feet per annum on this project and they have found it difficult to get users to use less water than the amount which contract calls for, there being a tendency here, as in all other cases, on part of irrigator, to take all water he can get and difficulty and destruction of land by reason of seepage has not yet ceased. During past season, average use of water on this project was 2 acre feet per acre, notwithstanding that users under their contract were entitled to 2½ acre feet. If more water, as I understand the contract, is used than 2½ acre feet per acre there is additional charge. A great many use their full amount and some use more than the contract calls for and pay for additional water, but, notwithstanding this extra use, as I said, on project as whole use of water dur-
3594 ing past season was 2 acre feet per acre. This use of water was on practically new partially developed land. The project is not old.

I know it is the desire at present, to still further limit quantity of water used in order to prevent further spreading of this seepage territory. The Reclamation Service has inaugurated a drainage system.

Excessive use of water in Nebraska under the Reclamation Service project has produced practically same results as it did on Laramie Plains under Pioneer Canal.

Obtaining a higher duty of water results in reclamation of more acreage without necessity of diversion of greater quantity of water from stream. Present methods of irrigation in Little Laramie Valley are very wasteful. In event crop returns from the land in that region would warrant any expenditure of money for further development, channels of stream there should be straightened and provision should be made for drainage of wet water-logged areas and provision should be made for returning surplus water, if any remains in ditches, to stream as early as possible. The running of water out on land in winter time and permitting that waste from exaporation, of course would cease.

It happens, that in those districts where best and most extensive agricultural development has occurred, there is a shortage of water. Complaints of shortage come with lack of water.

Usual consequence of superabundance of water supply is that land is overirrigated and that considerable areas become seeped and alkalied. It is a fact that average farmer, up to time he becomes skilled in use and application of water, is inclined to demand more water than he really needs and to take it whenever it can be obtained. Absence of complaint of shortage in better irrigated districts is on account of better administration. Where there is abundant water, there is a tendency to let everybody take water as he pleases. The neighbors of course disagree and fight over water, where if well administered, water commissioner keeps things straightened out and prevents neighborhood quarrels. I think in Poudre Valley itself, there is less conflict and controversy today than in the seventies, but I attribute absence of those conflicts to administration.

3595 In communities where there is an abundant water supply, there is usually a tendency to take more water than farmer really needs. The irrigator always, it seems to me, is demanding more water than he really needs. That seems to be a trait of human character which comes with irrigation.

Speaking of diversion of water from one natural drainage area for application upon land situate within another and foreign natural drainage area, in irrigated regions the custom is to go and get water where you can get it, whether it is from same water shed in which land is situated or whether it is from some other water shed.

Inter-water shed diversions are made where necessity arises that will justify construction. As a rule they are decidedly more expensive than intra-water shed diversions. As a rule, only obstacle is that of expense. Whenever there begins to be a water shortage, the irrigators or those desiring to build ditches or desiring to increase efficiency of their systems, look for other water supplies and this search for additional water carries them into other water sheds, and, if not too expensive, these diversions are made.

Future possibilities of development within drainage area from which water is diverted and taken are not taken into consideration as a rule in making or permitting these inter-water shed diversions. Future needs of district from which water is taken are never considered. Projectors of inter-water shed diversions simply ascertain whether there is any water there sufficient for them. Their necessities have come earlier than the necessities of those in the drainage area itself, and are supplied first, and they take their water in order of priority regardless of whether it is to be used in the same water shed or in a different water shed.

Rule of appropriation by priority, rather than rule of riparian rights, prevails within the boundaries of the jurisdiction of the several arid states.

3597 I have taken occasion to ascertain conditions relative to inter-water shed diversions in several of the arid states. I had intended to make detailed investigation of matter of diversion of water from one water shed to another, but in press of other work

that was principally assigned to Professor Carpenter, but, prior to that time I had written to state engineers of different states in arid region to ascertain the practice and custom in those states. I refer particularly to those states known as appropriation states, in other words, states where riparian doctrine does not prevail.

Such a letter was written to state engineer of Utah.

(Defendants' Exhibit 147, copy of letter to state engineer of Utah, identified and offered in evidence.)

This is copy of letter which I sent to State Engineer of Utah and is same as the letters which I sent to other state engineers. I sent this uniform letter to each state engineer. The letter reads as follows:

"STATE OF COLORADO,
ENGINEERING DEPARTMENT,
DENVER, Aug. 15th, 1913.

John E. Field, State Engineer.
A. F. Hewitt, Deputy.

State Engineer, Salt Lake City, Utah.

DEAR SIR: I am making an investigation of the extent of diversions of water from one watershed to another. I have divided such diversions into three classes:

1. Diversions across the Continental Divide.
2. Diversions from one main drainage to another.
3. Diversions of water from tributary stream where water is carried into the watershed of other tributary streams of the same general drainage area.

To illustrate: Of the first class would be diversions from the head of Eagle river in Colorado to the head waters of the Arkansas river, and from the head waters of the Grand river to the head waters of tributaries of South Platte river. Of the second class would
3599 be diversions from the Laramie river to the Cache la Poudre, the waters of both of which streams ultimately join at junction of North and South Platte rivers. Of the third class would be diversions from Big Thompson river in Northern Colorado to the Cache la Poudre, and vice versa, or from Clear Creek to Bear Creek, all these streams being tributary to the South Platte river.

I write to ask whether such diversions are permissible in your state, and if so, whether there is any distinction in permissibility affecting the three classes.

If possible, I wish you would give me from your records as complete a list as practicable of all such diversions which are being affected in your state in any of the three classes. I realize that the enumeration of the diversions of the third class would probably be very extensive indeed, in which case, a general statement to the effect that such diversions were common would meet my purpose. I would like, however, to have you give any instance of diversions between main watersheds; that is, those diversions coming under the first and second classes.

Any extra expense entailed upon your office by furnishing me with this data, I will gladly pay. Pending the sending of this list, I wish you would write me whether such diversions are permissible or common in your State.

I fully realize that I am asking considerable, and can only say that upon your request I shall be glad to furnish any information concerning this State which might be of interest or of use to you.

Yours truly,

(Signed) JOHN E. FIELD,
State Engineer."

3600 I sent letters identical with Exhibit 147 to the State Engineers of New Mexico, Nevada, Idaho and to Commissioner of Irrigation of Alberta, Canada. Received reply to my letter Exhibit 147, from State Engineer of Utah.

(Defendants' Exhibit 148, letter, three sheets, State Engineer Utah, identified and offered in evidence.)

Exhibit 148 is reply to my circular letter to State Engineer of Utah. There are two letters, one dated August 19 and one September 19 and third sheet comprises tabulated statement of inter-watershed diversions in State of Utah. This table is referred to in letter of September 19, 1913. The letters and tabulated statement are as follows:

Office of W. D. Beers.
State Engineer.
Salt Lake City, Utah.

August 19, 1913.

Hon. John E. Field, State Engineer, Denver, Colorado.

DEAR SIR: Your communication of the 15th inst., in which you ask for certain information relative to diversion of water from one drainage area to another, at hand. In reply will state that it is permissible in this state to divert water from one main drainage area into another, and also from the watershed of one stream into the watershed of another stream when both are tributary to the same drainage area.

3601 Regarding the classifications which you make will say that we have no diversions across the continental divide in this state. The diversion of water under classifications two and three, as outlined in your letter, are quite common within the state, but at the present time we are so rushed with work that I will have to postpone giving you this information in detail until such time when the work in the office will permit me to give the matter more attention.

Trusting that the above information will be satisfactory, I remain,

Respectfully yours,

(Signed) W. D. BEERS,
State Engineer,
By C. J. U.

U./M.

Office of W. D. Beers.
State Engineer.
Salt Lake City, Utah.

Sept. 19, 1913.

Hon. John E. Field, State Engineer, Denver, Colorado.

DEAR SIR: In accordance with our letter of August 19, I am enclosing herewith list of diversions from one main drainage area into another. As stated in our letter of that date, we have no continental diversions within this state.

Regarding the diversions of water from tributary streams, where water is carried into the watershed of other streams of the same general drainage area, will say that such diversions are quite numerous in this State. I have not made a detailed list of same, as your letter of August 15 asked us to only make a statement as to whether such could be done or not.

Trusting that the enclosed information will be satisfactory and of value to you, I remain,

Respectfully yours,

(Signed) W. D. BEERS,
State Engineer,
By C. J. U.

U./M.

(The list of diversions mentioned in the above letter will be found on the following page.)

(Here follows paster, marked page 3603.)

Water Diversions from One Main Drainage Area to Another, as Shown by the Records in the State Engineer's Office, Salt Lake City, Utah.

Application No.	Applicant.	Quantity of water diverted.	Purpose.	From		To	
				Stream.	Drainage area.	Stream.	Drainage area.
944	Timpanogas Irr. Co.....	7,500 acre ft.....	Irrigation	Shingle Cr. & Beaver Cr...	Weber River	Provo River	Utah Lake—Jordan R.
79 & 3563	U. S. Reclamation Service..	160,000 acre ft.....	Irrigation	Strawberry R. & Tributary.	Green River	Spanish Fork River...	" " "
1929	Jos. R. Murdock.....	2,000 acre ft.....	"	Beaver Creek.....	Weber River	Provo River	" " "
3510	Knight Power Co.....	50 sec. ft.....	"	Duchesne River	Green River	" "	" " "
°3519	" " ".....	" " ".....	Power	"	" "	" "	" " "
		1,000 sec. ft also					
4020	Burt & Carlquist.....	60,000 acre ft.....	Irrigation	Weber River	Weber River	" "	" " "
4244	Nephi Johnson	500 acre ft.....	"	Joes Valley Branch.....	Green River	Ephraim Creek	Sevier River.
4397	Thomas R. Cutler.....	2,000 acre ft.....	"	Weber River and Beaver Creek	Weber River	Provo River	Utah Lake—Jordan.
3124	N. T. Porter.....	30 second ft.....	"	Duck Creek, Duck Lake, Swaine Creek	Sevier River	Kanab Creek	Colorado River.

° Withdrawn.

3903 NOTE.—No. 79 & 3563 are the only ones in which the diversion has actually been accomplished; all others are proposed or in process of construction.

3604 Received answer to my communication, similar to Exhibit 147, addressed to State Engineer of Nevada.

(Defendants' Exhibit 149, letter State Engineer Nevada, identified and offered in evidence.)

Exhibit 149 is answer to my circular letter to State Engineer of Nevada. It reads as follows:

"State of Nevada.

Engineer's Office.

W. M. Kearney, State Engineer.
Seymour Case, Assistant.
R. A. McKay, Chief Clerk.

CARSON CITY, Aug. 21, 1913.

Subject: In replying, refer to—

Mr. John E. Field, State Engineer, Denver, Colo.

DEAR SIR: I have your letter of the 16th inst., in which you refer to the practice in this state regarding the allowance of diversions from one drainage area and between tributaries lying in the same drainage basin.

The Continental Divide does not affect Nevada, hence, we have no diversion of the first class mentioned in your letter.

Diversions of the second class are permitted and the most striking example of a diversion in this class, is the Truckee-Carson Canal, diverting water from the Truckee River near Wadsworth, Nevada, and carrying the water to the Carson River Drainage Basin, a portion of which water is to be stored in what is known as the Lahontan Reservoir site in the bed of the Carson River. This Canal was constructed by the United States Government in 1903.

Other diversions from the drainage basin of the Truckee River, at its head, exist, though the diversions are small and were constructed several years ago and this office has not a complete record of them. For instance, the Carson & Tahoe Lumber and Fluming Company diverted water from the drainage basin tributary to Lake Tahoe and discharged it into the Carson River drainage basin. Lake Tahoe is the head of the Truckee drainage basin. The Virginia City Water Company are now diverting water from Marlette Lake and its tributaries, within the Truckee drainage basin above Lake Tahoe, to Virginia City, discharging the surplus into the Carson drainage basin.

There are old ditches diverting water from Walker River drainage basin into the Churchill Valley, eventually discharging into the Carson River drainage basin. This, however, is confined to the flood season and it might be said that the land lies either in the Walker drainage basin or Carson drainage basin.

Diversions of the third class are quite common. Under the doctrine of appropriation, we hold that the taking of water from one drainage basin to another, so long as it does not interfere with prior

rights, comes within the scope of the doctrine and all such permits are granted as in other cases, where the point of diversion and place of use are within the same drainage basin or within the basin lying adjacent to the tributary from which it is diverted.

Very truly yours,

(Signed) W. M. KEARNEY,
State Engineer.

Dic. K./McK."

3606 Received reply to letter similar to Exhibit 147, sent to State Engineer of New Mexico.

(Defendants' Exhibit 150, letter State Engineer New Mexico, identified and offered in evidence.)

Exhibit 150 is letter from State Engineer of New Mexico in answer to circular letter which I sent him concerning diversion of water from one watershed to another. It reads as follows:

State of New Mexico,
Engineering Department,
Santa Fe.

James A. French, State Engineer, Member State Highway Commission.

September 15, 1913.

Mr. John E. Field, State Engineer, Denvor, Colo.

3607 DEAR SIR: Replying to your letter of August 16th, in regard to diversions across the Continental Divide, and from one main drainage area to another, and diversions from tributary streams where water is carried into the watershed of another tributary streams of the same general drainage area—I wish to state, after an examination of the records here the results are as follows:

1. Diversions across the Continental Divide:

There have been no such diversions in this state. Diversions from the headwaters of the Rio Grande to the San Juan are not allowed, if they were possible, since the U. S. Reclamation Service has a blanket filing on all the waters of the Rio Grande except for small individual appropriations of not over 1,000 acre feet per annum. Again the waters from the San Juan to the Rio Grande could not be so diverted at present, since they are in litigation on the San Juan.

2. Diversions from one main drainage to another:

There are none in this state that we know of coming under this head, and our law as backed by the Attorney General's decision holds that water cannot be diverted from New Mexico to use on lands in another state as long as the water can be put to use in New Mexico.

3. Diversion of water from tributary streams where water is carried into the watershed of another tributary stream of the same general drainge area.

The only example of this we can find of record is an application on file by the Farmers Development Company, No. 770, which is to

divert from Urraca river over into an Arroyo of the same drainage and thence to be carried to the storage reservoir. This application has been protested upon the grounds that there is not unappropriated water to supply the said permit.

If further information is desired, please advise me.

Very truly yours,

(Signed) JAMES A. FRENCH,
State Engineer.

J. A. F./W."

3608 Received reply to letter, similar to Exhibit 147, addressed to State Engineer of Idaho. This reply consisted of two letters, one dated August 19, and one September 12.

(Defendants' Exhibit 151, consisting two letters State Engineer Idaho, identified and offered in evidence.)

Exhibit 151 consists of two letters from State Engineer of Idaho. These letters are in answer to my inquiry concerning inter-watershed diversions. They read as follows:

State of Idaho,
Engineering Department,
Boise.

F. P. King, State Engineer.
Herbert Wing, Deputy State Engineer.
W. R. Heyde, Chief Carey Act Engineer.

BOISE, IDAHO, August 19, 1913.

Re Change of Water Shed.

3609 Mr. John E. Field, State Engineer, Denver, Colorado.

SIR: Replying to your letter of the 16th inst., in the above would say that Section 3244 of the Revised Codes of Idaho reads as follows:

"The water appropriated may be turned into the channel of another stream and mingled with its water and then reclaimed, but in reclaiming it the water already appropriated by another must not be diminished."

This section is 3158 of the Revised Statute- of 1887 and is in the same language as the California Civil Code of 1872, Section 1413.

I cannot at this time cite you any cases involving the question raised in your letter, except the case of Walbridge vs. Robinson, 22 Idaho, 236, 125 Pac. 812, 43 L. R. A. Page 240, which involves the question of the appropriation of water in Idaho to be diverted and used in a sister state.

Very truly yours,

F. P. KING,
State Engineer,
By WING.

W./G.

State of Idaho,
Engineering Department,

Boise.

F. P. King, State Engineer.
Herbert Wing, Deputy State Engineer.
W. R. Heyde, Chief Carey Act Engineer.

BOISE, IDAHO, September 12, 1913.

Re Transfer of Water Rights from One Watershed to Another.

Mr. John E. Field, State Engineer, Denver, Colorado.

SIR: Replying to yours of the 25th ult., would advise that just at present I cannot recall for purposes of identification the numbers of permits involving a transfer of water from one shed to another but I know that such action has been taken repeatedly, without question.

Very truly yours,
(Signed) HERBERT WING,
Deputy State Engineer.

W./G.

3610 Received reply to my letter, similar to Exhibit 147, addressed to Commissioner of Irrigation of Alberta, Canada. It consists of a letter of two pages, of a tabulation and of a sketch map, being four pages in all.

(Defendants' Exhibit 152, letter of four sheets Commissioner of Irrigation Alberta, Canada, identified and offered in evidence.)

Defendants' Exhibit 152 is letter writted by Commissioner of Irrigation of Alberta, in answer to my circular letter to him concerning inter-watershed diversions. The first three sheets of the exhibit read as follows:

3611 "Department of the Interior,
Irrigation Office.

Please address your reply to The Commissioner of Irrigation, Department of the Interior, Calgary, Alta.
Refer to File 1285.
C./P.

CALGARY, ALTA., August 25, 1913.

SIR: I beg to acknowledge receipt of your letter of the 16th inst. regarding the diversion of water from one watershed to another.

I am attaching hereto for your information schedule showing all of these diversions in so far as I am able to discover from our records. I would state in explanation that this matter has not been as difficult a one, nor entailed as much labour as you anticipate, because of the fact that diversions of this character in Western

Canada are not general, and I think that you will find the list submitted quite complete.

Regarding the class 3 diversion, there is only one case, as you will note, and this is possibly explained by the fact that the amount of water in our smaller streams is unusually small as compared with the amount of land which can be easily irrigated lying in the valleys of these creeks, and therefore, when nearly all the valley land of any particular creek had been irrigated, there was usually no water left to irrigate other lands with.

As you are probably aware, our laws in this respect are very strict and when this office considers that the appropriations on any stream are such as will use up the amount available, we do not allow any other appropriation on this stream in order that the
3612 water rights which have been granted may be absolutely protected.

If this information is not just what you want or if there is anything else you would like to know, I would be very glad indeed to give you the information if you will communicate with me again.

Your obedient servant,

(Signed) P. M. SANDER,
Acting Commissioner of Irrigation.

Class 1. Continental Divide Diversions, Canadian Pacific Railway Company Irrigation scheme near Lethbridge, Alberta, to divert water from the St. Mary river, Hudson Bay drainage and some of the waste water will run back into Pakowki lake drainage basin (no outlet) which lies in the Milk river drainage area, which is tributary to Missouri river and hence Mississippi river.

With some extension of the above ditch a considerable amount of water might go directly to Milk river drainage area.

Under terms of International Waterways Treaty, U. S. Reclamation Service is diverting water directly from St. Mary river, Hudson Bay drainage into Milk river, Missouri river drainage. (See Milk river project.)

Class 2. Main drainage area to another. Canadian Pacific Railway Company, western section, near Calgary, Alberta, diverts from Bow river into drainage of Red Deer river.

Canadian Pacific Railway Company, Lethbridge system, diverts from St. Mary river to Belley river.

Southern Alberta Land Co. near Medicine Hat, Alberta, diverts from Bow river into Belley river.

Province of Alberta, near High River, Alberta, diverts from
3613 Highwood river, tributary to Bow river, into Little Bow river, tributary to Belly river.

Sketch.

Class 3. Diversions from Battle creek to Middle Creek, both flowing into Milk river."

I sent a letter similar to Exhibit 147 to State Engineer of California. I received a reply to that letter.

(Defendants' Exhibit 153, letter two sheets State Engineer California, identified and offered in evidence.)

Exhibit 153 is letter from State Engineer of California in answer to my circular letter to him concerning diversions of water from one watershed to another. State of California is what is known as one of the states adhering to doctrine combining both doctrine of appropriation and doctrine of riparian rights. The letter consists of two sheets and reads as follows:

"Address all Communications to

Department of Engineering.

W. F. McClure, Engineer.
Earle Freeman, Secretary.
J. W. Wollett, Architect.
Jerome Newman, Paul M. Norboe, Assistant Engineers.

State of California,
Department of Engineering,
Sacramento.

August 21, 1913.

3614 The State Engineer, Honorable John A. Field, Denver, Colorado.

DEAR SIR: Replying to your inquiry of the 16th inst:

There is no law on the statute books affecting diversion from one watershed to another.

While there is no diversion of watersheds by the Continental Divide, the division between the Great Basin and the coastal drainage areas is similar. The great Los Angeles Aqueduct diverts from the streams of the Great Basin, crosses over and through the Main Divide to the Coast, and its right to do so has not been questioned.

Also the diversion from Hetch-Hetchy Valley to San Francisco might be construed as coming under your second class, though as a physical fact the Hetch-Hetchy water finally reaches San Francisco Bay in its natural course.

Permit me to suggest a case similar to yours in Montana. A portion of the water supply of Butte is pumped from Big Hole River, a tributary of the Missouri, crosses the Continental Divide to Butte, on the Pacific Slope.

There are many diversions in this state of the third class you describe.

California law has taken no cognizance of the different classes, though it may have been defined by some decision of the Court, not recalled by the writer.

Referring again to your second class: The U. S. Reclamation

Service controls to a certain extent the outflow of water from
3615 Lake Tahoe. The lake is mostly in California, about 1/3 of its surface lying in Nevada. Nearly all of its watershed is in California as is also the outlet—Truckee River, which flows into Nevada and terminates in Pyramid Lake. The Service has diverted the entire flow into the Carson River Basin for irrigation under the Truckee-Carson Project, so that this year no water is running into Pyramid Lake, according to news dispatches.

Since this State's control over diversions is so limited, no comprehensive list is made, but if citation of a few specific cases of class three will serve you better than the statement that cases of that class are numerous, effort will be made to supply them.

Very truly yours,

STATE DEPARTMENT OF ENGINEERING,
By P. M. NORBOE,
Assistant State Engineer."

PMN/HB

These letters Exhibits 148 to 153 inclusive, confirm statements already made to effect that inter-watershed diversions are generally practiced in each of several states covered by these communications.

JOHN E. FIELD.

3615 Cross-examination by Mr. John D. Clark:

My first visit to the Laramie Plains was a short trip in 1903. In 1910 I was there two or three days to examine the River-
3616 side ranch, and I was there the next time in 1913. In the intervening years I was at Wheatland a number of times. In May, 1913, I spent a week upon the Laramie Plains and in the Wheatland District. In June I was over the Laramie Plains for about a week, for five days in July and once in August, and after the commencement of the taking of testimony in this case I made a number of trips over it. Some of the trips were to
3617 supervise the surveyors who were making the plane table survey under my direction and some were for the purpose of investigating soil and agricultural conditions. My acquaintance with the Poudre Valley since 1890 has been rather close.

3618 The most expensive reservoir constructed in the Poudre Valley is the Halligan, costing $32 per acre foot of capacity, which was completed about two years ago, and I know of no reservoirs now in course of construction of equal cost. The ordinary cost of reservoir construction in the Poudre Valley at the present time is from $10 to $20 per acre foot. The present storage capacity in the Poudre Valley is such that in some years the reservoirs are not all filled, while in some years they are filled and water
3619 runs to waste. The normal amount of water flowing out of the Poudre Valley including seepage water is about 110,000 acre feet per annum. The cost justifiable for a reservoir is largely dependent upon the market value of water at the time. A larger

price could be paid for a supplemental supply to finish out a
3620 partial supply already acquired than if the reservoir water was the only source of supply for the particular tract of land. The value of a water right depends upon the amount of return that can be secured through the use of the water, and this is dependent upon the value of the crops raised.

3621 It would not be possible to inaugurate a scheme in the Poudre Valley to construct reservoirs to store water from one year of high flow to another where such water is the only source of supply, for the reservoirs would have to be constructed to hold the maximum amount, and if the water has to be carried over for three years the average diversion from the reservoir would be only one-third of its capacity, making the cost per acre prohibitive.

3622 The net average return from the crops raised in the Poudre Valley after deducting the cost of growing and harvesting the crops, would vary from $25 to $50 an acre, while the net return from the irrigated lands upon the Laramie Plains would be three or four dollars per acre, based upon the average production of one-half ton of native hay per acre, which is about the average production in that region, and a price as high as $10 per ton in stack. In my opinion the raising of native hay in connection with livestock is the best use to which the land upon the Laramie Plains may be put, although there will, of course, be grain and potatoes raised for local consumption. The use of native hay land upon the Laramie Plains in connection with the
3623 outside range increases the value of the irrigated lands very greatly above the value indicated by the crop production, and in consideration of this circumstance I would consider the market value of those lands to be from $25 to $50 per acre, whereas the market value judging solely from the standpoint of the crops would be from $10 to 25 per acre. A false conclusion would be reached in considering the value of land upon the Laramie Plains without taking into consideration their use in connection with stock raising. The conditions are such upon the Laramie Plains that in my opinion there is little likelihood of the area being divided into small tracts, as it would be impossible for a settler to support himself and his family upon a small area as is done in a better country.

In 1910 I made an investigation of the Riverside Ranch upon the Laramie Plains, spending three or four days in the examination, and prepared a report upon it for the owner, which was in part as follows: "I submit herewith a report on the farm and ranch properties of your company near Laramie, Wyo.

3624 On April 6th, I made a trip to Cheyenne to obtain records, etc., bearing on the subject and on April 24th to 27th I examined the property in company with your engineer, Mr. Robinson.

The features which appeared to require examination were:

1st. The water supply which includes a consideration of the stream flow, the existing rights on the streams in Wyoming, the water rights and prospective irrigation development in Colorado,

and the influence which interstate complications might have on your properties;

2nd. The climate including rainfall, temperatures, frost periods and length of the growing season;

3rd. The crops which will do well in this locality and the probable future character of the produce which will be raised;

4. Allied industries;

5th. Markets;

6th. Values present and prospective."

* * * * * * *

"In the consideration of any project involving the use of water from the Laramie River, the question of interstate rights is vital, for if Colorado, as has sometimes been claimed, has absolute control of all the waters within its borders regardless of the rights of a state into which the stream passes, and its citizens can divert the water to their land to the detriment of other and prior appropriators lower down on the stream and in another state, the rights and the interests of the people of Wyoming will be seriously affected. On the other hand, if priority of use gives the better right regardless of state lines, then the settlers and land owners taking water from the Laramie River in Wyoming will not be affected and the use of water in Colorado may even prove a benefit, unless the water is carried into a different watershed and the return seepage and surplus water does not return to its natural drainage basin. This matter has been in the courts a number of times and has been determined between different states by different courts. So far as I am aware, no decision by any court of last resort has yet been handed down which sets aside the rights as determined by priority of use because the later appropriator was higher on the stream and in a state in which the waters had their origin."

* * * * * * *

"It is hardly necessary, however, to consult the court decisions, as it is unreasonable to suppose that a subsequent appropriator could, by the diversion of water from the stream in another state, destroy the values and property rights of one who, through the expenditure of time and money, had previously created those values and established a home and a business dependent on such water and the enjoyment of the right of its diversion and use.

* * * * * * *

"A number of the Colorado canals take water from tributaries of the main stream and the diversion by them is probably much less than is indicated by the published statement of decrees. This less diversion is also probable from the fact that decrees in Colorado are almost always excessive and many have never been used at all. The capacity of all canals reported on by the Water Commissioner of District Number 48 is given as 563 cubic feet per second out of a total of 1255.8 cubic feet per second, while the irrigable area is given as 4,720 acres, using 57,894 acre feet, or nearly 12 acre feet per acre per annum, an amount obviously wasteful and excessive.

* * * * * * *

3626 "On the Riverside and Hoge farms the duty of water should not be very low, as on the meadows during the high water period, that is, in May and June, there will be a certain amount of subirrigation and overflow. The greatest demand will probably come in July, during which month probably three-fourths of an acre foot per acre will be required, or one cubic foot per second will probably serve about eighty-three acres. The decrees of the Company call for one cubic foot per second for each seventy acres.

The canals serving the land are comparatively short, and the losses proportionately small, and even that which is lost by seepage in transit will be of benefit to the land under which it passes on its way to the river.

In August and September little water will be used, as most of the crops will have been harvested and even the late maturing crops will have begun to ripen and the water will have been taken off of such crops. In all two and one-half acre feet per annum per acre is doubtless an ample supply, and the decrees owned by the Company and the water available in the river will furnish that amount.

* * * * * * *

The soil of the area may be divided into three different classes: They are, First, residual soils formed from the disintegration of rocks in situ; Second, alluvial soils formed from the material deposited in the rivers; Third, alluvial soils formed by the materials carried down from the mountains by the transporting agencies.

The soil of the Laurel Sandy Loam is an alluvial deposit varying from two to six feet in depth. This soil is usually black, although sometimes dark yellow or gray, and ranges in depth from
3627 coarse, sandy loam to almost loam. Some soils consist of yellow and gray sand grading into coarse sand and grapels at lower depths, the depths of sand and gravel grade from this type in the form of ridges. The Laurel Sandy Loam is found on the south or east side of the area and extends a distance of about one mile from the river proper. There is a small amount of this soil immediately bordering the river on the northwesterly side. This soil is generally subject to overflow from the Laramie River during extreme floods, while owing to its low lying position, the water table is near the surface most of the year. The water table is generally found at a depth of about six feet. In such places as the water surface is less than six feet below the surface, drains would be of great benefit in lowering the water table and in removing any alkali which may tend to reach the surface and concentrate there.

Hay is the principal crop on this soil. It is at present made from native grasses, chiefly among which are wire grass, salt grass, gramma grass and blue stem.

All of these native grasses have a high nutritive value. The average yield of hay is probably in excess of one ton per acre and sometimes produces as much as two tons per acre. This soil is well adapted to barley, wheat, potatoes and oats. Where the water is not too near the surface, alfalfa can be grown with success and

would require little irrigation after the first season. In areas where the water table is near the surface, the alfalfa would probably not do well for more than three years. However, as the value of alfalfa is largely its fertilizing property and as the best values are to be obtained by turning alfalfa under every third or fourth year, this soil put first in alfalfa and then in the higher priced crops such as potatoes, peas and oats would produce wonderful crops.

3628 "In its typical form, the Laramie Sandy Loam consists of a coarse sandy loam varying in depth from three to six feet, and is generally underlaid by sand and gravel. The soil gradually becomes heavier with depth and in some localities grades to a loam which extends to the sub-soil. The Laramie Sandy Loam is generally found north of the river and only a few hundred yards distant therefrom. It extends over the bottom lands and on to the higher areas on the first mesa. Gravel occurs in varying amounts from this soil type, being plentiful on the higher areas. The gravel in this soil consists of quartz, sand stone and lime stone, forming a combination very beneficial to plant growth. The soil is generally sufficiently coarse in texture to permit the rapid percolation of the water, though it retains moisture well. It is extremely unlikely that this character of soil will become alkalied except in such portions as lie too low for proper drainage from the river. This type of soil is believed to be the best adapted for agricultural purposes than any in the region. It is especially adapted to the growth of cereals and alfalfa.

"The Billings clay is the heaviest type of soil found in the area. It occurs in small patches or ridges, principally on the south side of the river and at a distance generally of more than a mile. The soil is derived from blue or black shale and is very heavy. It is compact and almost impervious to water. This soil type contains a considerable percentage of alkali, but occurring as it does on the higher lands, the surface drainage is generally good.

"It is the custom of the farmers along the Laramie River to use an excessive quantity of water in irrigation and to this must be ascribed most of the damage by alkali. With the moderate use of water and a reasonable amount of care, those lands which do not show alkali at this time are in little danger of becoming alkalied. On those areas where alkali does show the more conservative use of water in places, the building of drains or surface ditches will

3629 reclaim the larger portion of the alkali land. The soil towards the river is generally good and on account of the loose texture of most of the soils, the drains would not have to be put close together and would be quite efficient. As the best of the land generally shows alkali which is an indication of its richness, the cost of reclamation is very small as compared with the benefits to be obtained.

The agricultural methods followed in this section differ but little from those areas where agriculture is just beginning to be developed. Heretofore, the attention of the ranchman has been devoted almost entirely to the raising of hay. Little difficulty is experienced in bringing new land under cultivation. It has been the practice, in

bringing new lands under cultivation, to plant them to potatoes or grain.

The virgin soils yield splendid crops, and at this time rotation of crops is practically unknown. With better and more intelligent methods rotation will doubtless be practiced and in this rotation, alfalfa will play an important part. It should be the effort of the farmers who are to cultivate this land to put as much land in alfalfa as practicable during the first few years. This is especially true on the higher lands. On the lower lands, the wild hay crop is very valuable and is becoming more so each year. From those areas where a good hay crop is obtained, especially where the blue stem or wheat grass is found, the meadows should be used for the growing of this kind of hay.

From information obtained from the Wyoming Experiment Station at Laramie, I quote as follows: 'The yield of alfalfa on
3630 the Experiment Farm is on an average, three tons per acre; the average yield of barley is 42 bushels; wheat 35 bushels; field peas 18 bushels. (There are no records however, of the production of peas except during the year 1909); production of oats is 45 bushels; yield of cereals is 60 bushels to the acre, and the average yield of wheat for ten years is 25.5 bushels per acre. On Mill Brook Ranch 107 bushels oats per acre, machine measure, were raised. The average yield of potatoes at Laramie is 94 sacks per acre.'

From this letter and other information gathered, the average crops of this region I judge to be about as follows: Oats, 40 to 50 bushels per acre; Barley, 30 bushels per acre; Peas, 30 bushels per acre; Alfalfa, two and one-half tons; Timothy and Wild grasses, one to two tons.

The present yield of potatoes seems to be rather low. By using alfalfa as a fertilizing agent preceding the planting of potatoes, I do not doubt that 200 sacks per acre will be produced.

From the examination of the possibilities of this section, one is impressed with the fact that there is a very extensive and excellent range country surrounding it on all sides. The Laramie Plains furnish pasture lands for the winter months, while the higher mountain areas furnish pasture during the summer. A farmer having a home place along the Laramie River of perhaps 160 acres, can range his herds and flocks on cheap land belonging to himself and on the public domain. If he is fortunate enough to control a section of land on which there is a spring or stock water, he will have surrounding him a very considerable area for grazing, which
3631 on account of the want of water elsewhere, will not be available to anyone not similarly situated. On this land his stock is grown and matured. During severe winters, it can be fed on the farm, and when matured, it can be brought to the home farm, fattened and disposed of. Barley, oats, peas and alfalfa are fully as efficient and very much less expensive than corn. Stock so fattened commands a price equally as high as corn fed stuff. Likewise, hogs can be grown and fattened in this region with little expense. Cholera is practically unknown and the pea fed hog is much sought after by the local butchers and by the packers.

The value of farms in this region appears to be along the line suggested. It is a well known fact that horses raised in this locality are of excellent quality, and I anticipate that this district and Wyoming in general will, in the very near future, become one of the principal horse producing states in the Union.

The value of land at this time is hard to determine. The prospects of the future are so bright, and yet the country is at present in such an undeveloped condition, that one is at a loss to adjust the values which have been obtained until very recently with those which will undoubtedly be obtained in the near future.

Similar land in Colorado, but lying perhaps 500 feet higher, is worth with a good water right from $50.00 to $100.00 per acre. Generally speaking, the Colorado District has not as good railroad facilities, nor has it generally water rights equal to those on the farms which we are considering.

First, the annual cost of maintenance is considerably greater, and reservoirs are generally required; drainage is often necessary, and care must be exercised to prevent the accumulation of alkali. In this district around Laramie, I am creditably informed that water rights are worth about Thirty Dollars per acre; that land
3652 without water but with a possibility of obtaining water is worth from Twenty to Thirty Dollars per acre. It is a well known fact that a combination of land and water is more valuable than either of those essentials separately. This added value, generally called the 'Value of Assemblage' is considerable. I judge, therefore, that the lands in question have a value off from Thirty-five to Seventy-five Dollars per acre with a water right. The grazing lands are valuable for the reasons stated in other parts of this report, and depending upon their location and quality vary from Three Dollars to Ten Dollars per acre. In the case of Ten Dollar land, it must be so situated that stock water can be obtained. The three dollar land would be that which was mountainous and with a poor growth of grass, and possibly without stock water.

The possession of both irrigable land and pasture land should give an added value to both. That portion of the Company's land which lies near the town of Laramie, is of excellent quality and with water would be the most valuable which the Company owns. Water can be obtained for this land at about Thirty Dollars per acre. Although the roads in this district are unusually good for the use of automobiles, and any of the land is desirable for residence purposes, nevertheless, the cost of the transportation of produce to the railroad would be considerable for the more distant sections, and it is probable for this reason that the lands near Laramie are the most valuable."

* * * * * * *

"In considering the water rights on the several tracts, a preliminary statement is necessary for an understanding of the conditions.

The land, considering the water rights, might be divided into three heads:

First, Those lands which now have a decree. These decrees are shown by the records in the office of the State Engineer of Wyoming,

and in the office of the Board of Irrigation. When these decrees were granted, the grantors of the Company made proof on a considerably larger area than is called for in the decrees. The Company has instituted suit against the state officials to compel them to grant further decrees on the old rights. Those lands which are involved in this contest constitute the second class. The third class are those lands for which no decree has been granted, and on which the Company does not claim water under the old ditches, but claims water under its more recent appropriations.

The conditions can best be studied by taking up the several ditches and their decrees, and showing the area decreed, the area in contest, and the area for which application has been made.

The most important, as it involves the greatest area is the land covered by the King Ditch and the King Ditch enlargement and Extension. By the decrees, the King Ditch covers 2106.7 acres of land. This area is shown in color on the attached map. The contested land under this canal is as follows:

All that portion of the north half of Section 2, Township 13 North, Range 76 West, not covered by the decree, amounting to about 200 acres. The King Ditch has a very considerable fall, and it is possible to irrigate land, not only lying to the north, but also lying to the south of the ditch. The present decree covers simply that portion which lies to the north of the ditch.

3634 In Section 1 of the same township, the same condition exists, and the amount of land which can be covered is about 160 acres.

In Township 13 north, Range 75 West, all of the land belonging to the Company can be covered, amounting to 80 acres.

In Section 5, 200 acres is in contest.

In Township 14 North, Range 75 West, Section 32, 160 acres is in contest.

In Section 33 all except a small portion in the southwest corner is in contest, amounting to about 320 acres.

In Section 28 all of the land not included in the Caldwell appropriation is in contest. This amounts to 200 acres.

All of Section 27 is contested. In this section, however, a considerable portion can be irrigated from Caldwell Lake, and whether the contest is successful or not, at least 160 acres can be irrigated from the Lake.

In Section 23, lying above the Haley and Hoge Ditch there is contested about 400 acres.

Section 25 is under the King Extension, and permit is sought for its irrigation on account of the extension.

In Township 14 North, Range 74 West, the King Extension covers nearly all of the land belonging to the Company not otherwise covered, amounting to about 800 acres, it being the intention to extend the King Ditch to cover the lands in Sections 17, 9 and 8. Of the Sections touched by the King Extension, there is above the canal some 3,300 acres, for which there is no water.

Caldwell and Gardner Ditch: The Caldwell and Gardner Ditch has a decree for 1,523 acres. It can also be made to cover lands in

Sections 27 and 28, Township 14 North, Range 75 West. As
3635 previously stated these lands are in contest.

The Riverside Number One Ditch has rights for 1,470 acres. It also covers all the lands in Section 29, Township 14 North, Range 75 West, in amount about 400 acres. This land is also in contest. The canal could be made to cover the land in Section 21 as well, but as this section is also covered by the Riverside Number Two Ditch, for the purpose of this discussion it is assigned to that canal.

Riverside Number Two Ditch has two decrees, one for 2514 acres and the other for 1,024 acres. It is proposed to change the grade at the upper end of the canal, which can easily be done, keeping it on higher ground. This will make it possible to irrigate all the lands of the Company in Sections 27, 26 and 23, Township 14 North, Range 76 West, about 285 acres. It can also be made to cover the balance of Sections 19, 21, 15 and 11. The contest referred to covers these lands, in amount to about 1,150 acres.

The Haley and Hoge decrees call for 1,571 and 637 acres. This ditch also covers a considerable part of Sections 22 and 23, Township 14 North, Range 75 West, which have no decrees, and which amounts to nearly 500 acres.

In reference to the contested lands, I would say that the evidence so far taken in the suit indicates that the Company has a valid right to nearly all of the land in contest. Furthermore, the amount of water available to the canals, and the amount of water in the river, justifies one assuming that in some manner these lands can
3636 and will receive water. By means of rotation even present decrees would furnish sufficient water, though under the laws of Wyoming these decrees could not be used on the additional land except after a permit was obtained. With the certainty of an abundant water supply, these lands could in any case be served by filing an enlargement and extension on the several ditches. As before stated, this has already been done, so that regardless of the outcome of the suit, it appears certain that those lands will in time have a decree."

* * * * * * *

"My conclusions are, that the Company has acquired a valuable property; that the water rights are ample, and probably as free from complications as can be found on a tract of similar size, and which has the old valuable decrees dating from Territorial Days. Later decrees, covering an equal body of land, would be less complicated, but would be very much less valuable. It is the value of the old decrees that justifies the Company in seeking to cover as much as possible of their land by them.

My conclusion is further that the land should be subdivided into tracts of 160 acres or more, and that the purchaser should, so far as his means permit, acquire pasture land for summer use and for growing his stock, which will later be fed and matured on the farm; that with such a combination, the property would be more valuable than if either were owned separately; that the presence of a trans-continental railroad so close to the land, with the certainty of

other roads in the near future, justifies one in predicting that the land will increase rapidly in value.

I would recommend that as far as possible the water rights be consolidated, and that in the sale of land an effort be made to give each purchaser a water right of practically equal value. This
3637 effort of having the values of the water rights equal might also be extended, and the farms themselves made as nearly equal in value as practicable.

I would further recommend that the sales, at first, be limited to actual settlers, and so far as possible the speculative element be excluded.

Before the land passes into the hands of the farmers, I would recommend that a study be made of the seepage and drainage conditions; that a comprehensive system of drainage be laid down, and that revisions be made for necessary rights of way for drainage canals, to the end that should drainage become necessary and advisable, the rights of way will have been provided, and the settlers will have an idea how to proceed."

I gave general instructions to the party making the plane table survey of the Laramie Plains region, and I visited them a number of times and examined their maps during the progress of the work, and found that they represented the actual conditions. As ascertained from the plane table survey the amount of land actually irrigated was less than 50% of the amount lying under the old ditches, and there is another large acreage lying under the newly
3638 constructed ditches of the Lake Hattie system. In addition to the land lying under the ditches already constructed, the greater part of all of the land upon the Laramie Plains could be brought under ditch. In view of the great many depressed areas and alkali spots scattered over the area I would say that about 60 per cent of all of the land under the present ditches could profitably be irrigated.

3640 While there is opportunity for the extension by individual effort of ditches already constructed on the Laramie Plains, there is little opportunity left for the construction of new ditches by individual effort, and the main development to which that area must look must be the Lake James and Lake Hattie systems principally, the construction of which is not a matter of individual effort but must come through a large organization, while on the other hand the utilization of water furnished by these systems is always a matter of individual effort, which the constructing companies can influence only by means of presenting attractive prices. I do not believe the cause for the postponement of the utilization of the Lake James and Lake Hattie systems however, is that the water is held at too high a price, but that it is not profitable to farm in that region.

3641 Exclusive of the water surfaces of the Laramie Plains, I estimate that there are wet areas aggregating about 10,000 acres which lead to excessive loss through evaporation. These areas are composed of a strip perhaps a mile wide and several miles long, lying between the Pioneer Canal and the rise of the hill to the north

near the northeast corner of Township 14, Range 76, and
3642 a considerable amount of wet land in and around the Little Laramie River. This latter includes a considerable area near Two Rivers and another area in the vicinity of the Bath ranch which was so wet that it was almost impossible to get through with a rig. A large part of this land was not cut over at all. There are
3643 also wet alkali tracts around all of the lakes. In my consideration of these wet areas I have endeavored to exclude all land that is irrigated and to include only those lands which have become so wet without intention on the part of the owner. I made no list of these lands because the area of wet and useless land was vastly in excess of the estimate I have made, and I thought it was unnecessary. We did not have a plane table survey made of these wet areas because we did not have the time or the money.

3644 From maps prepared by other people I have made up a list of the water surfaces upon the Laramie Plains consisting of lakes and ponds from all of which there is evaporation which I considered as waste water. These water areas aggregate 6,379.19 acres, of which 3,000 acres lie in the Cooper lakes and 146.98 acres in Creighton Lakes, which are on the south side of the Laramie River and about three miles distant, being supplied with water principally from Antelope Creek and from Sand Creek, the water of which is carried into Antelope Creek through ditches which cover land above the lakes. A small dam has been constructed at Creighton Lakes and some work performed looking towards the future use of those creeks for irrigation purposes. There has been irrigation from Sand Creek and Antelope Creek for many years but I do not think it has progressed during the past five years. Cooper Lake
3649 has an area of nearly 3,200 acres. It lies west of the Laramie River about four miles, in the northerly part of the valley. I do not think that Cooper Lake has ever been a tributary to the Laramie River and I referred to it merely because it is a convenient source of supply that might be utilized for the Laramie Plains
3650 area. Its water supply is Dutton and Cooper creeks, from which there are a number of small ditches taking water. I do not know whether the amount of land irrigated from those two creeks has increased materially within the last few years.

3651 I have not included Lake Ione in my list because it has been turned through a cut into the river and the land is now being farmed. I would say that the area of Lake Ione would be about the same as the area of Creighton Lakes. The other large area of water surface is Hutton Lake, containing 392 acres, lying just south of Creighton Lakes and generally considered as a unit with Creighton Lakes. Hutton Lake is a part of the system being developed for irrigation by the Denver and Laramie Realty Company, whereby it is contemplated to irrigate a rather large area of land not heretofore irrigated.

In my discussion of stream flow measurements my use of the term "mean" or "normal" flow relates to the run-off in an average year. When the flow in any year is above this average or normal, the surplus above the average flow is conserved and held over for use in

later years when the flow is below the normal, so that the water available over a period of years is theoretically the same as
3652 the normal or average flow of the stream. Where reservoir facilities are not sufficient this theoretical available amount is not the same as the practical available supply, but on the Laramie Plains the normal supply represents the practical available supply on account of the situation of the Wheatland Reservoir at the lower end of the valley, being a channel reservoir which can hold and conserve all the water passing down the river. In this particular the Laramie Plains is in a fortunate situation.

3653 WILLIAM ILIFF, a witness in behalf of defendants.

Direct examination by Mr. Delph E. Carpenter:

Reside Denver, Colo. General security business. Engaged that and similar business for period of years in Colorado. Identified with the Laramie-Poudre Reservoirs and Irrigation Company since 1908 or 1909. Do not recall exact year.

As director came in contact more or less with finances, but not very much until latter part 1911 or fore part 1912. At that time when Farsons Sons & Company notified The Laramie-Poudre Reservoirs and Irrigation Company that they would be unable to go ahead with their contract I became active in finances of company. Farsons gave as reason for their inability to sell bonds that there was a general attack upon the enterprise; that it reached their cus-
3654 tomers and that they were unable to sell bonds. I am not familiar with what attack they referred to except in very general terms, except that there was whole lot of literature scattered throughout east emanating as I am told from Wyoming principally, which found its way to their customers and which prevented a continuance of their selling bonds. That was literature advertisting fact of present pending suit, or threatening of bringing suit, as I understand.

Became active in affairs of company about time Farsons notified company of their inability to sell on this account. Became active about February 1, 1912 and for following six or seven months, probably a little longer, I gave practically my entire time in an endeavor to re-finance company so that project would be completed. Devoted my efforts principally in New York, some in Philadelphia, some in Baltimore and in Chicago. Was personally in those cities during that period.

Was unable to re-arrange financial affairs of The Laramie-Poudre Reservoirs and Irrigation Company so that they could complete this enterprise. Was unable to re-finance project. Two obstacles prevented:—first, was general depression of security market especially in regard to irrigation bonds which however, was overcome by being able to present very attractive proposition, but when attorneys got hold of legal end of it and found Colorado-Wyoming suit
3655 pending, they advised their clients not to go into law suit and one proposition after another failed on that account. Was not able to overcome first obstacle, general depression of securities,

with all of the financiers with whom I was dealing. Two or three would consider proposition on financial basis subject to legality. When legality was investigated Wyoming-Colorado suit was obstacle. Understand that has continued to be obstacle to present time. Have not actively attempted to do anything since 1912.

At time of formation of district securities were sold to Farsons, Son and Co., through instrumentality probably of Mr. Camfield and Mr. Shields. Mr. Camfield assumed active duties in connection with financial end of The Laramie-Poudre Reservoirs and Irrigation Company's business, that is of procuring sale of bonds, etc., prior as well as subsequent to 1912. My assistance was only during 1912. Whole idea was to save ourselves from loss if possible, or as much loss as possible.

3656 Cross-examination by Mr. N. E. Corthell:

I was connected with the Laramie-Poudre Reservoirs and Irrigation Company as a director practically from its organization. At first I was interested as a bondholder, but at a later date I became interested as a heavy stockholder. In 1912 I became owner of 360 acres of land in the Irrigation District. I took up the matter
3657 of endeavoring to finance the Company merely in order to save my own heavy investment, and I received no salary or compensation for my work, and paid my own expenses. Farson & Son reported at the end of 1911 that they could not sell any more bonds on account of the reports relative to this suit by Wyoming which had been sent broadcast. I went to Baltimore with
3658 one of their salesmen, and a bank there which had purchased some bonds refused to take any more on account of the threatened suit. As to whether the suit had then been started I do not know. We were able to overcome the general sentiment
3659 against the purchase of irrigation bonds, had not these other matters intervened. The condition of the irrigation bond market has been very poor since the first of 1912, and I have never had anything to do with any issue excepting the one of the
3660 Greeley-Poudre District, so do not know whether other irrigation bonds have been sold during that period or not. From general report I know that there have been many cases of the organization of irrigation districts in unsettled territory which have failed.

3660 Redirect examination by Mr. Delph E. Carpenter:

We had already come to an agreement as to financial terms, and in two instances, I considered financial end of it actually closed and so telegraphed those interested in Colorado, only to have it fail after principals were advised not to go into enterprise on account of suits that were pending or threatened, I do not know which, threat-
3661 ened trouble with Wyoming, that is way it was stated. I was able to make financial terms by making securities attractive by bonuses of various kinds. No matter what position of other systems might have been, this would have been completed but for blight

of Wyoming suit. I never know what financiers will do until they get their money down, I learned that from experience, but I was so sanguine, so sure of it, that I proceeded on that assumption.

Over $2,000,000 of bonds had been sold by Farson, Sons & Co., prior to their inability to further sell bonds on account of this suit, as I understand.

As I recall, prior to 1912, one Clarence T. Johnston, then Wyoming State Engineer, was persistent to offering to the press various statements and letters, in which he published broadcast to world that the Greeley-Poudre system must be doomed to failure and that their water supply was of no avail in so far as Laramie river was concerned, and particularly in letters of September 15, 1909, and March 7, 1910, and published through Associated Press in Denver Republican on September 18, 1909, and August 4, 1910. My recol-
3662 lection is that such letters were in the office of The Laramie-Poudre Reservoirs and Irrigation Company but from my own positive knowledge could not say. I was not in such relation with company at any time as to enable me to look through the files.

It was matter of common knowledge, while I was in New York and Chicago, that letters and dispatches of this character had been circulated freely in financial centers, even while Farson, Sons and Co., were engaged in selling bonds disposed of by them.

Recross-examination by Mr. N. E. Corthell:

It was matter of common knowledge that data of various kinds was being circulated through east attacking Greeley-Poudre enterprise in various ways. I simply know what various members of companies have told me, Mr. Camfield and Mr. Shields stated that such was attack made on enterprise, and Farson, Sons and Co., gave it as a reason why they were unable to continue their contract in taking up the bonds. It was on account of their inability to sell securities due to wide circulation of attacks of different kinds on district. I saw circulars that were handed me to look at. I kept none and cannot say except from memory, that is general impression I have of whole matter.

3663 Redirect examination by Mr. Fred Farrar:

Immediately after commencement of construction on Greeley-Poudre enterprise, there was a great deal of activity. There were a number of towns that were organized in the district and there was a great deal of land taken up. Considerable land was fenced, houses were constructed, and, as time went on, I noted increased activity there and an increased number of people who had come into district both in towns and throughout district. These were Pierce, Nunn, Briggsdale, Camfield and Hungerford. A great many persons acquired land in the district. Towns of Nunn and Pierce are both on main line of Union Pacific Railroad between Denver and Cheyenne.

Hungerford, Camfield and Briggsdale are to east in main body of district and on branch of Union Pacific Railroad constructed by the

Railroad Company into the district anticipating revenues from district when system was completed.

3664 These towns became very thrifty. For new towns, springing up as they did, they were constructed quite substantially with brick buildings, a number of them. Was interested in enterprise and generally noticed character of improvements. Banks were established in both Pierce and Nunn and think at Camfield. There were usual and customary mercantile establishments in those towns. They were normal western towns. Development was very satisfactory from my point of view as a security holder in the enterprise. These towns were formed through individuals and associations. I do not think The Laramie-Poudre Reservoirs and Irrigation Company had anything to do with any of them, certainly not to my knowledge.

Safety of investment in the Greeley-Poudre enterprise and prosperity of the people who have invested and reside in the towns, depends upon completion of district and watering of lands. These towns did not exist, to my knowledge, before enterprise was

3665 projected. I know they grew from practically nothing to more substantial little towns after enterprise was projected. In inception of this enterprise I only made investment in bonds and it was only later that I became very heavily interested and visited and took an interest to go over district personally. The general development was made after the enterprise was started.

Examination by Mr. Delph E. Carpenter:

An item appearing on page 7 of the Denver Republican of Saturday, September 18, 1909, reads as follows:

"Wyoming Warns Ditchmen of Trouble Ahead.

Diverters of water from Big Laramie will be prosecuted. Need at home for all supply that can be conserved. Says diversion to Colorado will ruin districts of Albany and North Laramie."

"CHEYENNE, WYO., Sept. 17.—(Special.)

The following letter has been sent by State Engineer Johnston to every member of a company which is planning to take water from the Big Laramie river for use on land outside the state:

"Realizing fully the complications which arise after construction has been undertaken and money invested in an irrigation project where the water supply is inadequate, we are taking this op-

3666 portunity to notify you that the water of the Big Laramie river and its tributaries is fully appropriated in the state of Wyoming.

Any further diversion of the waters of the Laramie river for use in irrigation outside of the drainage area of the stream would injure Wyoming appropriators. The state of Wyoming, with the proper government authorities, has maintained measurements on

the Laramie river for a long term of years. There are many years when the flow of the stream has been wholly inadequate for the Wyoming lands under ditch, except through the utilization of large volumes of stored water. Reservoirs have already been constructed which store 130,000 acre feet of water from the Laramie river in Wyoming. Reservoirs are under construction which will store 75,000 acre feet in addition. When these reservoirs are completed they will have sufficient capacity to store all the waters of the Laramie river during the season of minimum flow, and to reclaim all of the lands under these reservoir systems it will be necessary to store water and hold it from one year to another, if we are to develop stable agricultural communities.

You are doubtless familiar with conditions on Sand Creek, a tributary of the Laramie river, which has its source in Colorado. Several years ago an attempt was made to divert the waters of Sand Creek in Colorado without regard to the rights of prior appropriators in Wyoming. Wyoming water users immediately secured an injunction in the United States courts.

A diversion from the Laramie river, such as contemplated, would ruin Albany county and northern Laramie county as agri-
3667 cultural districts. The state of Wyoming will therefore encourage every move to protect the water users and to protect the interest of the state along this stream. Should a diversion, as is contemplated, be attempted, resort must be had to the United States Courts for protection."

That is one of the articles I had in mind. The following appears in the Denver Republican of date Thursday, August 4, 1910, on the front page which with bold headlines reads as follows:

"*Wyoming Will Start Water Suit.*

Would Prevent Completion of Laramie-Poudre Project.

Attorney General Is Now Preparing Case.

Colorado Officials Confident That Completion of System Can't Be Stopped.

The Attorney General of Wyoming is preparing to bring a suit in the supreme court of the United States against the state of Colorado in an effort to prevent the carrying out of the proposed Laramie-Poudre Irrigation project. Although the Colorado officials are confident that the diverting of the waters of the Laramie river for this big irrigation project cannot be prevented by the Wyoming men, who claim that their rights are being injured, a suit similar in some respects to the Kansas-Colorado case will be filed shortly and it is understood the Supreme Court will be called upon to again
3668 pass upon the rights of Colorado to use the waters in her streams for the purpose of irrigation.

It has been expected for some time that there would be an effort on the part of Wyoming men to prevent the big project, which will reclaim many acres of northern Colorado land from being carried out, but only recently has it been learned that the attorney general of Wyoming is preparing to bring a suit against Colorado in the United States Court.

Do Not Want Waters of the River Diverted.

Wyoming takes the position that the waters of the Laramie are all used in Wyoming and in the valley of the Laramie in Colorado and that the possibility of further development of the irrigated area from that stream is very remote and if the lands along the Laramie in Colorado were irrigated to the fullest extent no harm would be done to Wyoming users because the return waters would all go back to the main stream.

The Laramie-Poudre project they claim diverts the water of the river from its own watershed and they will be lost so far as the Wyoming water users are concerned. If no water is diverted from the Laramie watershed they believe that it might be possible to reclaim some of the lands on the Laramie Plains, but this is held hopeless if any of the water is diverted according to the irrigation plans of Colorado men.

"This office has kept a record of the flow of the Laramie river near the Colorado-Wyoming line for many years" says Clarence T. Johnston, state engineer of Wyoming, in speaking of the proposed suit. "For ten years the average flow was 117,000 acre feet of water per year. We have one reservoir on the Laramie which has an earlier right than the proposed Poudre-Laramie diversion, for 120,000 acre feet of water. In addition to this we have about
3669 300,000 acres of land that has earlier rights, and all of this is irrigated from the direct flow of the river.

"The state also holds that an interstate adjudication by the United States Court will settle the question involved in accordance with some principle that can be carried into effect in both states. We believe that beneficial use will be the basis of this decision. We believe that the court must decide whether water rights belong to persons who can change them from one tract to another and from one watershed to another or whether the water rights belong to the lands reclaimed.

Colorado state officials believe that the Colorado-Kansas case has settled the question of the right of a state to use its water as it sees fit. The Laramie-Poudre Company has purchased many water rights and have gone to great expense to plan the reclamation of a large area in northern Colorado. It is believed that there is little danger that the supreme court of the United States will interfere and prevent the carrying out of the project.

The Wyoming men base their contention that the water rights belong not to the individuals but to the land that has been reclaimed, as held in the recent Arizona case in which the United States inter-

vened in the adjudication of rights to use water from Salt River. The case was decided on March 1st of this year and is entitled "Patrick T. Hurley, The United States, Intervenor, vs. 488 other users.'"

That is one of the various Associated Press articles I remember of seeing. That and similar articles did not have a very beneficial effect on bond market of irrigation securities. Those articles
3670 have evidence of appearing from official Wyoming sources. Denver Republican was an old well established daily in Denver carrying very heavy Associated Press business. It was one of best established daily newspapers west of Missouri River. It is a fact that Farson, Sons & Co. referred to article of August 4, 1910, which I just mentioned, among other references in stating fact that attacks on bonds were such that Wyoming suit prevented further sale of bonds.

JOHN E. FIELD.

Cross-examination by Mr. John D. Clark:

3671 The Weatland Reservoir differs from most of the reservoirs on the Poudre River in being a channel reservoir. The Halligan Reservoir, a reservoir on Sheep Creek, and Chambers Lake are the only channel reservoirs on the Poudre River, but there are three large channel reservoirs now proposed as part of the Greeley-Poudre system. The Wheatland Reservoir is the only channel reservoir upon the Laramie River in Wyoming and its location gives it a very considerable advantage. It acts as an equalizer of the whole stream during the season and from year to year, as it is never necessary to permit water to waste, and by the conserving of water when not needed upon the Wheatland tract relieves the demand on the river and makes it possible for higher ditches to get water when otherwise they might not be able to do so if there was a shortage in the water supply, a situation which does not now exist. Since its completion the Wheatland Reservoir has very largely increased the effectiveness of the whole river and its capacity is so large that it can practically conserve the flow of the river. There was one year when water passed over the spillway of the reservoir, but I think the history of the reservoir is that no attempt has been made to hold all of the water because it was not needed. Under present conditions with James Lake and Lake Hattie constructed and the Greeley-Poudre Tunnel opened, the large overflow of 1909 might all be taken care of or at least very considerably reduced, and there are other reservoir sites upon the Laramie Plains which might be utilized if necessary. It is my opinion, however, that the irrigation enterprises which have been more recently constructed are not
3674 justified, and a further development would be even less justified. The capacity of the Wheatland Reservoir could also be increased by digging a channel so as to reduce the area of the dead body of water, and I believe that this work has been largely performed already. It would also be possible to draw off water from the Wheatland Number Two Reservoir into the Wheatland Number

One Reservoir in order to have the Number Two reservoir available for subsequent floods.

In 1912, 162,370 acre feet passed in and through the Wheatland Reservoir and there were 47,000 acre feet remaining at the end of the year. A total of 80,700 acre feet was stored in Lake Hattie in that year and 22,000 acre feet were stored in Lake James. As-
3675 suming that the Wheatland Reservoir No. 2 was filled to its capacity in 1912, the 80,000 acre feet stored in Lake Hattie and the 22,000 acre feet stored in Lake James would have gone to waste in 1912 if these reservoirs had not been constructed, the water passing through the Wheatland Reservoir over the Spillway or through the valves and down the Laramie River. Neither Lake Hattie nor Lake James was in existence in the years from 1903 to 1908, and there would be no opportunity to store any of this water in these years, and if that amount of water had flowed in the river during these years it would have passed down the river, excepting such as was used at Wheatland. The six years 1903 to 1909 inclusive on the Poudre River average 109 per cent of the average flow in 30 years, and I would say that there would be the same relative flow over the same period in the Laramie River. I would say,
3676 therefore, that if in the years 1903 to 1909 inclusive, no water did pass the Wheatland Reservoir, it follows that the flow of Laramie River in 1912 exceeded the flow in the years named by at least 100,000 acre feet.

In Exhibit 127 I did not use the records of the flow of the Laramie River at Woods Landing for the years 1889 to 1893 inclusive because I considered that some of them were not entirely reliable, and I did not have the original data with which to check them up. In some of my calculations, and in Exhibit 128, I included the published records for these years and found that they did not greatly change the results.

3677 Most common method of measurement to ascertain flow of rivers is by use of an instrument, called a current meter, to determine velocity of the stream. The cross section of the stream is obtained by measuring the depth of water at regular intervals of one, two, or even five feet, and these depths, together with the widths of the different sections, added, give the total cross section of the stream.

The current meter is used to determine the velocity of water in each of the sections, and the discharge is computed by multiplying the cross area of that section by the velocity which is obtained for that particular section.

There are a number of methods for handling the meter. The average velocity of the section is what is desired and many measurements have been made to ascertain what methods are the better to use.

What is known as the integration method is most common. It is performed by allowing the meter to sink to the bed of the stream and then slowly raising it to the surface and again allowing it to sink to the bottom of the river. Different observers use slightly different methods in getting integration in this manner. The result

obtained by raising and lowering the meter in this manner is considered the average velocity of the section.

Another method which is sometimes used, where, for any reason the integration method cannot be used, is to take the surface velocity. This method is perhaps the least desirable and less used method, and it requires judgment to apply the proper coefficient, the surface of the water running at a considerably higher velocity than the average velocity.

Another method, known as the six-tenths method, is obtained by placing the meter at a depth of six tenths of the total depth of the section and measurements have shown that generally by holding the meter at that six-tenths point, the velocity obtained is the average velocity of the section.

3678 Where the current meter is not used, a weir may be placed across the river and we have formulae from which we can calculate the flow. These formulae have been determined by actual measurements. On a weir properly constructed and the observations carefully made, this will give closer results than the meter methods, but unless the conditions are almost perfect, the meter method is equally reliable.

Meters have been in use for twenty years to my knowledge. They have been considerably improved during that period. Greatest improvement was during 1897 or 1898. About that time we used a recording apparatus which was a clock arrangement, which recorded the revolutions.

Since that time, the revolutions are counted by the observer by the use of a small telephone which transmits to his ear the click when the circuit is closed as the meter revolves. That improvement, I think, was a considerable advance in the use of the meter.

The operator times himself with a stop watch. He starts his stop watch when he hears the click, which is the beginning of a revolution, and then counts the clicks as long as he thinks it is necessary and the watch is then stopped and the time read and the number of revolutions recorded.

This telephone apparatus is so arranged that in some cases every revolution is heard and in others every fourth of fifth revolution only is heard. The reason for using the apparatus which records only the fourth or fifth revolution is that often the velocity of the current is so great that it would be impracticable to count as fast as the meter revolves.

3679 The object of these two measurements which I have described is to ascertain the cross section area and the velocity of the flow. From these the flow in cubic feet per second is ascertained by a mathematical computation. That is the discharge measurement. From this discharge measurement, by mathematical computation, the discharge is computed over any period that is desired. Observations are made in the stream at different heights and the water discharge at different heights is recorded. These discharges are plotted and based on the quantity of discharge and the gauge height. A curve is then constructed which gives the intermediate points. A number of

observations, even at the same point, are desirable, so that errors from observation may be eliminated as far as practicable.

Discharge for the year is generally computed by constructing such a curve and computing a table for the discharge at each one-tenth of a foot on rise or fall of the river. The daily gauge heights are observed or recorded on an automatic register and from the gauge heights so recorded, the daily discharge is computed. The aggregate daily discharge gives the total yearly flow if observations were kept up for the entire year.

It is necessary to make these current meter measurements at different stages of the river in order to secure the table from which to estimate the velocity at different heights. The velocity of flow varies considerably with the rise and fall of the river. Velocity is not in direct proportion to the depth and varies in different streams, so that actual observations are necessary to construct proper rating tables.

3680 Accuracy of discharge curve depends largely upon number of measurements which have been made to fix the table. Table of velocity arranges itself in a curve. Where the channel is shifting and bed of river is not permanent, where channel is choked above or below stations, and where there are boulders or other impediments in stream, such as bridge piers, etc. More observations are necessary. Where channel is permanent and what we call a good station, where flow of water in different sections is approximately parallel and grade of river above and below the station is fairly uniform, a single observation gives very good results, and a good observer with one observation can produce reliable results.

Possibility of error would be greater where discharge and velocities are greater. It is more difficult to make observations when river is high and velocity is great. For that reason it might be that an observation at higher stages would not be as good as it was at lower stages, although there are conditions of river where observations at lower stages are questionable. It is also true that in cases of extremely high flows, computation is derived from extending the velocity curve and not from actual measurement, so there is possibility of error in that particular. Where you have to extend your curve, errors are liable to be made. Extension of curve is matter of judgment. It is always desirable to have actual maximum discharge made from an observation, so that higher point on curve is not left to judgment of hydrographer. If hydrographer is forced to make observations at a point where the channel is filled with boulders, his records, of course, while the best that he can get, are not as reliable as with a good channel. A single measurement at a perfect cross-section or station would be sufficient for determining flow at a given height, but not for all heights. You must have intermediate points and the more the better.

3682 WILLIAM S. ILIFF, recalled.

Direct examination by Mr. Delph E. Carpenter:

Miss T. H. Marso is my private secretary. She is secretary at present time of The Laramie-Poudre Reservoirs and Irrigation Company. Records of Secretary of that company are kept by my private secretary. Since testifying this morning Miss Marso and I have searched through letter files of the company for letters referring to letters and articles emanating from Wyoming authorities or persons reflecting on bonds of Greeley-Poudre Irrigation District. We found letters. They are from Farson, Sons and Co. of September 23, 1909, and March 31, 1910, and signed by John Farson, Junior. Letter of March 31 had enclosure, a letter dated at Laramie, Wyoming, March 25, 1910, and directed to Editor of United States Investor and signed by George A. Campbell, Secretary of Laramie River Association. United States Investor is financial paper published in
3683 New York City. Letter of September 23, 1909, reads as follows:

"CHICAGO, Sept. Twenty-third.
Nineteen Hundred Nine.

Mr. S. H. Shields, Secretary Empire Construction Company, Denver, Colorado.

DEAR SIR: We are this morning in receipt of a letter from Mr. F. H. Bowen, General Superintendent of the Lake Hattie Reservoir & Irrigation Company, Laramie, Wyoming, together with a clipping from "The Laramie Republican" dated September 18th, intimating that if any effort was made to take water from the Laramie river for account of the Greeley-Poudre District, it would be bitterly contested in the courts. This clipping includes a letter from Mr. Johnston, State Engineer of Wyoming, which is very forcible in its tone.

If you have not seen this letter we suggest you most carefully look it over without delay. We have made no answer to the letter.

With our best respects, we are,

Yours truly,

(Signed) FARSON, SONS & CO."

J. F.—F.
C. N. Y.—D.

This letter is addressed to S. H. Shields as Secretary Empire Construction Company which was company of Messrs. Camfield and Shields, formed for purpose of constructing irrigation projects and especially North Sterling and Riverside Projects, just prior
3684 to Laramie-Poudre Project. Substitution of that company for Laramie-Poudre Reservoirs and Irrigation Company was evidently an inadvertence. Letter of March 31, 1910 and enclosure accompanying same, omitting notation at bottom of original letter concerning other matter, reads as follows:

"CHICAGO, March Thirty-first,
Nineteen Hundred Ten.

Personal.

Mr. D. A. Camfield, Century Building, Denver, Colorado.

MY DEAR MR. CAMFIELD: Recently the United States Investor, a New York publication, had a very good article recommending the Weld County, which article evidently fell into the hands of a fellow named Campbell, with result that he has written the U. S. Investor as per copy herewith.

Will take this matter up and straighten it out as soon as I get to New York. Just wanted you to see this article.

With my best respects, I am,

Yours truly,

(Signed) JOHN FARSON, JR.

J. F., Jr.—F.
C. N. Y.

Encl.

Copy.

Weld County, Colo., Irrigation Bonds.

LARAMIE, WYO., March 25, 1910.

EDITOR UNITED STATES INVESTOR: I have, before me, a clipping from a paper which purports to be a reply given by you to
3685 an inquiry concerning the reliability of the irrigation bonds of the Greeley-Poudre Irrigation District, In Weld County, Colorado. You are quoted as saying, in substance, that these bonds are a safe investment.

I feel sure that you have not full information concerning this matter, and that your opinion is based upon the reports and statements made by those interested in selling the bonds.

The promoters of the district propose to divert the water of the Laramie river to accomplish the irrigation of lands in the district.

The fact is that only a small part of the water of the Laramie river has ever been used in irrigation of lands in Colorado, and the chief flow has been appropriated and used in Wyoming. There are something like 125,000 acres in Wyoming now irrigated by the Laramie river, which flows for many miles through this state. The appropriators of this water have banded together and raised a large sum of money for use in law suits, which are about to be instituted to prevent the proposed diversion of the waters of the Laramie river. The decision of the case between Kansas and Colorado by the Supreme Court of the United States is entirely in favor of Wyoming appropriators, as you may determine by reading the closing paragraph of the decision. It is certainly based on justice to protect the rights of the irrigators of 125,000 acres of land in Wyoming against the diversion of water to another watershed for use upon an entirely

new area. In other words, it is not justice to destroy the property of one locality to increase the value of lands in another, where no question of eminent domain can enter.

I have full detailed information on each point in the whole
3686 plan of the Greeley-Poudre Irrigation District, and can assure you that the promoters are about to run against trouble.

I deem it only fair to those thinking of investing in the bonds in question, that publicity of the impending suits be given.

One of the bills of complaint prepared by the best legal authorities of this region, now lies on the desk before me ready to be filed in court.

Yours truly, GEO. A. CAMPBELL,
Sec'y Laramie River Ass'n."

Mr. Camfield was president of The Laramie-Poudre Reservoirs and Irrigation Company on March 31, 1910 when this letter was addressed to him by John Farson, Jr. These letters and enclosures were obtained from files of the Laramie-Poudre Reservoirs and Irrigation Company today. Publication of articles such as letter of Mr. Campbell, attached to letter of March 31, in journals such as United States Investor has direct effect upon either purchase or inclination to purchase securities when approved or disapproved by financial papers of that character. I understand this paper is one of general circulation in financial circles.

3688 Redirect examination by Mr. Delph E. Carpenter:

The Laramie-Poudre Reservoirs and Irrigation Company was in no way concerned in or responsible for literature issued by Farson, Sons and Company in carrying out their agreement to purchase bonds of the Greeley-Poudre Irrigation District. No matter what representations were made by Farsons or how many suits may be or might be pending between them and their purchasers, that is something with which the Laramie-Poudre Reservoirs and Irrigation Company has no concern or responsibility.

I understand that a number of suits have been started or threatened against Farson, Sons and Company on account of fact that bonds sold by them of Greeley-Poudre Irrigation District have defaulted in interest owing to fact that project is not completed. If Wyoming litigation is responsible for failure to complete the system, it is also responsible in that degree for bringing of suits against Farsons.

Recross-examination by Mr. N. E. Corthell:

Farson Company is the firm that was selling these bonds and furnishing money to carry on enterprise. The Laramie-Poudre Reservoirs and Irrigation Company sold bonds outright to Farsons, but they did not take them up according to contract. They were not
3689 selling them for district or company. They purchased bonds outright. They agreed to buy bonds and pay for them but did not carry out contract.

Redirect examination by Mr. Delph E. Carpenter:

They were not the agents for the district or the Laramie-Poudre Company.

JOHN E. FIELD.

3690 Cross-examination by Mr. John D. Clark:

The reliability of stream measurements depends upon the accuracy of the various measurements both as to the cross section area and the velocity and upon the existence of sufficient accurate measurements upon which to base the proper discharge curve. The making of a few accurate measurements by a qualified person would not of itself insure the accuracy of the total record, but there must be enough of these measurements for that purpose. The
3691 measurement of stream flow requires both technical skill and experience, and the accuracy of the measurements depend largely upon the degrees of skill possessed by the observer, as well as upon the care exercised by him. In examining records
3692 I would prefer to know the character of the hydrographer as to whether he is a competent, painstaking man, than to examine his original field notes or to ascertain the character of the channel at the point of measurement. I feel that I may assume that a good hydrographer has made as accurate measurements as are possible at the time. Where results are authoritatively published, the assumption should be that they are correct, only as it is known in any particular case that the conditions were not favorable or that there was an absolute error. Before feeling justified in accepting records of stream flow, one must either ascertain for himself or must assume that the measurements were accurate. If a measurement has been inaccurate either in determining the cross section or in determining the velocity it is not worthy of faith. Inaccuracy due to faulty current meters is unusual. As a matter of precaution we test the current meters once a year before they are taken out into the field. Each meter has an individuality and must be rated.

3693 While in some cases an automatic register is used to ascertain the height of the river, the more usual method is to establish a gauge rod which is read twice a day by some observer. The correctness of the discharge records will depend, of course, upon the faithfulness with which these observers take these readings. On a stream the size of the Laramie River at its flood stage, one-tenth of a foot in height will make a considerable difference in the total discharge. The station at Woods Landing maintained by us in 1913 had no daily observations, but the hydrographer at Boswell's ranch took a reading each time he passed, which was six times in May, seven times in June, and five times in July, so that we felt that in connection with the daily record at Boswell's, our record thus gained was approximately correct. Our Woods Landing records for 1912 are acquired through a consolidation of a number of records, as there was no station maintained by us at Woods Landing

in that year. The principal basis of this record was the discharge at Boswell's ranch as ascertained by a continuous record, together with the records of inflow from intervening tributaries.

3697 With reference to the several records of the flow of Laramie River at Woods Landing, shown on defendants' Exhibit 127, I will state at the outset that I do not know who the hydrographers were, except in the years 1912 and 1913. I do not know what cross section was in any case or how many measurements were taken in each year. I cannot state the experience of the hydrographer. These matters are of record, however, and if it is desired that they be known or it is considered important, the records can be consulted and these facts ascertained. The record of 1895 was taken from reports of State Engineer of Wyoming. The information for this year derived from office of State Engineer was so obviously incorrect that I investigated to ascertain the cause. I took original data concerning discharge of river and had a rating curve and rating table constructed and then, with gauge heights as given, the discharge was determined. These records were furnished by Deputy State Engineer of Wyoming, Mr. Harry True. The gauge heights which I used were taken from the published records.

In 1896 the records were taken from the 18th annual report of the United States Geological Survey.

In 1897, from Water Supply paper No. 15, publication of the same department; 1898, from water supply paper No. 27; 1899, from water supply paper No. 39, and 1900 from water supply paper No. 49. 1911 was taken from the published reports of the State Engineer of Wyoming, his 1911-12 report, and 1913, having no published data, as I have explained, was obtained by the State Engineer of Colorado. 1912 was based upon data gathered by State Engineer of Colorado for Boswell station and supplemented by actual gauging made by or under direction of Professor L. G. Carpenter.

With reference to 1895 record, the gaugings on the stream on which the rating curve was based was from the published records of the discharge of the stream. Both the gauge height and the discharge records were published by United States Geological Survey.

I rejected the records for the years 1889 to 1893 inclusive as published by the State Engineer of Wyoming because I questioned their accuracy. If I had used the figures for these years the discharge would have been increased. Some of the computations in my exhibits I have made myself, but generally they have been made by an assistant in my office. I have not recomputed any of the measurements for the years 1896 to 1900, and have not

3699 analysed any of the figures for any of the years prior to 1912, and reduced them to their velocity and area. The 1895 record was obviously in error, because the discharge shown in September, October, and November was only 7 second feet, which I knew was ridiculous, being less than one-sixth of the indicated normal. If the discharge for more than half of this period was represented by zero in the published report, this would indicate an

error in the rating table, and not a lack of any measurement, although it would not be possible for any rating table to lead to a zero result upon the Laramie River in those months.

3700 Upon discarding the published record for 1895 and going to the original data I found two discharge measurements, one on May 24th at a gauge height of 2.8 feet and a discharge of 1,129 second feet, and one on October 23 with a gauge height of .8 feet and a discharge of 49 second feet. With these two measurements, knowing the general form of such curves and the kind of curves secured for other years, we constructed a rating curve for 1895 which I think was approximately correct, and from this made up a rating table to which we applied the gauge heights as published, and determined the discharge for each day. I do not know whether the same section was used for the measurements in 1895 as was used in the following years for which we secured rating curves, and the station was not a very good one. As the figures for 1895 are based somewhat on the curves of 1898 and 1899 it would be reasonable to investigate whether the measurements for the three years were made at the same station. I think my assistants looked into this matter.

3704 The records upon which Exhibit 131 showing the run-off of the Little Laramie River at Hatton is based are the figures for 1902, 1903, 1911 and 1912 which are taken from the geological survey publications, with missing portions of months supplied by assuming the run-off. The 1913 figures were taken from Wyoming records. I do not know anything about the character of the measuring section nor the personality of the hydrographer who did all this work, and the measurements for the last two years were taken at different points than those for the first two years. None of these tables have been re-worked by me. I have no knowledge of the character of the cross sections where the measurements were taken nor as to the individuals who took them in connection with any of the other tables which I have presented excepting in the case of Colorado stations. I have no particular knowledge as to the details of the measurements on the Poudre River either, excepting that a large part of them were under the direction of Professor Carpenter.

3705 The Skyline Ditch was re-rated by Professor Carpenter in 1903, and was fixed at very much less than its supposed capacity in former years. In my tables in connection with the amount carried through that canal for years prior to 1903 I have made no change on account of this re-rating. If those early figures are too high it would decrease the total run-off of the Laramie River to that extent, but would also decrease the amount diverted by Colorado into the Poudre Watershed and would decrease the proportion of the total run-off of the Laramie which can be diverted. The records of the flow at Glendevey as shown in Exhibit 125 for the years 1904 and 1905 are taken from the Geological Survey reports; for the years 1910, 1911, 1912, and 1913, from the reports of the State Engineer of Colorado. They were made by competent

3706 hydrographers. Some measurements were taken by Professor Carpenter, a man of very wide experience. His meas-

urements and conclusions are generally accepted without question. Some 1910 measurements by W. B. Freeman, U. S. Geological Survey, were also used. The station is well located and is equipped with an automatic register.

The records at Boswell's ranch shown on Exhibit 126 were made by the office of the State Engineer of Colorado and in 1912 and 1911 additional measurements were made by the Geological Survey. The station is fair and the channel permanent, but at high water
3707 all of the water does not pass through under the bridge, a part of it passing to the west. In 1912 the water was very high and a considerable amount passed to the west of the bridge and not through the channel of the river itself, so that in computing the discharge at high water it is necessary to add the amount passing around the bridge. I visited the station and examined the culverts west of the bridge and could see that there had been a considerable volume of water passing through them at very high velocity, so that I am positive that water did pass around the bridge and through these culverts. For this reason figures for this station for the year 1912 are not the same as published in the State Engineer's
3708 report. The hydrographer who worked up the measurements at this station is not subject to criticism, because he had no measurement indicating the existence of these added channels. I got the actual measurement of the high flow in 1912 from Professor Carpenter.

3711 The measuring station on the Laramie River at Uva, Wyoming, is below the mouths of Sybille Creek and the North Laramie River and above the mouth of Chugwater Creek. In 1913, run-off of Sybille Creek was 19,492 acre feet, between April 1 and November 22. I do not assume to make a mean discharge for that stream, but 1913 being a year of low flow and this covering only a part of the year, one would almost be justified in saying that the normal discharge was in excess of 20,000 acre feet.

3712 Drainage area of North Laramie River is about 500 square miles. I have been informed that some reservoirs were constructed upon this stream within the last five years. I do not have figures from which I could estimate the run-off of that stream.

Referring to defendants' Exhibit 145, showing run-off at Uva for several years, including 1903, in which total run-off was something less than 35,000 acre feet from May to October, inclusive, I think these measurements would indicate that water had been permitted to flow down the Laramie River from the Wheatland Reservoir No. 2.

3713 Where the question of the rights of prior appropriators and similar problems have been discussed in a report upon an irrigation project, and the conclusion is reached that a given quantity of water is available for the project, such report is taken to mean that the stated amount of water can be procured for the project with proper works, but all conditions and circumstances must be taken into consideration.

3716 In my discussion of the flow of the Laramie River I have not taken into consideration the water diverted from the

stream in Colorado and used in the upper Laramie Valley because no great amount is diverted, and it is used within a very short distance of the river and returns to the river very quickly without much loss. The same is true of the small ditches in the Centennial Valley on the Little Laramie River, in Wyoming. In my report upon the Riverside ranch my statement that the amount diverted in Colorado for use in the upper Laramie Valley exceeded 57,000 acre feet in the preceding year was obtained from the records of the Colorado Water Commissioner. It may be that water is turned on to these meadows to the depth of 12 feet in the course of a season, but the consumptive use could not possibly exceed one acre foot per
3717 acre, and more likely it would be one-third to one-half of an acre foot per acre. There would be some evaporation, but not much, because the large head of water used carries the water back to the river rapidly. Even if so large an amount does get back to the river this method of use is wasteful and excessive, just as it is on the lower part of the river in Wyoming, and on the Little Laramie in Wyoming.

3718 The amount of water diverted from the Laramie River into the Poudre River through the Skyline and Sand Creek ditches in 1911, which was a comparatively low water year on both streams, was greater than the total diversion through both ditches in the year 1912, which was a normal year, whereas in the year 1913, which was a very low year, there was less water carried through the Skyline Ditch than for four years, and no water whatever was carried through the Sand Creek Ditch. I account for this
3719 variation as follows: 1910 was a very low year, and it is probable that the reservoir capacity in the Poudre Valley was almost exhausted, creating an exceptional demand in 1911. At the end of 1911, on the other hand, some water was held over so that there was not the same demand in 1912. In 1912 the water supply in the Poudre River was so large with respect to the demand that a large surplus was left for use in the following year, so that in 1913 when the flow was but 73 per cent of the normal it was not necessary to divert any water through the Sand Creek Ditch, nor to take any place near the available quantity through the Skyline Ditch. This result was also in part due to the excellent condition of the land in the spring of 1913 due to the winter and early spring precipitation.

3720 It seems reasonable to assume that there is less fluctuation in the discharge of the Laramie River in the high mountain areas than in the plains areas, and the diversion into the Poudre Valley of a fixed amount taken from the high area will cause the fluctuation in discharge in the lower portions of the river to be more violent.

3721 The total capacity of the reservoirs in operation in the Poudre Valley in 1912 is 146,665 acre feet, including four channel reservoirs with an aggregate capacity of about 16,000 acre feet. According to report of division engineer for year 1912, amount of water stored in these reservoirs November 1, 1912, for use in succeeding season was 83,794 acre feet, which, in the report, is given as

held over from 1912 to 1913. This would leave 62,871 acre feet available capacity, by deduction from capacity given of 146,665 acre feet. If stream flow in that year had exceeded amount that did go down the river by figure I have last stated, it would have been used in lower district. As far as this district is concerned, it would not necessarily have been lost, as we have both ditch and reservoir priorities, and this surplus might have belonged, under dates of priorities, to reservoirs in the lower district on the South Platte below the mouth of the Poudre.

I do not believe that the flow in the South Platte is as similar to the flow of the Poudre as is the flow of the Laramie. The South Platte River drainage comes from an area at a very much greater distance from the head waters of the Poudre than does the flow of the Laramie, and the character of the South Platte water-shed is quite different. I think it is possible that a considerable portion of such flow would have been forced to go down the river, and further than that, the ditches on the lower river used water late in the season after November 1. That situation existed in 1912. The storage of 87,000 acre feet in 1912 indicated that there was that much available for storage in excess of use for lower district, but, of course,

I am not familiar with the conditions in 1912, as I was not
3722 state engineer at that time and cannot say that lower ditches were amply supplied in the fall of that year.

Considering Poudre as an entity, I have previously stated that any flow in excess of 62,000 acre feet above the flow of year 1912 would have been lost to the Poudre itself, with this modification, that if the flow of the Poudre had been greater than it was, diversion from Laramie River would probably have been less than it was. If there was more water than could be stored in the reservoirs in 1912, it would probably be used for fall irrigation, which is beneficial. They first seek to secure water for use late in season of following year, and bend every effort to carry over as much water as possible. Fall irrigation is beneficial, but is not usual in Poudre Valley

3724 Poudre Valley is not now in condition to take care of large floods which come down the river. These floods come in May and June and cannot be used for fall irrigation unless stored. In Poudre Valley there are times in every year when some of the ditches are short of water and the water in the reservoirs is used after June upon the lands. There would be more water used if more was available. This would not be conservation for succeeding years, but use in that year. The Poudre Valley could conserve, in high years, 146,000 acre feet for use in subsequent years. In years of large flow in Poudre River, some water would get away.

3725 If there had been a total storage capacity of 146,000 acre feet in the Poudre Valley in 1884 when the flow of the river was 666,000 acre feet from April to October, about one-half of this flow would have been wasted so far as concerns utilization in subsequent years, and in the following high year of 1885 there would have been a similar loss of about 100,000 acre feet. Where two high years occurred together, there would be an added loss.

3727 In estimating the use of water from the Poudre River, you have to consider not only the matter of storing water, but

must also estimate the direct use in attempting to estimate the amount of surplus water. In such years as 1884, a considerable amount of water would have passed out of the river, but when it comes to such years as 1899 and 1901, that is not true. It is probable that the amount of water flowing in the river in those two years was used, and the year 1902 took practically all the surplus that was held over for the other two years. There are intervals of perhaps five years that there are floods that escape from the Poudre River. If it were not for these floods and the hope of conserving this water, the construction of these channel reservoirs which the Greeley-Poudre Irrigation District proposes to build would not be feasible, even with the Laramie River supply.

3728 It requires both the surplus which occurs in the Poudre at intervals and the amount which can be brought across from the Laramie River to make the Greeley-Poudre District feasible. To try to conserve the flood waters of the Poudre and to construct these very expensive reservoirs to conserve the water which they might only get once in five years, three years or every other year, would make it not feasible financially.

3729 I have called the mean flow of the Poudre River over a period of 30 years the normal flow with the idea that it is possible to consider such flow as the amount of water which is available for irrigation. In 1912, however, no means had been used in the Poudre Valley to utilize the exceptional floods, and the mean flow avaliable for use in that valley would be considerably less than 297,000 acre feet, the mean flow of the river over the whole period. The variation between the mean flow of the river and the available mean flow in different districts will depend upon the nature of the districts, the crops which may be raised therein, and the expense of development which would be justified thereby.

The records at Uva Station show that in 1899 there were 446,000 acre feet passing that point. The present reservoir capacity on the Laramie River would conserve a considerable part of that water. Diversion by the proposed diversion system of the Greeley-Poudre would use some of that. After these quantities were deducted from the surplus shown by this Uva record, the amount would not be so enormous that reservoirs on the Laramie Plains could not be built to conserve it. Reservoir sites on Laramie Plains are very large and cheaply constructed, so that a large part of that surplus water could be used, and if the soil, climate, etc., justified the agricultural development there, such as there is in the Poudre Valley, these reservoirs would be built and practically all of that water would be conserved.

3730 I do not think it would be feasible to build reservoirs on Laramie Plains for conservation of this surplus for use on the plains. Returns from agricultural operations in that region would not be sufficient to justify it.

An irrigation project cannot be constructed upon the assumption that a low year will probably be followed by a high year, as there appear to be cycles when several low years follow each other.

The amount of water stored in the Poudre reservoirs on Novem-

ber 1, 1911, was 16,352 acre feet. As this was some time after the close of the irrigation season it is possible that this amount was stored after the close of the season, and cannot be said to be water carried over, and the same situation exists with respect to the water in storage on November 1, 1912, the large part of which was secured after the irrigation season closed. Because the amount in storage on November 1, 1911, was 16,000 acre feet and the flow of the river in a normal year exceeded the flow in 1911 by 92,000 acre feet, it does not follow that in a normal year there would be a surplus of 108,000 acre feet. I have, however, considered the amount of water in storage in the Wheatland Number Two Reservoir in the fall of 1913 as including the surplus in that year. Whether that reservoir had been emptied during the irrigation season I did not take into consideration. The amount of water stored in a reservoir several weeks after the close of an irrigation season does not necessarily indicate the surplus supply during the preceding season.

3732 Cross-examination by Mr. N. E. Corthell:

During the ten years from 1904 to 1913 the average annual run-off of the Poudre was 367,000 acre feet, of which amount 120,000 acre feet reached the Platte River, 10,000 of this from seepage from Poudre River ditches reaching the Platte River below the mouth of the Poudre and 110,000 entering the Platte from the Poudre
3733 itself. The average quantity actually diverted into the Poudre ditches would be something more than 300,000 acre feet, leaving 60,000 acre feet of original water passing down the river and 60,000 acre feet of return seepage.

3734 I estimate an average inflow into the Poudre of 10,000 acre feet from streams below the canyon. There are a number of draws into the Poudre River which I would hardly call streams, the water in which is utilized along their courses.

3735 The acreage I have stated as irrigated from the Poudre River, 265,000 acres, does not include the lands irrigated from these small tributaries. My estimate exceeds the report of the Water Commissioner of 224,000 acres irrigated in 1912 because he did not report on all of the ditches, and his report was made up from a report upon the acreage in different crops. My estimate is made up from my general knowledge of these districts, the conditions therein, and not from any survey or particular knowledge of this district.

3737 The drainage area of Stuck Creek, a tributary of the Laramie River, is 33 square miles, all of which is in Colorado; that of Johnson Creek is 13 square miles, practically all in Colorado, and that of Beaver Creek is 30 square miles, of which 9 square miles is in Colorado. The drainage area of these three streams is similar, but Beaver Creek and Stuck Creek have a considerable amount of high drainage, and Johnson Creek does not. I am not entirely satisfied with the division of the drainage areas as shown on Exhibit One, as I cannot reconcile the reported discharges with the drainage areas as there shown.

3738 If the drainage areas as I have stated are correct, it would show a run-off of .42 feet from the drainage of Stuck Creek, 1.9 from the drainage of Johnson Creek, and .6 feet from the drainage of Beaver Creek. A slight error on the part of the geographers would account for the discrepancy. Taking the three streams as a whole the average run-off would be about three-quarters of a foot, which is one-quarter of the run-off at the head of the Laramie River. That part of the drainage area of McIntyre Creek which would be diverted by the Greeley-Poudre system would have a run-off of about one foot.

3741 My estimate of the drainage areas of these several streams is based upon such information as I could secure from the Geological Survey, from the Forest Bureau, from Professor Carpenter and Mr. Meeker. I have not, however, based my estimates of the discharges upon these estimates of the extent of the drainage areas, but upon actual discharge records.

3743 These three creeks run off earlier in the season than the main stream. The seasonal and diurnal flow varies in all of them in about the same manner, I believe, and the diurnal fluctuations are perhaps twice the fluctuations on the main stream. I estimate that the depth of the annual run-off of the general territory covered by the drainage of these three streams will average about one foot.

3747 The data relative to the run-off of Sand Creek is meagre and unsatisfactory. From such records as I could find and upon an estimate of the run-off of the area and similar areas I estimated the annual run-off of the drainage basin of Sand Creek as 17,000 acre feet. I do not know of Sand Creek having at any time contributed any water to the Laramie River. I think that for many years the water of that creek has been drained into Hutton Lake.

3749 Aside from the measurements made by Mr. Meeker at the Pioneer Dam of the winter flow of the Laramie River, there was a measurement made late in October, 1905, showing a flow of 49 second feet and the river remained at approximately the same stage until the end of November. Measurements were made at Glendevey on October 7, 1911, and October 18, 1911; at Boswell's ranch on October 8, 1911, and a little below the Greeley-Poudre tunnel in February and March, 1914; also near Glendevey on November 6, 1910, and at Boswell's ranch on November 8, 1910. These are all the winter measurements I have, aside from those of Mr. Meeker.

3750 I have no data as to the flow of water from the drainage area of the Laramie River north of the Little Laramie, for which I have allowed an average annual flow of 12,800 acre feet. This area is drained almost entirely by Seven Mile, Dutton, and Cooper Creeks, which are tributaries of James and Cooper Lakes, and by Four Mile Creek, which is much smaller. So far as I know there has never been any flow of water from James and Cooper Lakes into the Laramie River. The territory from which I have estimated

this run-off of 12,800 acre feet also includes the mountain territory east of the Laramie River and south of the Wheatland Reservoir. In this region there are Willow, Five Mile, and Soldier or Government creeks and some unnamed gulches and canyons. I do not know how many years it has been since water has reached the Laramie River from either Willow Creek or Five Mile Creek. I have no data as to the run-off of any of these streams or gulches, and my estimate is based upon an assumed run-off of the area in question.

3753 The only data relative to the run-off of Sybille Creek was obtained from the State Engineer of Wyoming, and the discharge curve was calculated in my office.

3754 The saturated areas on the Laramie Plains aggregating six thousand acres of which I have testified, include areas over the whole district which I cannot locate by section. There is one large area extending about 15 miles on each side of the Pioneer Canal, and I believe that the total area of saturated land exceeds the 6,000 estimate by at least 4,000 acres, and that in addition there are 6,000 acres of unused water surface receiving water from ditches on Big and Little Laramie rivers. I believe the evaporation from these areas will equal six feet a year, and I have estimated four feet of evaporation over the whole area.

I have noted the method of irrigation on the Sodergreen ranch and on the meadows of the main Laramie River in 1913, but not under the Pioneer Canal.

3761 LOUIS G. CARPENTER, recalled:

Direct examination by Mr. Delph E. Carpenter:

Facts relative to run-off of water from any area of earth's surface has developed into pretty well defined method of measuring quantity of water by aid of current meters. These meters are a little bit akin to windmills, as to form, that is, they are some sort of a wheel that is actuated by movement of water and will go faster as water goes faster, so that they give a means of measuring velocity of water. Then, with cross-section ascertained, the factors give means of obtaining the quantity.

3762 There are other methods of measurement of larger streams and, even with moderate streams until a few years ago, other methods were generally used. It has only been within past few years that current meters have been available as instruments of commerce. There used to have an old German wheel on same plan called Woltmann wheel, and first one used in this western country was commonly called "Colorado Meter." This consisted of a wheel about 10 inches in diameter and it was this old Colorado Meter that was used to rate streams in Colorado from 1883 to 1885. First one of this type was made in 1883. Since that time there have been other and more convenient forms in use. These are especially applicable where streams are not very deep, which is case with most of our streams and ditches here. Before that time it was quite com-

mon to use double floats as in Humphrey's and Abbott's Gaagings of the Mississippi and in quite noted series of experiments in India at Roorkee, experiments by Cunningham, and sometimes flumes or channels of very nearly uniform depth are used, by vertical rods and sometimes by floats. The double float in particular was that of a float that might be a little heavier than water, and would float along in current and indicate velocity of water wherever float was sunk, its position being indicated by a marker on surface which was another float. With great depth of water this double float brought considerable trouble.

Of all those methods, the meter in the past few years has become an instrument that deserves a great deal of confidence. Nat-
3763 urally these were developed in last 20 or 25 years largely because of western needs. The meter was not considered a very reliable instrument. I had the second Colorado meter and used it for a number of years and tested it a number of times and found it was really very dependable. I refer to the original Colorado meter. The name was afterwards applied to another meter of similar size. The Colorado Meter was the old meter with a large wheel of which I have spoken.

In principle, all of these meters are such that speed of wheel increases with speed of current. They need a means of starting and stopping the counting gear and they need some means of counting the revolutions. This is sometimes done automatically by gears or counters and these may be thrown in or out of gear at specified time because in determining velocity, this rate of wheel must be obtained or, in other words, number of revolutions in a given time and of course some means of holding the meter, which in larger streams may be done by rod or in deeper ones by wire or some means of that kind. Along with the meter a means of determining depth of water and of ascertaining time is used. Time is determined by a stop watch that can accurately record seconds and fraction of a second.

In practice those instruments which have recording gears, would be thrown in gear and watch started at same time and at end of period both thrown out of gear at same time. That gives number of revolutions and number of seconds and hence number of revolutions per second.

3764 In order to turn that into velocity calls for an independent series of observations. If we have one revolution per second, for instance, that does not give number of feet per second water is flowing, unless you can conver- that from revolutions into velocity and that calls for a rating of the meter.

Each meter has a rating of its own and each one needs to be tested to be entirely worthy of confidence and that in part is done by moving meter at different speeds through still water and involves supposition then that if water is stationary and meter moves at certain speed, effect on meter is same as if meter is stationary and water moves. From a series of observations of that kind, means of converting revolutions of wheel into velocity is ascertained.

They use same system as has been used for years in anemometer of

Robinson pattern, which is used by all weather bureau stations, but it has also been known for years that the assumed ratio was not correct in these, or rather, that at high velocities relation between velocity of wind and movement of cups was different. So that in current meters, same thing is true, but a rating reveals these various ratios and every meter needs to be rated, as it is termed. The factor depends largely upon diameter of wheel, that is, number of feet of velocity of movement of current to cause one revolution of wheel. thus, in old Colorado Meter, it took about eight feet of movement of water to make one revolution of wheel. In smaller moderate sized meters, it took about 4 to 4½ feet and in some of smaller wheels used at present 2¼ to 2½ feet.

Ease of movement of wheel of course affects ratio slightly, but not very much. I mean, if pivots become rusty it would be
3765 supposed that wheel would move harder, and thus rating be affected, but in many tests I have made of same meter under different conditions, I have not found much difference from these causes, and I do not think there is much reason to take those into account, so far as mere rust is concerned. I have had one meter in use practically twenty years. I have tested it at different times under different conditions and the rating curve was very little changed. These all relate to meter conditions.

There are some other meters of an electrical type, where meter records by breaking or closing an electric circuit, either every revolution or every 5 revolutions or 10 revolutions, as may be arranged, are recorded and I have also used meters that simply made and broke the circuit with a counter on the outside. They were not very successful.

There are also what are termed acoustic meters. They all use the varied means of determining the number of revolutions the meter makes, which must be determined in connection with a stop watch or a watch of some kind and also with a rating table.

The hydrographer counts the revolutions with electric meters. Most electric meters make and break the circuit and that making and breaking is indicated by its connection with a telephone which as at observer's ear. It causes a vibration of the diaphram and a little click. The observer counts the clicks. In case of self recording meters he reads the dial and of course the electric ones of present pattern involve counting. This counting is done by hydrographer.

In the making and breaking of the electric current of the counters, the armatures, magnets, cannot work with more than a
certain degree of speed and I have found with some of these
3766 meters, such as we had, that when they got up to 8 or 10 feet per second, it simply did not work. I have used them in 12 and 15 feet velocity on the Poudre, or rather tried to. In the pattern which I tried, which is not same as now used, magnet would be magnetized and bring down armature and between breaking of circuit and next formation of circuit magnet would not be magnetized enough to let loose and they simply refused to record.

In use of meters that record at every revolution, in seeking to determine high velocities of water, it then depends on the skill of

the observer in counting these clicks. With a meter like the Price and Lallie pattern, which makes one revolution for about 2 feet per second, if the current is running 9 feet per second, which is not an uncommon velocity, the wheel would then revolve 4 times in one second. Hence the observer, if the meter is one that records every revolution, must observe these 4 clicks per second and count them accurately, and, as these clicks are not sharp and distinct and are a little prolonged, it becomes a matter of some difficulty to do this counting accurately.

It is for that reason that meters I have used of that kind, I have had made so as to record only once in every five revolutions. With this instrument, the click is made about once with every 11 feet of velocity. One per second in 11 feet velocity is not difficult to record.

With meter which records once for every five revolutions, hydrographer does not have to possess experience and skill required in counting for meter recording for every revolution. He is not
3767 so apt to lose count. With greater velocities, person would have to be very skillful, in fact, it would be very difficult for him to make a clear record at all.

Even if he could, then there would be that problem of counting four or five times per second, which, as far as ordinary person is concerned, cannot be done. Two or three times a second would be as much as person could ordinarily count and it is very easy *them* to lose clicks and to fall short. So I think meters which record less frequently are much to be preferred when recording higher speeds.

It is to be remembered that meter is simply an instrument to determine velocity and that it determines the velocity at the point or place where it is held. Where one wants to be as accurate as possible and where time is available, it is of course most conclusive if he holds meter at every point in current across whole cross section. By this method data for determining average velocity for whole cross section is obtained.

It is known that current in a stream is varying. It is faster in middle than at sides as a rule. It is faster at top than at bottom. It is not as fast a little below surface as at surface. Hence it required to get the mean of that varying velocity at all points in the cross section. Now that point method carried out to extreme limit, would involve ascertaining all of these points, it also involves supposition that stream has not risen or fallen during that time, that is, stream has been stationary in height. Consequently in our mountain streams, that involves a supposition that is not true, for it
3768 takes time to get a measurement and the stream changes. Hence it comes to comparison between extreme accuracy or care of that kind and an approximation. Sometimes a systematic approximation is made. In fact all methods have some approximation.

Ordinarily a system of vertical integration is taken, if observer has a limited time. In this system meter is held at certain spot and raised and lowered from surface of water to bottom, so as to get velocity in that particular vertical line. This then may be repeated at different intervals. Usually the spaces are uniform. The area of

these sections is then found by measuring the depth in each section and adding. In raising and lowering this meter vertically it is attempted to have meter travel with same speed as it goes up and down, so as to get general average of velocity. It is quite important to do that. It is important that meter should not rest longer in one place than in another and, in addition, with the form of vanes commonly adopted, speed must me moderate because as they have a slope to rear, if meter is raised and lowered rapidly, it will be found in still water vanes will move backward. In other words that brings in an opposing force that cannot be met. In case of streams of uni- from depth all way across, like flumes, this may be done with equal accuracy by making an integration clear across stream from one side to other in one reading.

Where approximations are noted, and an approximation may be sufficiently accurate at least to serve the purpose, the meter may be held at certain points in the depth in the current, for instance .6 of depth from surface to bottom is a point where is usually found average velocity of current. I mean that by taking a series of tests,

the velocity at .6 of depth is found to be from 98 to 102 per-
3769 cent. That percent. of velocity of whole vertical section.

Measurement is made from top. This does not mean to say that in any particular case that is true, there may be many cases where it is not true. This method is commonly called .6 method. It is measured .6 from surface downward. It would be equally as reliable to take velocity at any other point and multiply it by a factor, hence, surface velocity is about .6 percent. in cases of average velocity for that vertical section and of course it would be equally as accurate to take that and reduce by corresponding factor. That is, equally as accurate as .6 method. They both depend on averages and may be far out for individual cases. Just as you know as a matter of average in insurance, that a man 40 years old will ordinarily live to be 68 but it don't mean that any specific individual is going to do it.

Either the .6 method or surface method of computation is subject to great irregularities in individual cases. Especially so in mountain streams or streams with rocky bottoms. Streams of this kind have more or less rocks and these set up irregularities which are shown by boils, as we often speak of them. They are vortices and these appear on surface of water and break. The cause of that may be a rock that is quite a distance upstream, depending on speed of current and character and depth of rock. The water will not break

and boil on surface immediately above rock that causes it in
3770 first instance and the person observing stream will observe

that these boils do not reappear practically at same place in stream. The cause of the boil is above.

Nearly all of these averages used with either six-tenths or surface method and those determinations suppose that onward progress of stream is undisturbed, so that while these methods have their use within their limits, yet, they have to be taken with their limitations.

If surface method is used meter must be placed at various points on surface of water entirely across stream in order to obtain mean

surface velocity owing to fact that velocity of water is greater at center of stream than at sides.

Determination of maximum surface velocity, is still another method used commonly where no meters at all are available. This is usually done by putting in a float that goes with the current, partly submerged, so that it will not be affected much by wind. Time it takes to pass over a given distance is found and that is multiplied by a factor which may be anywhere from 65% to 95% or even more than that in some cases. Each individual case has its own factor, although they are fairly well classified, that is, where streams are fairly regular factor may be from 80% to 87% in order to strike average, if it is in fairly good condition. For some purposes to meet certain conditions this method is fairly satisfactory. But the more irregular the stream is the more irregular is the current and the more the stream is disturbed by irregularities
3771 at the side by irregularities on bottom from rocks or anything of that kind, and the more uncertain this coefficient is, because the selection of it is a pure matter of judgment and not a matter of conclusion from observation. Methods of six-tenths or two-tenths, eight-tenths, etc., are essentially the same and all depend upon the supposition too, that particular case is an average case. If in fact case is an average one assumption will give pretty good results. The more it varies from average case, which is pretty difficult to tell in case of water, the more unreliable it is and it does not have the conclusiveness of more extended methods.

Either the six-tenths method or surface velocity method involves the judgment or conjecture *or* hydrographer as to what factors shall be used in connection with these velocities which are determined in ascertaining average velocity of stream. In using meters for years, as I have done, I have in cases without number taken pains to also measure surface velocity, or velocity at different places, to obtain a basis for comparison between these methods of measurement and the average that would be found and out of it all I have arrived at conclusion that, except in very regular channels like flumes, the factor was a very uncertain thing. I was studying the matter to a greater or less extent, and in many of these cases I made an estimate before taking the measurement, as to what I thought the factor would be and the result generally proved that the factor was quite different and yet no very apparent reason could be seen why it should so vary. In nearly every instance the factor was a
3772 matter of uncertainty. I have by accident conjectured the factor that later proved to be correct. This did not occur with frequency. As a matter of probability you would be just as likely to choose the exact one as any other of the specific number but the obtaining of it was apparently as much a matter of luck as certainty. It was not certain, although I may say this, that in flumes and regular channels the limits generally are not very wide. In mountain streams limits are quite broad. There are so many conditions you cannot see and do not know, for instance, take any-

thing like eddies in current which at first give the appearance of greater velocity. As matter of fact the velocity very rarely comes out as high as it appears in those cases.

There is no uniform factor for determination of average surface velocity of stream by measurements taken on sides alone. That is particularly a factor that would be affected by roughness of sides and bottom. Of course 40 or 50 years ago, they were attempting to calculate flow of water without taking roughness into account, but they found out after taking the experiment of D'Arcey, that roughness was a factor and this is recognized in all the formulae for computation of flows and of course that would likewise indicate a priori that the velocities and distribution of velocities across the stream would be affected by the sides. That is borne out also by observation. I do not know that anyone has ever attempted to work out the rule accurately and, with the labor that would be required to
3773 ascertain that relation with any degree of definiteness, it would not be worth while because labor involved in that could be avoided by using a little different method. It would be an enormous labor to develop the rule, in fact would depend upon depth, roughness of sides, speed of current and various other factors and I do not think it would be worth the effort.

If a measurement were merely taken on one side of a mountain torrent and at the surface, of the water, a computation of average surface velocity of water would have a large latitude of possibility of error in it. It would have even more latitude of error than would prevail when obtaining velocity by surface method as compared with integration method. It would be more comparable with surface float method. It is more analogous to taking of one measurement and estimating velocity at all other places.

The one-point method so called, of obtaining velocities with meter is generally the same as the six-tenth method. The taking of velocity at one point in each section. The stream is divided into sections by any method, to determine the velocities with that method. You divide the stream into parts and the velocity in each part is found or inferred from observation taken.

3774 In using two-point method, so called, meter is held at two points in vertical section, in a vertical line, and from those velocities found at those two points, average is inferred.

In all these cases it is, to some extent, a matter of inference and presupposes that the particular case is an average one. Curves are drawn that are the average of a large series representing velocity at different points and if then average can be depended upon, why of course such a method would be reliable. I do not mean to say that these methods are not justifiable under certain conditions. I have used surface float a good many times where it was perhaps curiosity I wanted to satisfy, rather than to make exact measurements, when time was short and where conditions were particularly good, but I had to use it always with recognition of fact that it was not very conclusive result that was reached.

Integration method, which I have described, is from my experience generally accepted as the most accurate and satisfactory of all

the methods employed and I think that has also been experience among hydrographers, that they would prefer to use that method where they could, considering time and accuracy and confidence that would be given. If large averages are to be taken into account and streams flow can be considered as a whole, or in large numbers so that average could be considered, why, of course, one of other methods like six-tenths method might be available for that purpose. But where you want to get measurements at a particular station and want to have confidence in that result and have best results for time which is available, I think vertical integration
3775 method is the most satisfactory. Of course the distance apart at which these are taken are matters somewhat of judgment and depend somewhat on breadth of stream. In stream that is 20 feet wide, measurements need to be relatively closer together, so that final result will be within a certain percent., as compared with stream 100 feet wide, where measurements may be further apart and yet percentage of accuracy be same.

Before run-off can be accurately ascertained following facts need to be determined:—Rating of current meter needs to be known accurately and all these measurements also involve question of cross section of stream. Cross section is a factor of depth and hence depth of water needs to be determined from point to point across stream and, from quite extensive experience, I am inclined to think that as a whole as great a percent. of errors is due to errors in obtaining cross section as in obtaining velocity and yet, in most cases, hydrographer considers cross section measurements as a secondary matter. More than that, in mountain streams water is fluctuating constantly due to waves. It may vary five or six inches or more within a few minutes as a wave passes, that is, water rises and falls with these waves and hence a person may make errors in obtaining depth because he does not determine just what is height of water. When depth, cross section and velocity is determined, quantity in cubic feet per second or otherwise is merely a mathematical calcula-
3776 tion. It is subject to errors of computation and, of course, is subject directly to fact that any errors that may exist in determining depth or rating curve of meter, would bring an error in corresponding factor.

It is evident that in measurement of a stream or ditch, it is impracticable to measure stream at all depths. A person measures it when he is present or goes there and is practically confined to what he finds at that time. It may be that a person with a meter can go there only occasionally. The distance may be too great and consequently he may make measurements at certain times, not selected times, but necessary times.

Rating curve as it is called, is then, a curve formed from these observations so as to enable one to determine quantity of water that passes at any intermediate time. If one knows height of water that is the purpose. Method in making rating curve is this: Observations are taken at different times, having depth given at each observation and quantity of water is then determined. Then after

platting to scale on cross section paper or similar paper, it is found that these elements will fall into a more or less regular curve, that is by using the paper so as to use the depth for instance for the abscissa or vertical scale and the quantity as ordinates or horizontal scale, they they fall in a curve. This curve is usually essentially a parabola if the station is a good one, that is, where the current is regular, the channel straight and regular in other respects. In such case the points which register these observations will all fall on a very definite curve.

3777 If channel is irregular, conditions not so good, or if observations for any reason are not so good, the points will diverge more or less, or if mistakes have been made, and in any event, certain errors are found in all observations, these points will generally diverge slightly from simply a regular curve. They depart less as observations are better or conditions are good.

Task of person working up observations is to draw a curve that fits these observations, and as curve is so regular, it is possible to determine quantity of water for intermediate depths with a great deal of accuracy. If these observations diverge from a regular curve, then accuracy of curve is not as great and one's inference as to flow for corresponding depths would be more uncertain. That is particularly the case with mountain streams, observations are not so good, do not fit the curve so well as with streams under better conditions. But taking it altogether, they give a fair means of estimation of quantity and these curves so made are called rating curves.

If curve is extended beyond depth where measurements were made, then this extension becomes more uncertain still. but between high point and low point, inferences are pretty good. Outside of the high and low points, it is more unsatisfactory and may be a good deal a matter of chance. Curve should be used to ascertain quantities at points intermediate between those where observations have actualy been taken, but sometimes, from necessities of case, those quantities have to be taken from point outside of those actually taken. In such case it should be recognized that range of

3778 error is very much greater. Where there is lack of satisfactory data of run-off in any particular region, it comes then back to a matter of judgment and knowledge to a great extent. I mean by that, as to manner in which person might obtain most dependable conclusion.

If there are records of adjacent streams, these records may be guides as to quantity of stream under consideration. The nearer that adjacent watershed is in character, in elevation and in other conditions as to rainfall, etc., why of course the more nearly they serve as a just basis for deduction. It is necessary to use this method more or less. Of course most satisfactory method is to have long series of records on stream under consideration, but that is a very rare thing.

Assumption of average flow of any stream from records obtained from 1, 2 or 3 years' observations, is subject to exactly same errors as would be attempt to obtain average precipitation at a place from 1 to 3 or 3 years' records. It is a fact of the same general character,

is subject to influences of weather, and therefore record of any one year may be exceedingly misleading, notwithstanding it may be a valuable fact together with other facts for a basis of estimating run-off. In those cases too, any comparison of relative size watersheds is a matter to be considered, for floods are not in direct proportion to size of sheds, and hence, as far as maximum flow is concerned, they are not in same ratio as size of sheds. Of course, person would then have problem of forming some kind of conclusion as to run-off as very often comes to engineers. All items of information that bear upon the subject are considered and given weight. Comparison with other watersheds that do have records is one method
3779 and question of precipitation, if available, may have a very important bearing but in mountain regions that is very rarely to be had. Records of that kind are rare.

The Laramie River and Cache la Poudre River are adjacent streams, at least at their headwaters and is a case when general conditions are parallel and one of the cases where the conditions that have affected one do affect the other to a very great extent. It is probably one of the cases where inferences can be drawn much more certainly than in many others that might be mentioned and whose watersheds are as close to one another. While it is true that Laramie watershed is on opposite side of Laramie range, yet both are on east side of main continental divide. To attempt the same comparison between west side and east side might be as safe, although even then such a comparison would be valuable. The fact is, that Continental Divide extends around south and west of combined drainage area of the two streams. The intervening range between the two streams is low and none of it is above timber line. The same general conditions of precipitation affect, for all general purposes, two
3780 watersheds substantially alike.

Annual precipitation of Laramie, Wyoming, as given by previous witness, is not same precipitation as prevails at Centennial, Wyoming and is not necessarily representative of Laramie River Valley. Centennial is in Laramie Plains, but in that branch of Laramie Plains Region that is spoken of as Centennial Valley, that is, it is in the Little Laramie Drainage at foot of mountains on edge of plains. It is a part of main plains but on west edge.

Precipitation at Centennial is almost twice that as Laramie. If record is taken at Centennial by years and compared with record at Laramie by years, the difference would not seem to be nearly as great as it actually is. The reason, however, is apparent, that the record at Laramie and the record at Centennial are not for the same years or months, or rather, the record for Laramie is for a much longer period of time and consequently the average as deduced at Laramie includes a great many years where there is no record at Centennial. If we take a record at Centennial and on identically the same month take one at Laramie, we have up to two or three years ago, when I made the comparison, the average at Centennial as 15.97 inches per year. Now if we take identically same months for Laramie that we have records for for Centennial, we find that precipitation at Laramie at that time for those months was 8.98

inches per annum, or precipitation at Centennial is practi-
3781 cally 1 4/5 that of Laramie for same time.

The ratio is the basis for comparison rather than the average for a series of years where the years are not the same in both places. That general comparison is also true, for instance, between Hatton and Laramie where we have nearly four years' record at Hatton, a little better than four years, it is four years and five months, we find that while average at Laramie for those months and years was 10.37 inches, at Hatton it was 20.51 inches, which is almost twice as great. In other words, that is simply an illustration of general fact that in a valley of that kind, surrounded by mountains with a relatively flat bottom, precipitation changes as you leave that point and thus record which is exceedingly valuable, is nevertheless a record for that particular point and is not necessarily average for valley. In fact it is not. It might represent a stretch along on that side, but amount is changing very materially from place to place and especially as you go up into mountains on either side or go up nearer mountains.

In fact an inference made from that would be just as unsafe and just exactly same character as an inference of flow of stream from one point of observation on the stream. Precipitation is varying and of course it has long been known that precipitation changes as you go up into mountains and that mountain records are generally lacking. I have established a great many stations on eastern side of Continental Divide, especially in Poudre Valley and Big Thompson Valley. I have had rain gauges outside plains at Manhattan, Livermore, Elkhorn, which is east of Manhattan, at a place
3782 north of Manhattan and at Home postoffice. My rain gauge at latter place was a few miles from Zimmerman's where Home post-office is located. I sent one at one time to Home post-office, but got no results. I had one at Gleneyre on Laramie River for a number of years. Also one in North Park near Walden. The one at Walden was kept about 15 years. These records at Gleneyre were made from 1896 to 1902, practically 6 years. Record at Centennial, Wyoming, would overlap the Gleneyre record about 3 years, but I did not make any comparison between the two. If Gleneyre record is compared with Laramie record in same way as was done with Centennial and Hatton, that is, taking those months on Laramie record and those same months on Gleneyre on Laramie River, we have total for year at Gleneyre as 12.56 inches and at Laramie for those same months 10.15 inches, or that rainfall at Gleneyre is about 25% more than at Laramie. Gleneyre is in bottom of valley near stream, near the thalweg, that is, the place where the stream goes, but on other hand its elevation is considerably above Laramie. It is in Colorado south of Colorado line but is relatively low down. Gleneyre is only station we have in Big Laramie Valley in Colorado and, so far as records are concerned, only basis of judg-
3783 ment for comparison with Laramie and for comparison with Centennial and Hatton in Little Laramie Valley. In this case Gleneyre is only 25% higher than Laramie, while Centennial

and Hatton run from 80% to 96% higher. So far as these lead to an inference, and subject to same general limitations of course, shortness of record, rainfall at Gleneyre would be less than rainfall at Centennial or Hatton.

This would indicate that Little Laramie watershed is better contributor of water than Big Laramie river, so far as these observations go. Of course Gleneyre is only one point in Colorado portion of Big Laramie and it does not represent average of Big Laramie watershed in Colorado any more than Laramie record represents average for Laramie Plains. But it does perhaps give a pointer which taken together with other appearances, might give basis for drawing a conclusion of that kind.

Importance of Little Laramie watershed as compared with Big Laramie watershed, may be judged to some extent from appearances, more particularly from records obtained from measurements of snow, where as matter of fact in mountain watersheds it is almost impossible to get rainfall records. People do not live at high elevations in first place and in second place those who do live there are not particularly interested in this kind of a record and they generally cannot be interested either, so that next method I have used to quite an extent has been observations of snow fall as a means of at
3784 least getting winter precipitation, for it would be on ground for sometime while rainfall passes off at once.

There is a very heavy precipitation of snow on Medicine Bow Range along Little Laramie River. A very heavy precipitation. And it seems to be as large, and I do not know but larger than certainly a good part of Laramie watershed in Colorado.

Records of run-off of Cache la Poudre River have been kept for quite a period of years. Poudre River has longest series of records and most continuous series of any stream in Colorado. I have already stated that that stream is, for all general purposes, practically parallel with the Laramie. Record of run-off on Poudre River started systematically with 1884, with about one month's record in 1881. It has been practically continuous since 1884. In 1884, '5 and '6 it was kept under direction of Mr. E. S. Nettleton and was started by ditch users in valley. They subscribed about $3,000 to put in a floor and formed a rating station by subscription among the ditches. Object was to make a regular section and to avoid discrepancies from roughness of bottoms, sides, etc. The floor was made of timber and poles and so floored as to regularize the flow. So constructed that bottom of change would not change and that cross section would not change in character. This was done at solicitation of Mr. B. S. LaGrange, who was Water Commissioner, one of the first in Colorado, and one of those having a great deal to do with development
3785 of system of supervision. He was also a man of advanced ideas along those lines. It was also his idea to put in a telephone. The ditch companies raised $3,500 by subscription for such a phone.

Poudre rating station was established by them and Mr. Nettleton put in a recorder for 1884, 1885 and 1886. In 1888 or 1889, this was washed out. I made measurements there myself in fall of 1888 and, when I found in 1889 that State Engineer was not intending

to continue the instrument or to replace it after it had been destroyed by the flood, then I took charge of it by furnishing an instrument from the experiment station and maintaining an instrument there from that time until I left the experiment station 2 or 3 years ago. Poudre records were kept with an automatic instrument that was very sensative. Its records were, as a whole, very excellent. I sent a man or went myself once a week to change the paper and to see that the pen agreed with the height of water and to make gaugings of stream at various heights, so that as a whole we made I presume without having counted them 100 to 150 different measurements of the stream were made with meters, which served as basis of the rating curves. Subsequently this flow was washed out and the sides and timber rotted, but in that case then a masonry wall was constructed and same place has been maintained as a rating station. The
3786 floor was not re-established in the new station. Proper consideration of the change was made in determining the quantities. The new station was not quite as satisfactory as the one with the floor, because it changed to some extent with rise of river. While water would tend to wash out certain parts, but as a whole the record was a very excellent one and became especially valuable as being the longest record of any stream subject to irrigation and also the most continuous. Later on in the winter season I adopted a practice of sending a man up once a month or thereabouts, to make observations of conditions, when it was covered with ice, but in first few years there were no winter records. They were not very satisfactory as compared with run-off during summer.

Taken as a whole, I do not know of any stream in the west where records have been as carefully kept as at the Poudre River station. Reason for this is that it was not taken up for any commercial purpose or affected by any commercial considerations, but for a desire to get out the record and to keep it, all of which seemed to be a matter of public importance. Many of the other stations have been abandoned as persons responsible for them thought that they were against their interest or had not the funds to maintain them. I could use experiment station funds and was going to, but, as matter of fact, it did not involve much outlay except we had to buy several instruments to replace those that were washed out by floods. I resided 14 or 15 miles from the station. It took a good portion of one day of each week to tend to the station. At one
3787 time I put in a self recording instrument and ditches of valley put up a wire or telephone or what might be called a telephone wire that connected stations with my office so as to record heights in my office.

I kept Poudre Station under my personal supervision during this long period of years purely for scientific purposes. I started I think in 1889 and dropped it in 1910. About that time office of State Engineer had more funds available for such purposes and they were able to take up responsibility of additional stations. It is almost certain that history of water flow in Cache la Poudre River, as recorded by Poudre Valley station over that long period of years, could, for all practical purposes, be taken as generally similar to

the history of the flow in the Laramie River in the same general period of years. It is of a similar character, subject to the same fluctuations and the same relative fluctuations as the Laramie. Of course they have their individual rises and falls from local storms, etc., but as far as general conditions are concerned, the two streams are subject to same conditions. They have some snow fall of higher regions and general rains would affect both. Local thunder storms might affect one and not the other.

When Poudre River Gauging Station was first established in 1884, it was above all existing ditches except North Poudre Canal, which took very little water and irrigated a very small tract of land. I might also state that a little ditch known as the Route Ditch, sometimes known as the Canon Ditch, was also located above the station. This ditch fell into disuse at about the time of the establishment of the station. It had long flumes that were difficult to main-
3788 tain and it did not carry very much water nor very continuously.

Previous to 1889 some water was diverted across the range of mountains from Michigan River into the Poudre River. Later water was diverted from the Laramie and the Grand. Later on the North Poudre System increased its diversion from the stream, constructed reservoirs and it extended to cover an area it originally contemplated to cover and it took more water from North Poudre that would otherwise have gone through this gauging station. The Poudre Valley Ditch was constructed along about 1903 and this starts above gauging station, so that the water that is diverted by Poudre Valley Canal is then abstracted from the river as it passes the gauging station and correspondingly reduces the flow as registered there.

Water that comes from Sky Line Ditch, Michigan Ditch, Mountain Supply Ditch and Grand River Ditch, all comes into main stream and goes through this gauging station and increases water there by corresponding amount so that the effect in operation is that these mountain diversions increase the amount and the North Poudre and Poudre Valley Canals decrease the amount that is measured at the gauging station. And in getting the amount that comes from the Poudre watershed alone, the North Poudre and Poudre Valley diversions should be added and the inter-mountain diversion subtracted. The quantity of water diverted by the North Poudre and Poudre Valley Canals above the rating station prior to 1904
3789 would be about the same as the quantity brought into the watershed from foreign watersheds. The North Poudre was not using a large amount of water prior to that time and Poudre Valley was not using any until 1904. Prior to that time the Grand River Ditch brought over some water but it was small. The enlarged Grand River Ditch did not deliver water into the Poudre Watershed until 1904. Generally speaking, I think the amount of water passing the Poudre River Gauging station from foreign watersheds prior to 1904 would about offset and make up for that diversed above the gauging station by the North Poudre and other canals prior to that

date. It would not make much difference one way or other. It would not make a difference of over 1 3 of one per cent. anyway.

I encouraged measurements and investigations of run-off of Laramie River in Colorado above Woods Landing, Wyo., in 1903 or 1904 and some were taken up by U. S. Geological Survey and Mr. Lamb was put in charge of that. Mr. Lamb had been a student of mine and he spent two summers on Upper Laramie and in North Park. I gave him such encouragement and advice as I could. Mr. Lamb is a competent and careful hydrographer. At that time he was a student and had not had a large amount of experience, that is, he graduated in 1902 or 1903 and I think this was his first independent work, that is my impression. He was working at that time under U. S. Geological Survey. Notwithstanding he had not had great amount of experience he was competent and could be entirely relied upon.

3790 Whatever statements he made are the facts. I think he could be absolutely depended upon. He had a good foundation, which has shown in the results, and has shown in his subsequent career. He was a man of good judgment and I took what he said with a good deal of confidence. He has remained with the water resources branch of the government ever since and has been promoted and given positions of greater responsibility, showing also that he has the confidence of his Bureau and of the officers with whom he is working. Mr. Lamb made observations during year 1902, 1903 and 1904. He had stations at what he called Jelm, which really was Decker's and at Glendevey on Laramie River. I believe he also measured McIntyre. Don't know what he did on other streams, he was spending practically all his time there at those stations. I believe he kept a constant record.

Decker's station is very close to Boswell Station, a little above it. Boswell Station is on Main road across Laramie and on one of roads leading to North Park. Decker Place was at the Decker Ranch house, which is not far above Boswell's, perhaps ¾ mile. Boswell's is in Wyoming and Decker's is in Colorado. There is a private bridge at Decker's and Mr. Lamb had a self-recording instrument.

3791 The box in which the instrument was placed was still there the last time I visited that point. After the U. S. Geological Survey had ceased these measurements I furnished an instrument to Mr. Decker and he kept records there later. He became water commissioner and also carried on some special observations for me. Mr. Decker took a good deal of interest in this matter and especially in connection with his duties as water commissioner. He was of a careful and pain-taking disposition. Later on I had occasion to compare these results and, in 1912, I carried on a good many measurements up there individually and with aid of assistants. Subsequent to time Lamb went there, Mr. Decker kept records at Decker Station. I think later, 1908 or 1909, there was one year of records at that station. There was one year when I furnished an instrument and I don't know but two years. By instrument I mean an instrument that records fluctuations of stream, charting, so that pen moves up and down as stream rises and falls, thus with those

instruments of that type, if record is good, you can determine fluctuations of stream in between. It is equivalent to a continuous reading of gauge heights, if record is good.

Automatic register is equivalent to person staying or being at station all the time and recording different gauge heights as indicated on gauge at each period during the day. This is the
3792 kind of instrument I referred to but perhaps did not describe, on the Poudre. They were self recording instruments that maintained a constant record, but as they had 8 day clockworks, clock had to be re-wound and papers taken off once a week.

Made observations and measurements on Big Laramie River in 1912. They consisted of measurements of Big Laramie River and Little Laramie River also, but not these streams and all their tributaries. I started out to measure the tributaries and purpose was carried out as far as I could with time and means at disposal. I had from one to three men there during first part of 1912, that is up until after high water had passed, until some time in July. I was there myself quite a number of times and we established stations, especially on side streams. There were some records being taken on main stream, and at first I did not expect to duplicate these in any way, that is, we found that automatic self-registering instrument was placed on Big Laramie at Boswell's. At first I did not intend to duplicate that, but after we found instrument was not recording correctly, I took more pains to read gauge and also took measurements.

Instrument at Boswell Station in 1912 was inaccurate. First times I was there, I simply learned there was an instrument, and, of course, assumed it was keeping a correct record. Sometime later I happened at Boswell's and man was changing the papers on the instrument. He had been living at Boswell's the year before. He was put in charge of station and at this time had moved somewhere else as Boswell Ranch had been turned over to some other party. He at that time called my attention to fact that the pen on the chart did not agree with the depth of the river as indicated on the gauge. Pen or chart should record same *as* depth as shown on gauge. For illustration, if depth of river is 3 feet, pen should so show on chart. Pen simply duplicates readings on gauge. In this instance, however, it did not and further, if river rose one foot pen should indicate then a rise of a foot and if river went down 6 inches pen should indicate that fact on chart. He called my attention to fact that instrument did not agree with the depth of stream as shown on gauge. I asked him if he did not note on paper every time he took off, any change or irregularity. In continuity of season there are various causes which may affect movement of pen of instrument and when you put on a new chart or take off old one, pen may not be at quite exact elevation gauge rod shows. Now, I learned from him first of his experience. Observers are usually instructed to record on chart or paper the reading of the gauge rod at the beginning and end of the paper. That then gives a means in the office of verifying it and seeing if it is correct and eliminating any of these changes.

Observers, hydrographers and others having charge of stations should check gauge rod on stream with pen as indicated on chart

from time to time as they happen to pass. In this case, it was not being done and I asked him if he had not been doing that and he said "No" and after I suggested to him it was wise to put pen
3794 up to where it should be he said that he had no instructions to that effect. I told him it was desirable to do so and I should think he should have such instructions. That I would do so and take responsibility for it, which I did, and so marked the fact on the chart. Later on in season I think he was instructed and did make corresponding readings whenever he took chart off and put on new one.

That very night stream at Boswell's rose .4 of one foot. I saw that myself. I staved at Boswell's all night and in morning river had risen .4 of a foot over night. I had not had opportunity to compare the charts until recently, but in comparing movement of pen with fluctuations of river, I found that the pen on that night did not record any rise, in other words, the instrument was not keeping a record for some reason and there were several other occasions throughout season, showing that instrument was not a reliable instrument for some reason or other.

In comparing back with records as shown by instrument at Boswell's Station and observing gauge heights, which we had, there was an evident tendency for the pen on the instrument to drop down. It was shown in that particular night of which I speak and the next time I saw chart after that, which was the only other time subsequent that I saw it during the season, a couple of weeks later, I think the pen was .3 or .4 lower than the gauge showed it should be. It had failed to move in this other instance I speak of, that very night after pen was moved up one foot to correspond with river reading and had failed to record. Fact it did not rise with river I didn't know until I saw chart later here in office of State Engineer. I did not know that fact the next morning because I did not have access to the instrument. It was locked and man in charge lived over on Johnson Creek so, while I went over on Johnson Creek next day, I didn't see instrument or how it was recording and could not do so unless it happened I was at Boswell's at the same time that he was there.

3795 I made quite a number of ratings at Boswell Station in 1912 after we found the pen on the automatic register was not working properly. We took more pains to read the gauge as we went along and I instructed the observers who were there for me, spending their whole time on the river, to read the rod every time they went by and that was generally done.

This instrument was not of the type that I have been using and from my observation of its work there and comparison of it it does not seem to have given very good results.

May 29, 1912 was date Mr. Oviatt called my attention to fact that this instrument was not working properly. Later on upon seeing records in State Engineer's office, I also found a notation I think on sheet of May 12, by an employee of the State Engineer's office. He states on that that record was not working properly and was recording too low by about one foot. This seemed to have been case

for some time and that whole week was wrong. It was on May 29, that I observed it and moved the pen so as to make it correspond with the actual height as indicated on gauge.

After ascertaining that the instrument at Boswell's was not working correctly, I had my assistants keep gauge readings from time to time whenever opportunity offered and after seeing record, I also became rather suspicious of its general accuracy, because it does not show fluctuations in stream that are peculiar to these mountain streams and certainly so on the Poudre, which has daily fluctuations in times of high water.

3797 The charts show that the instrument recorded about a constant height. From my general knowledge of streams I began to doubt its sensitiveness, so that these were addition- reasons why I began to keep records there as I did elsewhere. These daily tides, as one might call them on these snow fed streams, are not evident on Laramie River according to this sheet.

I have checked those charts taken from this automatic register maintained at Boswell's in 1912. This checking has been done since 1912. I have checked them with the gauge readings which I obtained. Wherever the instrument was found not recording properly, I think it was invariably found to be recording lower than the actual height. We can note several cases. Thus on May 29 pen was recording 2 feet and gauge rod recorded 3 feet in depth. Pen was then reset at what was intended to be 3 feet but actually was about 2.95 feet. Next morning gauge rod actually read 3.45 feet in depth at 6:30 o'clock a. m. and record made by pen on chart of instrument indicates that it was recording 3.05 feet. In other words, while stream itself rose .4 during night, pen raised .1. I might mention that is rather difficult to read this small amount with any degree of accuracy on chart because mark made by pen is fully equivalent to .1 on the sheet. These measurements were all in feet.

On June 1, there is a notation made on paper, I think by myself, that the rod was reading 3.3 while pen on chart at same time indicated depth of 3 feet. The pen and the gauge did not agree but the difference was not so great as it was on May 29, and, as it was difficult to set pen, and as I didn't want to interfere for relatively small differences, I did not attempt to set pen, simply indicated discrepancy. June 4 river was gauged and average height during gauging was 3.62 feet in depth. Rise varied during gauging from 3.60 to 3.65. Reading of pen as recorded on chart is between .3 and .4 feet low at that time. On June 11 we have notation and was first chance after that we had to compare. On that date we made gauging early in the morning at which time reading of gauge rod was 3.5, pen was recording on chart 3.2, so it was below actual height. The pen I believe was moved up to 3.5 which corresponds with actual depth, but I do not recall whether we made change or not, I do not think we did.

I think it was about that time that I had mentioned to observer, Mr. Oviatt, that when he took off paper he ought to indicate on sheet the reading on gauge rod, so that at office of State Engineer they might see if any correction were needed.

June 20, we found reading seemed to be very nearly same as pen

I believe, gauge height at 7 o'clock a. m. was 2.6. July 2 we made a reading early in the morning. Gauge height was 3.10 feet. Pen on chart read 3 feet and was apparently slightly low. From that time we had no checks, but there were several checks later on by representative of State Engineer's office, at times when depths were much less. There was one on July 17, one on August 16 and on September 26. At time of these readings quantity of water in stream was less than ½ of what it was in cases where we had opportunity to check. I think that at time of making this reading in July was last time anyone from my office was at Boswell's during
3798 1912.

Laramie River at Boswell's goes under a bridge. Stream is at extreme east side of bottoms and bends just a little above the river bridge, flowing from west side of bottom abruptly east, almost at right angles, and then turns north almost at right angles, just a little above bridge. Road which crosses bridge passes across bottoms for approximately quarter of a mile where it strikes west side. River does not run quite north and south, but approximately so, so it may be called that direction, and hence river runs approximately parallel to road for distance of 600 to 800 feet before it turns at right angles and flows under bridge near Boswell house. Bottoms west of house and along road are about uniform height as you cross bottoms west of bridge and west of channel proper and they partake of general slope of valley going down stream, so it is matter of fact that point where river bends is higher than ground at road. I refer to place where river bends upstream and above the road and the bridge, where it changes from direction nearly north to direction nearly east. If river overflows bank, water would simply pass down valley to road.

Banks of stream are relatively low. From my observations on night of May 29 and on May 30, 1912, I should judge river *brings* to overflow and run over bank at about 3.4 feet in depth as recorded on gauge height at bridge. This overflow water that comes out of river runs over meadows and is carried across road by several culverts to west of bridge. There is one immediately west of bridge about 100 feet, a second culvert at a little greater distance and another culvert at something like 800 feet west of river bridge.
3799 As I recall the west culvert is about 18 feet long. These distances were not measured and are simply estimates. They are approximately correct.

Road is a low embankment slightly above level of meadow and these culverts then carry water that overflows from river.

Water in river raised from 3 to 3.4 feet in depth at bridge one night when I was staying at Boswell's. Men were working with scrapers in evening on road, filling up some of low places on road, so water would not run over it. Conditions were indicating that water was going to come down to road and they were working there with scrapers. They left scrapers when they unhitched that night, on south side of road, that is, on upstream side. In the morning the scraper was very nearly submerged with water. River had only

risen .4 in depth as recorded on gauge, but as it was backed up by road it had risen on road several feet.

May 31, in morning, water was going through first culvert west of bridge, just beginning to go through, not very large flow. Whether it went through other culverts, I did not observe at that time. I had not, previous to this time, been over to Johnson Creek and did not know of these other two culverts, that is, a culvert and a bridge, so I did not see the other two on that date, but from facts as I later found them, as I actually observed them, I think water must have been passing through those other two culverts on that morn-
3800 ing. I think water rather tends to pass through the westerly of these three culverts first, owing to topography of valley. There was a little depression there, possibly an old river channel, and this west culvert is the larger of the three, it is 18 feet long instead of 8 feet, so it might be considered to have the dignity of a bridge. Of the other two culverts one is 8 feet wide and the other is 6½ feet wide.

I think water must have gone through west culvert at least, and probably through both of west ones on morning of May 31, 1912. If it was, I did not measure it on that date. I did not suspect it until I saw these culverts later on and as water went down. Later on, at a less gauge height, we found water going through these other culverts. I presume it must have been going on May 31 also. These culverts were quite deep, that is, water was on June 11. Gauge reading indicated 3½ feet deep on that day and in first culvert nearest bridge water was 3.3 feet deep. It was passing through culvert at that depth and flowing quite rapidly. In first culvert it had velocity of about 1½ feet per second. In second culvert, which was 6½ feet wide but relatively shallow, greatest depth was 2.1 feet and at last culvert, which is 18 feet wide or with a bridge of that length, water depth ran up to 4.5 and was over 4 feet deep for quite a portion of its width, so that, all things considered, I think that west culvert must have been carrying water even at the low overflow stages. Velocity at west culvert went up as high as 3.3 feet per second and average velocity for whole cross section of that culvert was nearly 3 feet per second on June 11, after stream had gone down quite a little bit.

3801 It was evident from conditions as we found them that, after stream reaches a certain gauge height, there is quite an appreciable amount of water going around the bridge and is not included in the stream channel proper. June 4, there was practically 500 cubic feet per second going through these three culverts as compared with 2012 feet under bridge. On June 11 there was 220 cubic feet per second going through these three culverts as compared with 1790 cubic feet per second going under bridge proper, so that it was evident from conditions that discharges of Laramie River at Boswell's Station should take these culverts into account when river began to overflow. At Boswell's Station at 3.4 feet gauge height, and I think it must be lower, overflow occurs and culverts should be taken into account.

Water continued to run around the station at the Boswell Bridge,

over the bottoms and through these outside culverts more than four weeks, a month of heavy run-off during summer of 1912.

Water first commenced to go around Bridge at Boswell Station and through first culvert, the shallow one, night of May 29-30, 1912. Did not observe the deep culvert on that date and so from observation could not state whether water was then going through it, but think it must have been doing so.

Could not state when water ceases to overflow bottom above bridge and ceases to pass under these culverts, owing to lack of continuous observations of the culverts. June 20, there was a measurement made of river at Boswell's bridge and no record is made of water going through these culverts, so that I presume it had stopped
3802 there at that time. On night of May 29 and 30, when I first saw it overflowing near bridge, in evening of May 29 at gauge depth of 3 feet water was not going through culvert but overflow was imminent. Next morning at gauge height 3.4 water was flowing over meadows and through culvert in quite a stream, so that it must have began to overflow river banks and to pass through first culvert between gauge heights of 3 feet and 3.4 feet at the west culvert, the furthest from the river, the river bottom was lower and would catch water just as soon as it ran over bank above. From situation, it might have protected it somewhat and just when it would begin to overflow the bank and go down over meadow I cannot say. After it started to run over though, I think it would keep up a little longer and at a little less gauge height than when it started. After water gets over the lip of the channel, as it were, it is apt to make some little channels and to continue.

A large quantity of water of Laramie River in 1912, escaped from channel and ran through these culverts by overflowing around and away from gauging station. On June 4 we measured the water and found 500 cubic feet per second passing around the main station. 500 cubic feet per second would be equivalent to 1000 acre feet per day.

Have platted results of my various gaugings at Boswell Station during 1912. I have brought together dates, gauge heights and discharges as we measured them that year at that station. Memorandum of these facts reads as follows:—May 31 from 1:45 to 3 P. M., gauge heights 3.40, area cross section 247.15 square feet, mean velocity 7.28 feet per second. Discharge 1807.18 cubic feet per second (see 3804).

June 4 from 7 to 9 o'clock A. M., gauge height 3.62, cross section 279½ square feet, velocity 7.23 feet per second. Discharge 2511.7 cubic feet per second, this included normal;

June 11, 9 A. M., gauge height 3.5 feet, cross section 255.72
3803 square feet, velocity 7 feet per second; Discharge 2010.9 cubic feet per second;

June 20, from 7 to 8 A. M., gauge height 2.6 feet, cross section 187.80 square feet, velocity 4.18 feet per second. Discharge 784.86 cubic feet per second;

June 25, from 7 to 8 o'clock A. M., gauge height 3.25 feet, cross

section 342.41 square feet, velocity 6.04 feet per second. Discharge 1553.6 cubic feet per second;

July 2 from 7:30 to 8:40, gauge height 3 feet, cross section 322.34 square feet, velocity 5.56 feet per second. Discharge 1237.65 cubic feet per second;

River continues to overflow and water to pass through westerly most culvert until river falls below 3.25 gauge height at bridge. I slighted one of these measurements a few minutes since, in answer to question as to when river stopped overflowing bank. Our measurement at gauge height 3.25 feet shows a flow through westeriy-most culvert. At that gauge height on main bridge, the gauge which we fixed on this westerly culvert shows one foot of water in depth passing through it and also showed that quantity was 29 cubic feet per second there passing.

Areas which I have given for June 4 and June 11, are areas of portion of stream under bridge only and exclude culverts. Area of culverts is excluded from consideration in these two measurements. Velocities are for the main stream only.

3804 Measurement of May 31, giving total of 1807.18 cubic feet per second discharge was made on rise of river. I do not include western culvert, which I have no doubt did discharge a considerable at that time. I estimated the amount passing under first culvert was 7 cubic feet per second, I did not measure it, it was a small amount and would not be material one way or the other. 1807.18 cubic feet per second is too low for the actual amount probably passing at that time. It is too low by considerable. June 25 with gauge height at 3.25 we have 29 cubic feet per second passing through western culvert. June 11 with gauge height of 3.50 we have 179 cubic feet going through western culvert, so that for intermediate depth of 3.4 feet on gauge height on gauge, which was case on May 31, quantity passing underneath we-terly culvert was somewhere between those two extremes and probably something like 10 cubic feet per second.

3805 We used vertical intergration method in ascertaining velocities of current at Boswell Station in ratings made in 1912, that is, determined velocity in vertical lines and these vertical lines were half way between stations, that is, places where we took depths. Depths were determined in that case with an iron rod measuring down from surface of bridge to bottom of stream and from bridge down to water. It was rather difficult because of fluctuation of stream and rapidity of flow. Water was fluctuating more or less and to get mean height, extremes of fluctuation of water were obtained and mean of these two were taken as height of water surface.

An electric meter of Price pattern which recorded every fifth revolution was used.

Speaking in common parlance, it was instrument that clicked every fifth revolution of meter wheel. Operator at a telephone by which clicks were indicated. This was fastened by a headpiece over his ear and then, by aid of a stopwatch, clicks were counted. Stopwatch was started at the click and was stopped after a certain number of clicks, in this case generally twenty clicks or one hundred revolu-

tions, which would correspond to about 230 feet of current having passed.

Made no measurements at Boswell Station in 1911. There were same kind of automatic registers, I believe, kept there during that year and same man took paper off, that I met there in 1912, Mr. Oviatt. He was then living at Boswell Ranch house right adjacent to station.

3805 It is very possible that some of water flowing in Laramie River in 1911, overflowed bank. I think it is probable even under discharge as published, but with same automatic register and same method and same lack of recording at time paper was taken off or on just what gauge height was shown by gauge rod, it is quite possible and in fact probable, that records of machine were defective in 1911, just as we found them in 1912. They evidently registered less water than was actually passing. I have not made a comparison of the times they were measured, but Mr. Oviatt who had changed the papers in 1911 also, I believe had not been accustomed to marking sheets so there would be any change from that source at time that would enable one to correct these sheets. But if record be correct, as far as that is concerned, which is subject to a very grave question, there would also be the fact that water would go through westerlymost culvert for a while at least, so that would not be shown by diagram, and if pen was out at all, or subject to same errors as in 1912, the period of time would be much longer than the sheet would otherwise show for that year.

Have observed record of flow at Boswell Station for 1912 as published in report of Charles W. Comstock, former State Engineer of Colorado. From examination of this published statement as to flow, compared with facts as ascertained from actual observations on ground, I find in first place, record of machine from which these published records was obtained was wrong, during period of high water as I have shown by comparing with observation made by myself and assistants. These inaccuracies were to some extent taken into consideration by hydrographer before making up final

3807 records during that period from May 11 to June 16, assistants under direction of Mr. Comstock made no measurements at all, and that was period of high water, nor did they make any measurements from June 16 to July 18 and there again was a period of high water.

General history of river was a rise about May 15 up to a summit of flow June 5, then a cold spell which caused it to drop down quite low June 20, then a high stream came again June 27 and 28 and then again a drop. As it happened, measurements that were made under Mr. Comstock's direction, skipped these high peaks, both of them, from May 11 to June 17 and from June 16 to July 18 and they did not have any measurements of high water, that enabled them to form a rating curve wherein there was a measurement of high water. A rating curve as I previously stated, is dependable for heights between ascertained heights. It is dependable between the higher and the lower ascertained heights, but it has got to use another term. A curve of that kind is good for interpolation but not for ex-

terpolation. That is, it is good to fill in between known points, but is rather unworthy to extend beyond ascertained facts. If your highest measurement has been 3 feet in depth, for example, it is quite dangerous and at least uncertain, to deduce what discharge would be at a gauge depth of four feet. If, on other hand, you had had measurement at five feet in depth and another at 3 feet in depth, then determination of flow at 4 feet in depth would be quite sufficient. Now they did not have any high water measurements at all or any data for their rating curve for those heights at that time. Highest measurement for 1911 was for less than 1100 cubic feet per second and in 1912 was only 840 cubic feet per second, so that when water doubled that or more, tripled it in fact, why, their curve might be off to considerable degree, that is always found to be the case.

3808 This is largely true where water is not confined to same channel but overflows above station and goes off in different channels and in this particular case, quite a good deal of water went by in channels that would not be observed at all in low water, in channels that would not be seen. I, myself, missed and did not observe an important channel and it was only by accident that I found it had been running water. I had not gone to it and did not suspect it. I had had no cause to go that way. My attention was drawn to it afterwards because I had occasion to go that way in going to Johnson Creek. If I had not been going to Johnson Creek I could not say that I would have known of that channel at this time and certainly not unless somebody had mentioned it to me.

The State Engineer's records, as far as rating curve was concerned, was based on their own records and did not go far enough to take in high water. They did not have direct measurements anywhere during high water. Consequently measurements made by me or under my direction, came in just during the time of the peak flow. This was fortunate. The State Engineer's office in working up records of the automatic instrument, attempted to correct for these changes the pen had made, I believe. Of course some changes might take place and it would be very difficult to determine just what they had been or just what to eliminate, but rating curve they used as compiled from their previous measurements had been for flow of river under bridge. It did not include water that had passed through culverts and the third bridge to the west.

3809 Consequently when they extended their rating curve, or attempted to deduce amount of water that would be flowing at given height, they would infer an amount of water from that curve, which would give them an amount of water passing under bridge and excluding portion that went through other culverts. While their correction for error in position of pen seems to have been fairly well done, their rating curve seems to have been based upon flow under bridge and it is not surprising that they left out of account all flow under other culverts, and that would account for amount I give and deductions of their curves.

It is also fact that at some point before the high part is reached, the channel even under the bridge suddenly broadens. At a

moderate height, about 3 feet, river is confined to practically two spans of bridge, while when it gets to 3½ feet it flows under 3 spans. In plotting a theoretical curve, this extra width is not taken directly into consideration, but as matter of fact curve does take it into consideration if they have sufficient observations. If they do not have observations at greater depths, they would be apt to leave that out of account, because curve is drawn on approximately same law for extra heights as for observed heights, and that means it was drawn on supposition of continuance of same conditions, and that would be practically for same channel. In that case it would fall short where river suddenly broadens. In this case, cross sec-
3810 tion very suddenly increases, very materially increases at a depth approximate- 3 feet. It is, as I remember it, about 40 feet wide. These spans are approximately 20 feet long, possibly a little less, then up to 3 feet in depth it flows in space of 40 feet, then upon becoming a little deeper, it becomes 60 feet wide. Am familiar with Woods Landing Station on Laramie River. Visited it a number of times. Road going up river crosses bridge at that point so that gauging rod which was on bridge and conditions there were observable every time.

Familiar with Glendevey rating Station. It is fairly good. Probably as good as most of those mountain stations. Did not see self-recorder they had there in 1912. Think man who took off paper did not live near bridge, it was about one mile away. Forest Ranger attended to it and he never happened to be there when I was at Glendevey Station, so that I never had opportunity to see instrument and compare pen with actual gauge height. After I saw errors in machine at Boswell, which I did not appreciate until along in June, I was rather desirous of seeing that one at Glendevey and observing whether it was recording properly, but I did not have opportunity.

I established a number of gauging stations in 1912 on various tributaries of Laramie River entering stream on both sides above Woods Landing and more than that, I intended to establish them on all tributary streams and this was practically done, although we did not completely carry out our intention. We had measurements on following tributaries of Laramie River:

Grace, Bear, Johnson, Jimmy, Forester, Fox, Beaver, Woods, Stub, Nunn, Deadman, Rawah, McIntyre near mouth, Lagarde on two stations, Laramie at Glendevey, Stuck and other creeks including west branch of Laramie and Lake Hattie Inlet on both Big and Little Laramie Rivers. Besides that there were occasional measurements made on other streams as opportunity permitted.

Regular observations were made on those streams mentioned, that is, as often as observer could be there. On some of them such as McIntyre, Johnson, Beaver and Lagarde Creeks, we had intermittent observations made by persons living in vicinity. At Glendevey and Boswell's, which were counted of considerable importance, we had supposed in beginning that record could be depended upon for those readings and did not attempt to duplicate them until we found they were uncertain, I mean at Glendevey and Boswell's. I do not

know whether Station at Glendevey was working properly. Have not had chance to compare gauge heights with the instrument, but we did take gauge heights at a number of times and that would give means of checking it up.

3812 In establishing all stations on tributaries of Laramie, best possible location was selected, that is, one where water could be confined to one channel and one where bottom was stable, and, if possible free from large stones and also one that was accessible. That was quite important. First time in looking around it was attempted to find place where some person could be found to act as observer. That we found was not possible except on McIntyre, Lagarde, Johnson and Beaver Creeks, although those were not very satisfactory. So, in each of these cases, there were two things to be done as in case with main river, first to select a place that was fairly suitable to establish a reference point, so all ratings that should be made thereafter could be referred to same data and then to take enough of these measurements at different stages of stream to make a rating curve. Then having a rating curve, if we had height of water on intermediate days on same date we could determine what amount of water then flowing was with relative certainty. That was general condition. Most of them were fairly accessible. Stations were fairly good, as good as conditions would permit, streams were crooked in many cases and in many places an ideal station could not be found but one that would be fairly good under conditions.

State Engineer John E. Field, had access to sheets on which depths and measurements made in 1912 were recorded and I know he and his men took notes from my memoranda. To what extent they took notes I do not know but think they took whole series of measurements.

3813 I have had no opportunity of checking with Mr. Field relative to his use of those notes but I do know in one sheet he has prepared of measurements, that he has noted use of all measurements I made in 1912 for purpose of obtaining rating curves, so that he certainly made use of those. As to gauge heights on McIntyre for instance, and so on, I cannot say. I never heard him say and never asked about those. I think those sheets were put in hands of assistants. He was looking them over and I think he took those records and thus they were used, I suppose.

Principal tributary streams entering Laramie River between Woods Landing and Glendevey Stations are McIntyre and Lagarde Creeks between state line and Glendevey. Stuck is very good stream but not as large as these. Grace Creek is a pretty good creek. Of course there are a number of streams that bring down considerable water. Grace Creek for instance has watershed of about 13 square miles, Jimmy Creek has watershed of about 20 square miles. Stub Creek at times runs as high as 45 cubic feet per second and that was not at extreme high water. Johnson and Beaver are

3814 principal creeks entering from west below state line. Above Glendevey Station Nunn creek comes in just above station and Rawah also comes in above Glendevey Station.

McIntyre and Lagarde together are two very excellent creeks and

yield most water of all tributaries. The latter creek is in no way diverted by Greeley-Poudre System. That system intercepts headwaters of Mill Creek below McIntyre. It does not take very much of the McIntyre even.

McIntyre Creek has drainage area of about 41 square miles and Lagarde of about 27 square miles. Maximum discharge shown by our observations, for Lagarde Creek during 1912 was 485 cubic feet per second.

Highest single measurement made by us on Grace Creek is 120 cubic feet per second. That was at secondary maximum, that is, it was apparantly after maximum flow had passed and after stream had dropped down same as main river had at Boswell's which I mentioned some time since, but was at about secondary maximum. By comparison I think there is no doubt of fact that there were indications of larger flow having already passed at time rating was made. Indications of the streams rising and falling are quite parallel, so where one stream goes up and has a maximum, adjacent streams will also have maximums at about same time, or within a day or two. If a period of cold weather or cloudy weather comes on, streams will drop, but that is a general condition and all streams go down about the same time and rise about same time, so we have those periods of maximum flow of water. In 1912
3815 there were two very marked peaks of flow on all those streams. Those peaks correspond quite closely with those described by me in connection with Boswell records.

Johnson Creek in 1912 showed maximum measurement of about 150 cubic feet per second.

Beaver Creek, highest single measurement 1912 was 93 cubic feet per second, and there were number of measurements very near at that point. Beaver Creek might be said to have gone practically 100 cubic feet per second.

Various measurements were made from time to time during progress of season. Intention was to make systematic measurements on all streams as conditions permitted. We visited not only upper Laramie River but also visited other stations down below and on Little Laramie River.

Stuck Creek, 1912, highest measurement was about 100 cubic feet per second, this was taken at apparently secondary maximum flow. If measurement had been taken at primary or first maximum, as compared with secondary primary maximum at Boswell, it probably would have reached considerably higher amount. It would take little further comparison to translate what primary maximum was and expressed in figures, because of fact that water-shed is smaller and at lower elevation and it
would depend somewhat on character of water at that time,
3816 whether melting of snow was at low or high elevation. If melting snow was at low elevation and perhaps was, streams would be larger in proportion that they would be later, because in later periods a larger percent would be coming from streams at higher altitudes.

On Little Laramie River we made measurements on inlets to

Lake Hattie, on inlet to Lake James at times, on stream itself at Wrights, that is at Lake James inlet, also on Little Laramie at mouth at Two Rivers where it flows into principal stream.

Medicine Bow Range of mountains forms west boundary of Laramie watershed. It forms west boundary of Big Laramie principally in Colorado and west boundary of Little Laramie watershed in Wyoming. Character of this watershed was also investigated in secondary way by observations carried on from time to time as to amount of snow that was collected there. These investigations were during spring and winter months.

From these observations, I found that Medicine Bow Range is very excellent source of water supply. A very much better source than I had anticipated at the beginning. Summit of a portion of this ridge at headwaters of Little Laramie is somewhat lower than it is further up in Colorado. It rises in Medicine Bow Peak in Wyoming, to height of 12,000 feet, or thereabouts, some distance above timber line. Snow on this range becomes very deep. There is a great deal of snow. Run-off from it is relatively large, so it is really a very excellent contributor of water and really about as good as almost any part of range in north, except extreme high portions.

In checking water supply conditions, I used not only stream measurements which we had but supplemented them by various trips over this mountain range. Observations of precipitation are unsatisfactory unless they can be carried on for some time. Snow records, however, form a means of getting at amount of precipitation which falls in winter, because snow lies on ground, and until snow begins to melt it is practically the sum of all that has fallen during winter months. Consequently in absence of rain-fall records, snow records is a means quite satisfactory in getting at amount of available precipitation and water. The principal difficulty in obtaining these snow records is that there are no people in those regions to make observations and no people there who can be used as a base for supplies.

In order to obtain these snow records I sent parties on snow shoes and in a number of cases with blankets, who lived on the country and what they could carry on their backs and made measurements not only of snow, but of amount of water there was in snow. All of these investigations demonstrate fact that watershed is a very excellent one. This was shown both by quantity of water, its run-off as compared with its area, and by depth of snow and amount of water it contained.

3818 Mountain range does not run to a sharp peak but is rather a broad one, a broad ridge, and so much of it is at a high elevation that gives an excellent shed, more so than if it came to a sharp ridge.

As a whole, Medicine Bow Range is certainly not inferior from standpoint of water supply. Supply as a whole, as compared with this area, is very good indeed. Run-off is relatively large and the supply of water good.

3818 LOUIS G. CARPENTER.

Examination by Mr. Fred Farrar:

At upper reaches Laramie River in vicinity of Chambers Lake there is, generally speaking, a divergent range which forms eastern divide of Laramie River watershed, separating it from Poudre watershed. This range is sometimes spoken of as Laramie Range and in this testimony is termed the Green Mountains. This range is lower and much poorer from standpoint of water supply than is Medicine Bow Range. In Green Mountains there are no peaks that go above timber line. Chambers Lake is about 11,000 feet in altitude and that indicates in general way fact that it does not go as high. In Medicine Bow Range there are several groups of peaks that go above timber line.

Cameron Pass crosses main range of mountains in vicinity of Chambers Lake.

Ute Pass is situated generally west of Glendevey at point where state road crosses range. The Pass west of Boswell's is sometimes called Ute Pass also. This latter is approximately on interstate line.

Going northerly from interstate line, mountains rise reaching climax at Medicine Bow or Centennial Peak in Wyoming. Range in Wyoming is much broader than in Colorado. In this group of mountains adjacent to Medicine Bow Peak, right west of town of Centennial, group of streams contributing and forming Little Laramie have their origin. There is group of various peaks in there.

3820 Difficulties in obtaining snow observations were first physical difficulties of going into region of steep mountain slopes and region where there are no settlers. A region where it is necessary to go on snow shoes; where it is necessary for person to carry all his supplies. Taking it together, it means journey with good deal of hardship and calls for person not only skillful in handling snowshoes but also person of nerve and daring, to greater or less extent. It calls for person of self-reliance who is willing to take risks for, under these conditions where a person goes away from places of habitation and on a path it would be almost impossible to follow in case of any serious accident, such as breaking a leg in going through fallen timber which is plentiful, it would be almost impossible for observer to escape death before he could be rescued. In fact, no one would know that accident had befallen the observer until it was too late to be of any service to him. Really the first great difficulty is in finding a man to do this work. I might mention that in one trip a man who went out for me, Mr. A. P. Morey, carried a load of 50 pounds on his back in clim-ing those sharp mountain slopes. He was out some days. These observations took him generally the whole extent of the Medicine Bow Range from Medicine Bow Peak to the vicinity of Chambers Lake.

3821 More attention was given to conditions down in Wyoming. That was partly intention but a number of trips were made in vicinity of Clark's peak which is at South end of this Medicine Bow Range right opposite the headwaters of Laramie River. A trip was made all along the range including the range from Clarks Peak to Wyoming State line. Trips were made in Wyoming

along summit of ridge quite a number of times and two trips were made to top of Medicine Bow Peak. It would be almost impossible to make continuous trip along whole length of mountain range without coming down to valley for supplies. Difficulty in going from Clark's Peak to state line was fact that there was no stopping place or cabin or means of getting there for one thing, and then again, we expected that that work would be done by another party which we failed to reach successfully. This accounts for fact that greater observations were made in Wyoming portion of the Medicine Bow Range rather than in Colorado and for the addition- reason that we could reach summit of ridge in one place by means of the Laramie and Hahn's Peak Railroad.

Snow observer worked from point several miles south of Glendevey at Stuart's Cabin which was last inhabited spot near mouth of west branch of Laramie River. Observations were made in March, April, May and June of 1912 and in May and June of 1913. Also had observations of similar character taken of Medicine Bow Range in Colorado at time previous to that. This was some years
3822 ago at which time I sent Mr. Decker up there. He went for me several springs and I had also had before that, records made at extreme south end of Medicine Bow Range when Mr. Enos A. Mills made trips for same purpose for me.

In determining amount of water contained in snow on Medicine Bow Range used two principal methods. First was to actually melt snow, measure depth of snow then melted and determine amount of water it held. That was found difficult to apply in practice, because observers were away from any place to stop and it took considerable time. This finally resulted in the second way which I adopted, of determining amount of water content by weight. Taking a section of snow of definite size and then weighing it. That would be same as weight of melted snow or water and then comparing depth of snow with depth of water found by weight. When I first sent out Mr. Mills we used an aluminum tube but this was not very successful and I finally used the other method.

Conclusions drawn from observations relative to water supply from the Medicine Bow Range in its different sections are indicated by reading a few measurements. For instance, at one station, April 30, 1912, there were 24 inches of snow which contained about 30% water. That was on Medicine Bow Range not far from interstate line but in Wyoming. That was at one of comparatively low places on the range.

Snow in its ordinary condition, fairly well packed, would contain about 10% water, so this 29% of water, three times the average, would represent normal fall of 150 inches or 12 feet of snow before it was settled or consolidated. This observation as I stated
3823 was taken April 30, 1912. Evidently portions of it had melted before that time which explains greater density. Density indicates that water had descended and soaked up rest of snow something like a sponge, and had remained in the snow. This water was not set free until later in Spring. That fact is substantially shown by measurements later in season. Run-off at lower elevations

begins earlier than that, but not very much. Run-off depends on character of spring. There is very little run-off for elevations as great as these that early. There is considerable run-off at lower elevations, say 7000 feet, prior to this time. Where snow is as deep as that, water is held in the snow.

Two hundred or more observations of depths of snow at different places were made altogether. In 30 or 40 of these the quantity of water in the snow was determined. I can give data indicating results of these observations in that portion of the range ordinarily designated the Centennial mountains at head of Little Laramie.

I furnished printed forms for observer in which were recorded location, elevation taken by barometer, and depth of snow at number of different places, aspect, character of timber and other conditions that affect snow. The density of snow and whether or not it was crusted, granulated or otherwise and other facts were also observed and noted. Measurements of snow depths were taken frequently while measurements of quantity of water were taken at less frequent intervals. Those were not so necessary.

3824 Have not had opportunity to check Mr. Field's conclusions as to flow of water in Laramie River, as given in his testimony, except to this extent, I have compared his heights at Boswell Station with my rating curves and was either informed of or heard part of his testimony showing how he derived his conclusions. I will prepare to testify as far as possible concerning this matter in the morning.

Referring to Poudre River, report of State Engineer for Colorado for biennial period 1912, shows that on November 1, 1912, there were 83,794 acre feet of water in storage of reservoirs in that water district. That amount of water in storage on that dates does not necessarily indicate surplus of water during preceeding irrigation seasons.

Storage of water in Cache la Poudre River begins at close of irrigation season. In favorable years they begin a little earlier. In some years there is surplus water in September, ordinarily

3825 they cannot begin storage until October or November. In 1911 litigation was commenced by appropriators of water down in South Platte district in vicinity of Fort Morgan, preventing storage of water to great extent in valley after irrigation season was closed. State Engineer's report shows that in year 1911 about 17,000 acre feet of water were in storage in the Poudre Valley reservoirs on November 1. Presence of that water in those reservoirs on that date would not indicate surplus of water for use of irrigation during preceeding season.

People in Poudre Valley, as mentioned in my direct testimony some weeks since, use every drop of water they can and if, at times during irrigation season, there is water that either because of size of stream or because of storms is available but cannot be used directly, they store it. They utilize all water that comes. This use is simply result of that general need of water which is felt in Valley and a matter of not letting any water run to waste.

146,000 acre feet reservoir storage capacity as heretofore given

for reservoirs in water district No. 3 Colorado, does by no means indicate total needs of valley for water for irrigation of its crops. Long before reservoirs were constructed, there were the ditches and reservoirs were built to supplement ditches and not as independent sources of supply. These reservoirs have been constructed as adjuncts to the ditches and the building of reservoirs has not decreased use of ditches at all, on the contrary, it has assisted in developing a much larger area of land and the reservoir supply of water is used
to insure water for crops over a large area which is already
3826 partially supplied by water from ditches. Reservoirs as a
whole are looked upon as only a partial supply and in amount much less than supply from streams direct.

It would be economically impossible and unwise and unjustified to construct a system of ditches and reservoirs of sufficient size and capacity to intercept and store all of water of stream such as Poudre River, at its extraordinary high stages. This could not be done from financial conditions. These extraordinary flows are of course only once in a series of years and that would mean then that in 9 years out of 10, for instance, or 4 out of 5, or 19 out of 20, whatever it might be, the series of works that were built large enough to take these extraordinary floods would be more or less deficient in supply and therefore the capital which had been invested in such works would be more or less unproductive. That is one reason from a purely financial condition. The second reason, which is more important in the development, is the related fact that if people took up lands which were to be supplied by such flood waters, they would be short for a considerable part of the time and thus those people would be at least hampered in their attempt to make a living and perhaps prevented from so doing by lack of water. This would lead to failure so that when an extraordinary year
occurred, settlement would be more or less gone. People
3827 have to live steadily and not simply once in a while.

It would not be physically possible to construct a ditch which would enable diversion of the enormous quantity of water passing down the river during a few hours in extraordinary high water in ordinary years, which excess water now passes out of district. The general rule and conditions for such a condition would be same as that of attempting to utilize extraordinary flows only once in a few years. It is not only possible but usually true on the streams that there are times of flow of water beyond the ability of ditch of reasonably capacity to carry. Mere fact that water of that nature passes from Poudre River into Platte, does not indicate a loss to industrial factors in Colorado.

Water which goes out of Poudre River may be used down on South Platte River. There are ditches on South Platte River of earlier date than many ditches on Poudre River and so far as water which passes out of Poudre River is concerned, it may be taken in by those lower ditches and usually is.

Poudre River territory has used its facilities for storing water to a remarkable degree. It started in 80's with one or two reservoirs and of course used the best ones first, that is, generally speaking,

those that were available for ditches that most needed them. Gradually they have been taking over the more expensive reservoirs and have developed an extensive and very perfect system and practically all of reservoir capacity that has been available has been used.

3828 There is not sufficient water under known conditions on Poudre River, which would be by any reasonable means, intercepted and stored in sufficient quantity to irrigate lands in Greeley-Poudre Irrigation District. Considerably less than one half of the lands included in the Greeley-Poudre Irrigation District could obtain water supply from Cache la Poudre River on an average. This is my general conclusion without refreshing my memory from opinions previously drawn. This amount could not be obtained without erection of dams across Poudre River for proposed channel reservoirs which are designated on map "Exhibit No. 1," as Stove Prairie, Elkhorn and Roosevelt Reservoirs. It would require construction of such dams and my answer involved that supposition. My answer did not consider question whether it would be financially feasible to go to that extent of construction of those dams for that small area and, in fact, I doubt very much whether that would be so. Ditches could not be constructed which would carry water some distance from river so as to utilize any such flow and quantity that could then be utilized would require these expensive reservoirs across channel that could collect floods even if they held them back without requiring an inlet canal. These reservoirs would be very expensive.

Cost of Wheatland Reservoir No. 2, $140,000 for storage capacity of 126,000 acre feet, is no criterion for cost of construction of these channel reservoirs on Poudre River which are proposed as part of Greeley-Poudre System. There is no comparison in cost. Wheatland Reservoir has an earthen dam, very low, that is 30 or 40 feet and not any great length. There is a natural basin which this dam utilizes. In case of mountain channel like Poudre River, a high dam is called for. Expense increases very rapidly as height increases so that if you double height of dam you increase cost something like at least by square of height in a general way. Cost increases very rapidly and engineering difficulties increase likewise, so that character of construction which would suffice for dam 30 feet high would be totally inadequate for dam 100 or 200 feet high. General conditions of latter would call for masonry dam. These conditions require great cost and capacity is relatively very much less and cost compared with quantity of water stored is very much higher.

Cost of Wheatland Reservoir No. 2 is very much less than cost of storage generally in Poudre Valley. Dam on Wheatland Reservoir is less expensive than dams of many reservoirs in Poudre Valley, and, while Wheatland Reservoir is said to contain 126,000 acre feet of water, corresponding dams at corresponding

3830 cost in Poudre Valley might hold from 5000 to 7000 acre feet while cost of construction would be about same. That illustrates relatively difference in proportion of cost.

Reservoir dams in Poudre Valley have been rip rapped in various

ways, some of them with rock and some with concrete. Where they have not been far distant from mountains they have taken rock. This rock is piled irregularly forming surface against which waves break. In case of Cache la Poudre No. 2 Reservoir they brought rock from mountains by trains and then hauled it 2 or 3 miles from railroad station. It is sandstone from foothills. It is not shale. The surface of dam is paved with it laid irregularly. The cost is very much increased by necessity of paving.

Lake Hattie and Lake James Reservoirs in Wyoming are of large capacity and dams are not very expensive. Considering capacity general comparison as to cost between them and Poudre Reservoirs would be about same as that given for Wheatland Reservoir
3831 No. 2.

From standpoint of economy of construction conditions in Wyoming lend themselves largely in favor of reservoir construction in that area, as to cheapness of construction, largely because basins are very large.

3832 JOHN E. FIELD, recalled.

Direct examination by Mr. Fred Farrar:

In opening testimony in evidence for defense, I stated that drainage area of Big Laramie River at Boswell's Ranch is about 365 square miles, all in Colorado. This evidence appears at page 35 of transcript. Have since made closer computation of area included within this drainage and find it to be 312 square miles. My testimony in that regard should be corrected to read 312 square miles in lieu of 365 square miles.

3832 Cross-examination by Mr. N. E. Corthell:

Included in the waste water surface on the Laramie Plains which I have given is Carrol Lake, which is used partially for irrigation, and Alsop Lakes which may possibly be used in times of scarcity for irrigation purposes, but no really available use is made of either of these, although to a slight extent they are artificial reservoirs. I have never observed the control works at any of these lakes.

3836 It is not unusual to find more or less wet land and to find water escaping from irrigation systems, especially in the case of new projects. Wherever there is a surplus of water these conditions are very apt to be found. I have never made any observations of the rise or fall of the underground water level, but in my judgment it would not vary much. Our measurements of return seepage on the Laramie River showed almost nothing between Sodergreen's ranch and Laramie City, indicating that very little of this underground water passed towards the river, but remained on high land and evaporated or passed in another direction. These seepage investigations were made in October, 1913. We
3837 have made no investigation of the amount of water diverted between the Pioneer Dam and Two Rivers in 1913, but have made an estimate of the use of water between the two places by taking

the difference between the flow at the Pioneer dam and the flow at Two Rivers, which would involve a consideration of the amount diverted and the amount returned to the river.

3838 The only seepage measurements we have made on the Laramie River were made by Mr. Bunger at my office in October, 1913. Another measurement was made by other persons and published in Wyoming Experiment Station Bulletin No. 61 wherein it was stated that there was practically no seepage return found until the Wheatland flats were reached, when a return of 7.59 second feet between the North Laramie and Uva and of 16.15 second feet between Uva and Fort Laramie was found. The return flow in the upper valley of the Laramie above Woods Landing is probably greater than the flow in the Poudre Valley and that in the portion of the Laramie Valley below the Pioneer Dam both with respect to upland and bottom land is very much less than in the Poudre Valley, although considering the bottom lands alone it might be as great. I attribute this difference to the difference in the character of the soil and the existence of so many depressed areas on the upland and the fact that there has been little or no attempt at drainage. The soil on the uplands is very gravelly but contains enough clay or other fine material to seal the soil.

3840 The Laramie sandy loam occurs on the bottom lands and according to the soil survey report on the region covers most of the upland portion of the Laramie Valley on the north and west side of the river and I would classify it as a tight soil.

At the time my report was made it was principally for the Riverside Ranch and was in the nature of a reconnaissance and my attention was not directed particularly to the upland, in fact, it was not directed to the uplands at all except as manifest in the Riverside Ranch, and the uplands which I examined more particularly were open and loose. Since that time my examination of the upland country shows conclusively to me that the larger part of this upland is classified by the Department of Agriculture Survey Bulletin as a tight soil.

3843 If the Soil Survey Report classifies this land as open, through which the waters pass readily, I would disagree with it, because the water remains on the surface until it evaporates. These Soil Survey Reports are used largely in reconnaissance but not in final reports by engineers, and I know of no more thorough investigation of the Laramie Plains than that made for the purpose of this Soil Survey Report of the Government. In the main my investigation confirms the Soil Survey Reports showing relative to the depth of the water table below the surface in this area excepting that in my opinion the area wherein the water surface is marked as more than ten feet below the surface is much too broad. It is possible that this is due to the fact that the soil survey was made in 1903.

3845 None of the investigations upon which my Exhibits 123 to 129 inclusive and No. 131 are based were made by me personally. The greater part of these tables are based on published records. In many instances I have felt constrained to reject the

published figures and substitute estimates of my own. Some of the reports are from private and some from public sources.

3846 The reports relative to the amount of water carried through the Skyline Canal were made by the Water Supply & Storage Company, the owner of the ditch which was allowed to withdraw from the Poudre River an amount of water proportionate to the amount reported by them as being taken from the Laramie River. I do not know how much the capacity of this ditch was cut down by the re-rating in 1905, and I have not endeavored to rectify the earlier records upon the basis of the later re-ratings. My

3847 figures relative to the flow through the Sand Creek Ditch were secured from the owner of the ditch and from the water commissioner, whose figures did not always agree, and there is also uncertainty as to how much water was taken from Sand Creek and how much from Dead Man Creek.

3850 The showings relative to the Wheatland Number Two Reservoir upon Exhibit 140 are based upon an assumption of a capacity of 123,000 acre feet and my estimate that it contained 113,000 acre feet on May 6, 1913 is based upon this assumption. I have never made any measurements of the capacity of the reservoir. The dam of this reservoir could be raised perhaps 12 feet at quite a moderate cost, adding at least 70,000 acre feet to its capacity. I believe $150,000 would surely be sufficient for this work.

3852 I am familiar with the investigation of a report on reservoir sites in Wyoming and Colorado made by Captain H. M. Chittenden of the United States Army in 1897, wherein considering the proposed reservoir in Big Hollow upon the Laramie Plains and the amount of water available for such a reservoir he considered the discharge of the river at Uva, stating that the mean discharge upon a three year record was 87,316 acre feet; that 20 per cent should be deducted for inflow below Big Hollow, leaving approximately 70,000 acre feet which might be available for the proposed reservoir; that the evaporation from the surface of the reservoir would be 24,000 acre feet per annum, leaving an available annual storage of about 46,000 acre feet per annum. This report was made before the construction of Wheatland Number Two Reservoir, Lake Hattie Reservoir and James Lake Reservoir. I did not take the report into consideration in preparing my estimate of the run-off of the Laramie River because it was based upon a reconnaissance. The data at hand was very meagre, and Captain Chittenden's investigations were in the nature of a reconnaissance and his opinions have been found to be erroneous in vital particulars not only with respect to this reservoir but with respect to other projects.

3854 In 1904 I made an investigation of the resources of the Laramie River, but made no report thereon. The only conclusion I reached at that time was that there was no need of the Government undertaking any work in the Laramie Valley and that whatever development might take place along the Laramie River

would in no manner affect the proposed project of the Government on the North Platte River.

3856 I estimate that if the Greeley-Poudre Tunnel had been in operation and the Upper Laramie River system belonging to that project had been completed, 50,000 acre feet of water would have been carried from the Laramie River through the tunnel in 1911 and 50,000 acre feet in 1905, an average year. The records for 1904, 1910, are not sufficient upon which to base an estimate and an estimate based upon the discharge at Woods Landing would be very uncertain.

3857 The total amount of water which might have flowed into the Poudre River below the canyon and from the north side if not intercepted by ditches might amount to 10,000 acre feet in some years. Since utilization of such water as flows in these small tributaries, a small amount reaches the river.

3859 Water rights were originally secured from the large corporate canals in the Poudre Valley upon the basis of one cubic foot per second for 55 acres, and in some cases it was provided that when the entire capacity of the ditch had been sold upon this basis the title to the ditch should pass to the consumers. The Little

3860 Laramie River, for ten or twelve miles across the valley consists of three or more natural channels. With some expense and with the co-operation of the various owners it might be possible to combine the river in one channel which would lead to economy in the use of water.

3861 Continuous measurements of the Laramie River were made during the year 1913 a little above and a little below the Wheatland Reservoir Number Two. If the records were correct the amount of water carried from the reservoir within any period might be ascertained by deducting the flow at the upper station during that period from the flow at the lower station, and if the reservoir was full about the middle of May, 1913, the difference between the discharges at these two stations would give the amount of water carried from the reservoir during the period, and by adding the amounts of evaporation the amount of water the reservoir had held would be ascertained. Personally, however, I have not much confidence in the records made at these stations.

3862 Mr. Cogswell, who has been connected with the irrigation department continuously since 1895 has been division engineer for six years of the division including the South Platte River and its tributaries, among which is the Poudre. In his report for the year 1912 he states that that year will be recorded as the wettest known in forty years, with a more than average supply of snow in the mountains at the commencement of the season and numerous rains during the season, and a comparatively slow melting of the snow so that there were no excessive floods. That report also states that in the near future the paramount issue in his division will be the excessive waste in running water from the rivers to the irrigated lands, not more than fifty per cent of the water diverted from the rivers there for direct irrigation or for storage reaching the land, and there being an additional loss of not less than 20 per cent from the

reservoirs by evaporation and seepage, of which perhaps 25 per cent returns to the river through seepage.

3864 Redirect examination by Mr. Fred Farrar:

Referring to misunderstanding relative to sandy loams on Laramie Plains area, soil map in bulletin from Department of Agriculture shows that there are two classes of this sandy loam, one being designated as "Laurel sandy loam" and the other "Laramie sandy loam." This map shows relatively small portion of Laramie Plains area. This is area on each side of Laramie River from point near Woods Landing following down river with somewhat irregular boundaries to junction with Little Laramie River. In some places width of survey shown, at right angles to thread of stream, is as much as 12 miles. No portion of the Little Laramie River except that right near junction with Big Laramie, is shown by this survey. That land lying intermediate between two streams is not shown, other than as I have described it. Map shows soil conditions just south and also east of Lake Hattie. Soil in vicinity of that lake is characterized as "Laramie gravelly loam." An area lying west
3865 and little north of Laramie in western portion of Tp. 16 N., R. 74 W. shown by map indicates same character of soil. Big Hollow area is not shown on this survey.

Gravelly loam soil extends for considerable distance east and a little north of Lake Hattie and connects up with area marked on map as "Laramie gravelly loam," that is, this gravelly loam extends from area shown on map in southwest corner of map to area west of Laramie. Area designated as "Laurel sandy loam" seems to be in general way mostly on south or east side of Laramie River and forms what are generally termed bottom lands.

Mr. Farrar: I desire to read into record from page 11 of this bulletin being entitled "Soil Survey of Laramie Area, Wyoming," published by U. S. Department Agriculture, Bureau of Soils, showing on title page that field operations of that Bureau were made in 1903. Under title "Laurel sandy loam" appears following: "The natural drainage, except in the higher places is comparatively poor. During the wet season the type is subject to overflow from the Laramie River, while owing to its low lying position the water table is near the surface most of the year. At the time this soil
3866 was surveyed the water table was rarely found at a depth of more than six feet.

A system of artificial drains that would be effective during the dry season both in keeping the water table sufficiently below the surface to allow the growth of shallow-rooted crops and in removing the alkali would be of great benefit to this soil type. These drains would not only free the soil of alkali already present, but would check the further accumulation of alkali within the root zone of plants. To be most effective these drains should be laid as deep as the level of the river would permit."

(Defendants' Exhibit 154, soil map of Laramie area, offered in evidence.)

Mr. Farrar: In connection with same bulletin, I desire to offer in evidence map or plat which is labeled underground water map, this latter being portion of same bulletin mentioned. This map or plat will be marked:—

(Defendants' Exhibit 155, offered in evidence.)

From legend on underground water map, Defendants' Exhibit 155, it appears that areas which are colored light green represent countries where water is less than 3 feet below surface. Area which is colored yellow represents territory where water is from 3 to 6 feet below surface. Other depths are also indicated in different areas. According to this survey, water table comes nearest to surface, generally speaking, in areas marked green and lying along line of Pioneer Canal, beginning within about 3 miles at head of Pioneer Canal and extending almost continuously for some
3867 9 miles. Again there is considerable area starting at point 9 miles southwest of Laramie and extending some 6 miles north of town of Laramie. These areas are mostly on lands of higher elevation. For considerable portion of area shown, and particularly from upper end of survey down to approximately 8 miles above Laramie, land in which water comes near surface lies from 1 to 6 miles from river. Location of areas in which, according to map, water comes within less than 3 feet of surface, is about same as special areas which I had in mind in my testimony, although map does not extend quite far enough to take in all of the territory I mentioned. The two maps I have just mentioned, Exhibits 154 and 155, coincide as to area covered. These areas in which water table comes to within less than 3 feet of surface occur in large part in area marked as "Laramie sandy loam" on soil map, Exhibit 154.

The survey covered by Exhibits 154 and 155, was made in 1903. In my judgment effect of continuous irrigation from that time to present time would be to cause water table to rise and the wet area to be extended.

3868 Mr. Farrar: I desire to read into record from this bulletin, certain references under head "Laramie gravelly loam", commencing on page 17:—"The soil of the Laramie gravelly loam consists of a coarse sandy loam mixed with large amounts of gravel and varying in depth from two to three feet. The color ranges from yellow to dark gray, the latter color predominating. The subsoil consists of sand and gravel and extends to a depth of more than six feet. On the surface the gravel making up so large a part of this soil varies in size from small pebbles to boulders about twelve inches in diameter. In the deeper layers the gravel is much larger and increases in size with depth."

Again on page 18: "Owing to the large percentage of gravel in this soil, it is not a desirable type for farming. It is used almost entirely for grazing purposes, although in the lower areas under the Pioneer Canal some hay is produced. The yield is about the same as on the other low lying soils of the valley".

Defendants' Exhibits 109, 110, 111 and 112, photographs intro-

duced by defendants in connection with evidence of Professor E. B. House, illustrate character of this "Laramie gravelly loam". I was present when these photographs were taken.

Am able to make comparison between actual tests made in behalf of defendants to determine depth of water table from surface, with this survey, and able to determine whether or not water table has arisen since survey was made, insofar as this particular point is concerned. A soil sample was taken from near S. W. corner
3869 of Sec. 21, Tp. 15 N., R. 74 W. Water was found at depth of about 3½ feet. Underground water map, Exhibit 155, shows water to be more than 10 feet. Particular point where this test hole was sunk, is shown on Defendants' Exhibit 106, being about center of picture in very near foreground. Test was made upon one of alfalfa fields of Hart Ranch. That is also shown in photograph. Photograph was taken July 16, 1912.

My testimony relative to seeped areas in Laramie Plains area, was in nature of a criticism of failure to take any steps to utilize this seepage water. Such facilities of obtaining water supply, coupled with reclamation of seeped lands, have not been overlooked in Poudre Valley in Colorado. They have been utilized and the attack has been made to eliminate it as far as practicable. Drain ditches have been dug in that Valley for purpose of reclaiming lands and securing the water, and the fact that the land was benefited was a secondary consideration.

I testified to various gauge readings from many sources, some from State Engineer of Wyoming, some from United States Geological Survey, some from Assistants to State Engineer of Colorado and others from still other sources. If doubt is cast upon fidelity of gauge readers, speaking in abstract, concerning all records, both those of United States Geological Survey, other United States Bureaus that use this system and all state and other records, it would result in efforts to obtain data being useless, but not entirely useless but would result in less than their probable cost.
3870 The human element and a possibility of mistakes must of necessity enter into all calculations of this sort wherever and by whomever made. We must trust to the faithfulness of the observers as in all other lines of investigation.

In compiling a table showing total discharges for any period, gauge heights and velocity of current are really the basic data and the published or unpublished discharge measurements are nothing more or less than conclusions derived therefrom.

Hutton and Creighton Lakes, in which I stated water had been impounded from Sand Creek, have not been used up to present time for storage of water for irrigation. Any water which has heretofore been impounded in these lakes from Sand Creek, was entirely lost for irrigation purposes.

Amount of water which might be diverted in any one year does not have any direct relation to amount of seepage or area of seeped lands in that particular year.

The flow of underground waters is very slow. Several years are

generally required for water to make its appearance and for effects to be observed. If return seepage or water flowing into depressed areas was carefully observed, I do not believe that anyone from such observation could state that the action or use of water in any one year was responsible for the seepage. Water which does appear is result of a number of years of observations.

3871 It would not be economical to construct ditches large enough to carry the maximum floods of the Poudre River. It would not be within reason, physically possibly. Of necessity a certain amount of peak of floods of Poudre River must pass out of Poudre Valley, unless you could construct channel reservoirs. Amount of water coming from other sources, combined with these peak loads or floods of Poudre River, would make construction of such a reservoir feasible. But to construct simply to conserve these peak floods would not be feasible.

Cost of any system of reservoirs on Poudre River capable of conservation to that Valley of any considerable portion of these peak floods would be very large indeed. Stove Prairie Reservoir which is considered cheapest channel reservoir now available, would require dam about 175 feet high. Such a dam would cost about $1,000,000 or more. That is one of proposed reservoirs for Greeley-Poudre System.

Sufficient water from Poudre River under normal conditions is not available for irrigation of lands of Greeley-Poudre Irrigation District without the addition of the water which it is pro-

3872 posed to divert from Laramie River through the tunnel. I have previously explained that possibility of acquiring this water for the Greeley-Poudre Irrigation District, has made it possible to construct expensive works on Poudre River itself to conserve, among other waters, that water which now runs to waste.

Aggregate capacity of reservoirs of Poudre Valley is not measure of amount of water needed in that valley for irrigation, by far larger part of water needed in valley is not stored at all but is used by direct flow from river. Fact that on November 1, 1912, there appears to have been, according to State Engineer's office of Colorado, 83,790 acre feet in storage in reservoirs in Poudre Valley, does not indicate a surplus of water during irrigating season of that year. It is possible that amount of water was stored after insistent demands of ditches had abated somewhat and that water, or a part of it, had been placed in reservoirs after that demand for direct uses had ceased in part. Draught on reservoirs late in season is modified by amount of precipitation at that season of year, to some extent.

East and West Side Collection Ditches of The Greeley-Poudre Irrigation District System on Laramie River could not be kept open during winter for same reasons that Sky Line Canal of The Supply and Storage Company has not been kept open. I judge this in part from evidence given by witness Edwards.

3873 Poudre Valley has utilized its opportunities for securing and storage of water from that stream. It has utilized all sources of supply as it has been financially able so to do.

Water brought into Poudre River and tributaries through various

inter-watershed ditches now constructed and in operation, is measured by water commissioners in charge, usually by deputies. Amount of water which enters from these other sources is measured and a check kept upon that amount. Water commissioner must know that quantity in order to make proper deduction and a direct delivery. He deducts certain percent of water which enters his district and makes deduction for loss in transit before delivering water belonging to inter-watershed ditch companies.

Poudre Valley is not entitled at all times to all available water of Poudre River. Ditches on South Platte River below mouth of Poudre, are, some of them, prior in point of date of appropriation and, when there is scarcity of water on main river, ditches of senior date on lower river have not sufficient supply and the junior ditches on tributaries must be closed down to supply that deficiency. Further than that, reservoirs on Poudre River are some of them later in priority than some of ditches on South Platte River and they are not permitted to store water when ditches senior in point of priority to the priority of the reservoirs, need water.

3874 It is contended, though not settled, that junior ditch is entitled to water for direction ahead of senior reservoir.

Seepage measurements taken on Laramie River in Wyoming either by Wyoming Experiment Station or my hydrographer, shows that very little seepage returns to river. Ultimate conclusion is that water which accumulates in seeped places evaporates.

Have testified that in computing flows did not charge against stream either water which was used by ditches in Laramie Valley in Colorado or, on the other hand, water which was used by ditches on Little Laramie and its tributaries in Centennial Valley in Wyoming. I did not take into consideration either, water which is used by ditches intervening between Boswell's Station and Woods Landing. In both instances, that is, in Colorado and Wyoming, I have not charged against either Big Laramie or Little Laramie the use of water in upper reaches of stream and above Woods Landing Gauging Station on Big Laramie and above Hatton Station on Little Laramie.

3875 Referring to my report of 1910 for Riverside Ranch, Northwestern Land & Iron Co., and The Denver, Laramie and Northwestern Railroad Company, are practically one enterprise. The Land & Iron Company was composed largely, if not entirely, of same people constituting other company. The Denver, Laramie and Northwestern Railroad was designed to construct from Denver to Laramie and thence westward. Exploitation of lands was an incident with the enterprise. The Railroad Company today is in hands of a Receiver. I believe both the Railroad Company and The Land and Iron Company are insolvent. Statistics and returns and data incorporated in the report, I obtained from Agricultural Experiment Station Bulletins of Wyoming and from Professor Olin who was at that time employed by the Northwestern Land & Iron Company. He was an agricultural booster for whole enterprise and employed by company to look after certain operations, that is work of development of lands owned by it. This report was en-

3876 tirely exparte. Object of report was primarily to pass upon water supply. Questions asked me whether they had good

water supply for Riverside Ranch and incidentally they asked me to make suggestions relative to how property should be handled and disposed of.

Report was not designed or intended to cover anything more than the proper handling or disposition of Riverside Ranch. It was made May, 1910. Predictions or estimates of capability of section upon which I reported, have not materialized during four years since report was made. Report was made at time when there was what you might call a boom in agricultural lines all over the west. There was good deal of enthusiasm and optimism abroad at that time and I fear that all of us were a little too optimistic. As far as Riverside Ranch is concerned, I believe that property could be divided up into tracts of 160 acres or more as I suggested, and that, in combination with ranch operations, cattle and sheep, one owning such property would be able to succeed. Laramie River passes through length of
ranch. It is one of best ranches on Laramie River. I visited
3877 it in 1913. There had been no improvement or development on this ranch since my reconnaissance of 1910. I hardly think it in as good condition today as in 1910. There were one or two settlers on ranch in 1913 that were not there in 1910, but I think that was about all on the entire ranch. Not all of ranch houses on different portion of ranch were occupied during my visit of 1913. Occupation of ranch houses was about same in 1913 as in 1910.

My opinion as expressed in 1910 relative to water supply has been confirmed by my investigations in 1913, to effect that no matter what outcome of litigation should be, there was ample supply for ranch not only for older ditches, but also for their newer ditches and for extensions thereof. There is no danger whatever of them ever being short of water supply on that ranch. By litigation I refer to this case and contests that had been started at that time relative to appropriations of water for ranch. These contests being over adjudication of water rights in Wyoming. In portion of report read by Mr. J. D. Clark in my cross examination, I stated that there were ditches diverting water in Colorado from Laramie River in water district No. 48, with aggregate capacity of 563 cubic feet per second. I referred
to valley ditches on Laramie River itself and not to inter-
3878 watershed diversions. These ditches have priorities decreed under laws of Colorado and all of them prior to 1902. Fact that these decrees are for excessive amounts does not change flow of river. A decree does not necessarily mean that there is that much water is river, neither does a decree put water in stream. By acreage of 4720 acres stated in my report was obtained from water commission's reports. Have had occasion to modify that during progress of this case.

Mr. Wortham, one of witneses in this case, made surveys of Laramie River Valley in Colorado and, if I remember his testimony correctly, stated there were 3200 acres irrigated on Laramie River itself in Colorado and 960 acres on Jimmy and Grace Creeks. This makes total of 4160 acres. Regardless of exact figures I have given, I refer to testimony of Mr. John R. Wortham and the exhibits introduced, same being plats of his survey. That includes all land on Laramie

River area in Colorado under irrigation. That is practically all the land that can be put under irrigation in Laramie Valley
3879 in Colorado. It would then make no difference whether or not these decrees are excessive, even if they should be ten times as excessive as they are at present time. Use and necessity would be just the same and, even though an excessive amount might be diverted, it would return to river very quickly.

Diversion through the Wilson Supply Ditch and its correlated ditch, the Sand Creek or Divide Canal, does not make any very great difference on flow of Laramie River. Amount diverted by that system, is small, in any case, and when merged with other supplies and considered in connection with them, percentage of difference would be very small even though Divide Ditch diversion was entirely included. If there is any doubt as to amount which this ditch takes from upper reaches of Deadman Creek, and also amount which it later takes from Sand Creek, there nevertheless would be practically no difference in general effect on stream. One or two percent. would probably cover any differences. The water from Sky Line and Sand Creek or Divide Ditches is brought across the divide into the Poudre Valley and is stored. Discharge is equalized and regulated by storage.

JOHN E. FIELD.

Recross-examination by Mr. N. E. Corthell:

3879 Mr. Olin, to whom I have referred in my testimony, was for a number of years a professor in the Colorado Agricultural College at Fort Collins, and at the time I made my report upon the Riverside ranch was supervising some agricultural operations there.

3880 Redirect examination by Mr. Fred Farrar:

In making my estimate relative to these seeped or saturated areas, I did not consult the map which has been referred to and offered in evidence, either in whole or in part. The map rather corroborates and coincides in part with my own ideas.

3881 JOHN R. WORTHAM, recalled.

Direct examination by Mr. Fred Farrar:

Some work was started on Greeley-Poudre tunnel and on approach cut to tunnel on Laramie River side, with force of men and teams after commencement of taking of testimony in this case. This work will be completed so as to divert water by May 1, 1914.

3881 Cross-examination by Mr. N. E. Corthell:

The work in the vicinity of the tunnel of the Greeley-Poudre system which has been performed this winter was commenced January 8, 1914, and 60 per cent of the work then remaining incompleted has now been completed. This work has been on the cut

from the river to the tunnel itself, cleaning out the tunnel and upon the diversion dam in the river channel.

Redirect examination by Mr. Fred Farrar:

We endeavored to get a crew of men in there for work earlier than date upon which actually started. Attempted to get outfit there last two or three days in November, but on account of excessive snows, it was absolutely impossible and we had to make another attempt. We finally shipped outfit by rail from Greeley through Laramie to Mountain Home, a station on the Laramie, Hahns Peak and Pacific Ry., and from there outfit was sledded in to west portal.

3883 L. G. CARPENTER, recalled.

Direct examination by Mr. Fred Farrar:

Can give specific data on snow measurements little more readily today than I could have done last night. April 3, 1913, snow varied from 48 inches to 20 inches. There are great many other cases along there. Near Wyoming-Colorado line, near Wycola or Mountain Home, we had series of measurements running about same way, 38 inches, it was a little more uneven. April 4 we had measurement of 50 inches at elevation of 8300 feet. This was on ridge. At one place where snow had blowed away, it ran as high as 16 inches. Most of measurements ran in neighborhood of 36 inches on average, some as high as 56 inches and some as low as 16. On April 8, at one place we had measurement of 54 inches and at another place 50 inches. One place was 24, another was 50, another 36, another 50, etc., all along in that general section.

In May, we had series of measurements running about same, at about 3 feet. Measurements of May 1 were not very far from town of Centennial, Wyoming. Trip was made at that time to Medicine Bow Peak. Measurements cover from May 5 or 6 up to May 10. For instance on May 7 here at one spot it was noted that snow was 3½ to 4½ feet deep. Those are extremes. At one place 3 to 4 feet is noted. At another place 5 to 4 feet is noted. At another place 4½ to 4, 6 to 5 etc. Measurement Number 96 runs from 5 to 4 feet. Measurement Number 97, 6.2 to 6 feet.

3884 These measurements were made at different points as observer passed along. They were made quite frequently, so far as these test depths are concerned. For instance on May 7 there were something like 13 different tests of measurements of snow made as Mr. Morey proceeded and at each of these spots depth was taken from 3 to 5 times. If snow was uniform, one measurement was taken. If depth varied, more than one measurement was taken to show variation.

At some time during the day or while observer was in that general vicinity, a test of amount of water in snow was made, in addition to the depths. Test of water content was not made as frequently and did not have to be so frequently made, because that covered somewhat the same general conditions.

These measurements were all on Medicine Bow Range, the ridge between Little Laramie River and North Platte River. There were also numerous others. There were cases where snow had been drifted or blown away.

In 1913 in valley above Centennial, crossing this region from there to Medicine Bow, tests were made starting from Centennial to Medicine Bow Peak and back, ranging as follows: First measurement not very far above Centennial was one foot in depth, then at Number 137 we have 2½ to 1 foot in depth. This was on May 4. First measurement was on May 3, 1913. At point Number 140 snow was 2 to 1 foot in depth. At Number 146 from 3.2 to 2 1-5 feet. At 147 it was 2.65 feet in depth. At Number 151 it was from 3½ to 1½ feet deep. This gives an idea of the ranges of
depths. The numbers refer to my serial number as we made
3885 them consecutively in note book. Number 153 was 5 to 3½
feet; Number 155 which was at this time about 10,000 feet elevation, varied from 10 to 5 feet; minimum was 5 feet and maximum 10 feet. Number 158 was from 6 to 2½. Number 160 was 5; Number 161 was 3.2; Number 162 was 6 to 3¼ feet, that was at a lower elevation. Number 165 ranged from 5½ to 3½, that was about 400 feet lower than previous one. Number 166 was 5 to 3 feet, that is slightly lower. Number 168 varied from 4 to 3 feet, that was 100 feet lower. Then going only 100 feet higher, it varied from 10 to 2 feet. Wind had evidently given it a sweep. Each of these serial numbers refers to point where a number of measurements as to depth were made. At least three measurements were made at each station as a rule. I am giving the extremes of the various measurements. Blanks I had prepared were arranged with spaces for three measurements at each point, but, if there was any material variation, more measurements were taken. Number 174 was from 6 to 5 feet in depth. Dates of last ones I am now given- were a little later in month. Number 173 was on May 30 and show it from 6 to 5.3 feet. That is not over 10 miles west of Centennial on way to Medicine Bow Peak. These measurements on this trip were within 10 to 15 miles of Centennial.

The mountain range at head of Little Laramie River at Centennial and west from there and also south to state line is rather broad,
and a flat top. That is shown in some of these photographs
3886 that may be presented in evidence. On side next the valley,
there is quite a steep de-cent. The Laramie, Hahns Peak and Pacific Ry. climbs that grade somewhat diagonally, but when it reaches top, it travels over rather a flat open country and, while this country is more or less rough in places, yet that illustrates the general characteristic of the range which is flat and rounded out.

The Medicine Bow Range is broader in Wyoming than in Colorado. At headwaters of Laramie River in Colorado, this range is very narrow. From Chambers Lake to Clarke's Peak distance is only 4 miles. Clarke's Peak forms crest of range. From Clarke's Peak range broadens as it goes north, but still preserves appearance of mountain peaks.

Medicine Bow Range is timbered in Wyoming and partially in

Colorado. In Colorado this range runs above timber line and this group surrounding Medicine Bow Peak in Wyoming also runs above timber line. There are a few peaks above timber line in both places but more in Colorado than in Wyoming. The Laramie, Hahn's Peak and Pacific Railroad crosses ridge practically at interstate line. I think the downward slope begins there.

Have photographs illustrating snow condition.

(Defendants' Exhibit 156, album of snow photographs, offered in evidence.)

3887 On each of these photographs there appears to be a number, for example, 2.201. That is simply my filing number at office for reference and identification for obtaining negative. They are all numbered.

Photograph Number 2201 is view taken May 7, 1912, from head of Medicine Bow Creek, looking west over top of that ridge. That is ridge between Little Laramie River and North Platte River. It shows general flatness of that ridge, that it is devoid of peaks and not very much broken up for a mountainous country. Mountains in background are correctly labled on face of picture.

Number 2202 is photograph from same point but looking southeast and shows snow at that time. Picture shows country looking southeasterly and rather up than west of Little Laramie. It is the flat top range between Little Laramie River and North Platte River.

3888 Laramie Plains would be at east or northeast of this point of view. Objects appearing like shrubbery, coming through snow are trees not covered by snow in both of these pictures.

Number 2203 is view taken from point further up and shows snow range or Medicine Bow mass a little to west of observer. This picture was taken at 10 o'clock. Point of view is N. E. ¼ of Sec. 18, Tp. 16, N., R. 79 W.

Number 2098 is in vicinity of Medicine Bow Peak and shows outlying portion of that mass. Taken May 7, 1912.

Number 2099 is another picture in Medicine Bow Peak country. It shows part of Peak shown in previous picture, but from higher elevation. This is from an elevation of mountain mass and shows trees and snow and snow depth at that elevation. Mountains shown in pictures 2098, 2099 and 2203 are above timber line. That is above point where trees will grow.

Mr. Farrar: In connection with these photographs specifically described, I desire record to show that exhibit includes pictures Number- 2204, 2206, 2208, 1975, 1953, 2205, 2202, 2073, 2210, 2095, 2096, 2092, 2089, 2075, 2074, 2097, 2086, 2064, 2100, 1940 and 1945.

3889 All pictures in series above designated are in Wyoming on west side of Little Laramie River Valley and on ridge or range that is watershed between Little Laramie River and North Platte River. It is the contributing area to the Little Laramie River. Legend on each picture contains correctly date and location.

Took some photographs in Colorado at a later date and these do not make fair comparison of two areas at same time. We did have some pictures taken in Colorado in March and April, not covering very large area, and I think others were mostly taken in June, except just along Laramie River itself where some were taken in May.

Photograph Number 3037 was taken from ridge at head of Laramie River, west of Chambers Lake and looks down into that lake. At left side is Laramie River Valley proper and whole view covers region very similar in foreground to Laramie Valley. Mass of mountains in background is on watershed between Poudre River and Big Thompson. At left of this view and in middle ground, is ridge between Laramie River and Poudre River. Photograph taken May 30, 1913. At extreme left is Laramie Lake, which has been referred to in testimony, and waters flow from it into Laramie River.

Photo Number 3038 is view from peak above timber line and somewhat to northwest of point where 3037 was taken. It
3890 was taken after climbing nearly one hour after taking 3037.

Photo Number 3039 is view from same place as 3038 but in different direction. 3038 is view looking south and shows Clarke's Peak which is at head of Laramie and on divide between North Platte on west and Laramie and Poudre River on east or left. Waters from Clarke's Peak drain into three different directions and into North Platte, the Poudre and Laramie.

Photo Number 3040 is another view from same point. These three pictures taken together with three following, all overlap and form a picture around the horizon, forming a panorama. Photo-3040 is a view looking approximately northwest.

Photo Number 3041 is a little more northwest, that is north of west, and shows watershed which drains into Laramie River through either McIntyre or Rawah Creeks.

Photo Number 3042 joins 3041 and is looking north. At right hand of this picture is shown valley of Laramie River going to north and at extreme right is ridge spoken of as Green Ridge or Laramie Mountains. It is through this ridge that tunnel passes.

Photo 3043 joins photo 3042 on right and looks across Green Mountains or Green Ridge (Laramie Mountains) and shows valley of Laramie River in foreground. The little light spot in left hand is pool of water at storage dam at tunnel.

All these photographs were taken May 30, 1913.

(Defendants' Exhibit 156, album of photographs showing upper Laramie River Valley in Colorado, offereed in evidence.)

3891 Medicine Bow Range of mountains in Wyoming for same elevation, is as good if not better than same elevation in Colorado. There is a large area of that elevation in Wyoming, because ridge is broad, than there is in Colorado. In Colorado, in vicinity of Clarke's Peak, there is some area that is better than this in Wyoming. I reached the conclusion without having as much data as I desired, that a large portion of the Medicine Bow Range from Clarke's Peak to state line is not as good as that portion of the range

in Wyoming. This includes that portion of The Colorado Range south some 15 miles from interstate line.

Notwithstanding the fact that Wyoming portion of range is better than Colorado, there is very considerable run-off through streams which enter river from the low portion of range in Colorado. Stuck, Grace and Laramie and La Garde Creeks all enter Laramie River from this low portion of Colorado range.

That portion of range of higher elevation in Colorado which is best drainage area is not very extensive. Region in vicinity of Clarke's Peak is highest portion of this whole range and precipitation on that in form of snow is rather more than at the lower elevations. It is analogous to the situation in the case of Medicine
3892 Bow Peak in Wyoming. I think that the precipitation at the elevation at Medicine Bow Peak in Wyoming is relatively more than the precipitation at the same elevation at Clarke's Peak in Colorado.

Examination by Mr. Delph E. Carpenter:

I have included in album Exhibit No. 156, some photographs showing Sky Line Canal or portions thereof and also some of upper Rawah Canal. Photographs Nos. 2232, 2237 and 2252 represent Upper Rawah Ditch. Taken June 21 and 22, 1912. They show character of country through which ditch is constructed and snow conditions on that date. Show snow banks in ditch. Photo Number 2230 is picture of headgate of Sky Line Ditch taken June 21, 1912. Photo Number 3143 respects a portion of Sky Line Ditch. Ditch is shown in photograph as white line from snow banks and ice. It was taken June 12 from opposite ridge and thus looks across Laramie Valley south of point where West Laramie forks to west.
3893 The ditch is something like 500 feet above bottom of valley and thus as point of view is considerably above ditch by probably 1000 feet or more, it does not make slope appear quite as steep as it actually is. Slope is very steep. That is evident by looking a little further to left somewheres about middle of picture and seeing slant of these lines of ice and snow. Point at right hand side of picture is at forks of two streams, that is West Laramie and East Laramie. Through that ridge the ditch goes by a tunnel.

Photo Number 3146 is taken from same point as photo number 3143, only in this case, view is almost to north, looking down Laramie Valley towards Wyoming line. On cliffs at left hand side of this valley is seen Lower Rawah Ditch as it comes from the Lower portion of Rawah Creek and follows along side of these cliffs and with water running towards us as we stand. This ditch empties into the flat space in the central foreground, which is a portion of the reservoir site. That is the dam site where tunnel reservoir outlet is being constructed.

Lower Rawah or West Side Collection Ditch of Greeley-Poudre Irrigation District System finally reaches floor of valley at site of this dam indicated in central foreground. Of course slope of ditch is toward us. Farthest point of ditch is at an elevation sufficient

for water to run this way. From time to time lines of excavation upon this canal seem to be broken where line meets pro-
3894 jections of rock. At some of these places are tunnels. This picture does not impress one with the steepness of the mountain upon which the canal is constructed. The impression is not the same as when a person is looking on the ground or climbing these cliffs. The sides of the valley are very steep and, in looking down in this way, it sort of flattens them out. This picture was taken from a point part way up Green Mountains on east side of Laramie River on June 16, 1913, same as previous pictures.

Most complete records I have of Little Laramie River and its very favorable watershed, the records with which I am best acquainted, are those of 1912 obtained on Little Laramie River at Filmore in that year and at which place I made a good many measurements and had kept daily records. At that point drainage area is about 163 square miles or 104,000 acres. Run-off in month of June alone was 76,632 acre feet and in July 27,676 acre feet or a run-off of practically one foot in depth for those two months, June and July only, for entire drainage area.

I have a hydrograph showing flow in Little Laramie River by itself, at this point, from a period of May 20 to some time in October when our records of the stream heights ceased.

3895 (Defendants' Exhibit 157, hydrograph of Little Laramie River at Filmore, Wyoming, offered in evidence.)

Exhibit 157 represents flow of Little Laramie at Fillmore, Wyoming, and shows as other diagrams of same character, flow in cubic feet per second for each day during that period from May to October. Vertical heights represent quantities in cubic feet per second and horizontal, as shown, days of month. Diagram is colored in part, so as to make it easier for eye to discern.

Run-off of Little Laramie River, as illustrated by this hydrograph, confirms my conclusions relative to flow of Little Laramie River drainage area in its general relation to run-off. My first impression about little Laramie River had been that it was not a very good stream, but, after going over it carefully, going over the watershed and seeing the water that comes down, it caused me to see that my first impression had been very far wrong. My first impression was possibly aided by manner in which that stream is generally spoken of, as Little Laramie, whereas it is quite comparable to the main Laramie River in some respects.

Spoke last evening of having made series of measurements during year 1912 at Boswell's Station, also of fact that my measurements at that station varied with those published by State Engineer of Colorado. I gave reason for variation. I have caused to be illustrated by hydrographs the differences between the published records of State Engineer of Colorado and records as ascertained by
3896 me from actual measurements.

(Defendants' Exhibit 158, hydrograph showing flow of Laramie River at Boswell's Station, 1912, offered in evidence.)

Exhibit 158 shows flow of Laramie River at Boswell's Station in year 1912.

Portion of diagram that is colored yellow, lower portion, is that shown by published record given in State Engineer's report of Colorado for 1911-1912. Upper line represents that as found by measurements that were made by me or under my direction during period of high water. As explained last night, during period of high water, State Engineer of Colorado, or measurements made under his direction or those which were published, did not include any measurements of the stream. There were gauge heights recorded by an automatic machine which was out of order, or tended to get out of order, and, as I then mentioned, depth as we found varied somewhat from machine, and, in addition to that, there was quite a large quantity of water flowing under three bridges or culverts across the bottom, that were not included in the river under the bridge. The upper portion of this diagram which is colored red, is the difference then between the quantities as published in that report and the quantities as I found them and is practically the same as the quantities as we found going through those culverts and going around the main gauging station.

In speaking of the published record, I refer to that published by Charles W. Comstock as State Engineer of Colorado for years
3897 1911-1912. When I speak of the amount going around station I refer to the discrepancy between the figures as published by the State Engineer and the measurements we made. Amount going under third span of bridge at those depths is not very great and certainly not as great as that going through the three culverts. This excess may be due to almost entirely the amount going through the culverts. At any rate it is the discrepancy between these results as published and the results as we found them. As I stated, the automatic instrument was in error, but I think the published records had attempted to correct those heights, but in converting the heights into quantities, they evidently had not been acquainted with the fact that a great deal of water went around the bridge and would not be shown on the oridinary rating curve. I am advised that Mr. Field in testifying to the run-off of the Laramie River at Boswell's Station for 1912 used my measurements on the ground rather than published record. I do not know, however, as I did not hear his testimony on that particular point.

Mr. Delph E. Carpenter: In order that record may be clear upon this subject, Mr. Field being present in the room, I will digress to ask Mr. Field what figures he used, those as obtained by Professor Carpenter from actual measurements in 1912 or those published by State Engineer Mr. Comstock.

3898 Mr. Field: I used the data as used in compiling the published reports, in so far as they related to gauge heights. I used the discharges for the high water measurements as determined by Professor Carpenter.

(Witness continuing:) I had occasion to ascertain amount that

might be diverted by Greeley-Poudre System of Collection Ditches and tunnel as now being constructed and completed in the Laramie River Valley in Colorado by the Greeley-Poudre Irrigation District, and incidentally had to look into amount passing interstate line. Do not think I drew a conclusion in percentages but figures I reached would only be needed to be converted into per cent. So converting those figures I find that about 23½% of the run-off of the Laramie River in Colorado would be diverted by the Greeley-Poudre Irrigation District System. This 23½% represents amount that might be obtained by means of the tunnel as a passing way, the tunnel reservoir and the collection ditches that were under contract at that time, (1909), that included what is known as Upper Rawah Ditch and its extension to McIntyre, the small portion of McIntyre that it would capture. That did not include the possible extension of Lower Rawah or West Side Collection Ditch from Rawah Creek to
3899 McIntyre Creek. I made this computation and estimate during winter of 1909-10 from data available at that time and prior to obtaining of recent data.

Complaint is made in pleadings in this case that citizens of Colorado are diverting water from Laramie River to alleged injury of citizens of Wyoming. There are instances, other than those I have already mentioned, from Fish Creek, where citizens and residents of Wyoming are diverting and using waters originating in that state to the detriment and injury of citizens of Colorado.

There are quite a good many such diversions on Crow and Lone Tree Creeks in Wyoming, which are tributaries to South Platte and have quite a long list of appropriations in Wyoming, and in addition there are quite a good many appropriations or decrees that have been adjudicated to rights on Dale Creek and various tributaries of the Cache la Poudre other than Fish Creek.

Do not know extent of reservoir constructed by City of Cheyenne diverting portion of flow of Crow Creek. Outside of that reservoir there are a good many rights on Crow Creek for irrigation and other purposes, so I presume that structure don't take all the water. There are a good many acres that are irrigated from Crow Creek in Wyoming and I do know also that in Colorado Crow Creek has practically no water. Almost every time I have seen it it has been without water.

A number of rights for diversion of water within Wyoming from Dale Creek have been granted by authorities of that State.
3900 These rights have been granted and use is made of waters of this creek in Wyoming, notwithstanding shortage of water in Cache la Poudre River, of which Dale Creek is tributary. Dale Creek is tributary of the North Poudre and both the North Poudre and the Poudre River have been short of water for a portion of the year, for many years. That is especially true of the North Poudre. Dale Creek is a tributary of the North Poudre, is a flowing stream throughout its length and the water that is used and taken out in Wyoming, undoubtedly depletes the stream in Colorado and there are existing rights in Colorado. The adjudicated rights in Wyoming on the stream not only run back for a number

of years, but are being continuously increased and adjudications are being made from year to year up to present time. I believe there were some rights adjudicated last year. By adjudicated, I mean certain water rights were quieted and confirmed in owners by Board of Control of Wyoming, even as late as last year. I mean users have conformed to laws of Wyoming and their rights have been so confirmed.

I have in my hand a list of adjudicated rights on Dale Creek and tributaries in State of Wyoming, obtained from Secretary of Board of Control of that State. 111 ditches, are mentioned in this list of adjudicated rights, as having been given decreed water rights out of Dale Creek and tributaries in Wyoming. This does not include those ditches which have permits but have not gone to final adjudication. There are a good many such permits which have been issued and are outstanding but upon which final proof has not yet been made.

3901 Diversion of water of this interstate stream continues in Wyoming, notwithstanding shortage on the same stream in Colorado.

Fish Creek is a tributary of Dale Creek and the diversions on the former are included in those just given. On Fish Creek Wyoming appropriators have not only diverted water from Creek for irrigation of lands within the drainage area of Fish Creek, but even more, they have diverted waters of Fish Creek for application upon lands lying outside of its drainage area and in the drainage area of Laramie River, as shown on Exhibit 50 of Defendants.

Water is diverted from Cache la Poudre Drainage basin into Laramie River Basin in Wyoming.

Dam for reservoir of water system of City of Cheyenne, furnishing water for Fort Russell and Cheyenne, was constructed within the last few years, three or four years ago. The use of water by Fort Russell I believe has been enlarged and connected. These diversions are from Crow Creek and tributaries. They are from one of the tributaries of the South Fork of the Platte River, which tributary joins the South Platte in Colorado a little east of Greeley.

Have obtained further information concerning instances of diversions of water made from one stream and carried over watershed to another stream for application, other than those already given. They are simply illustrative of the same general rule that I have been attempting to show to be universally true, which is, that wherever there is an occasion to use the water, whenever there is a need of water, people are going to obtain it from the stream that is nearest to them or the stream that is most accessible physically and financially and, whether a divide stands in the way or not, does not cut any figure, any more than it requires more capital.

I have not made any particular search, but I have noticed many since testifying. Did not note them all down but took them

3902 as being illustrative of the same general principle. I have found cases of physical and possibly financial obstacles, but thas has been all.

There has been no difficulty or opposition from fact that water

was taken across divide. I might mention a number of cases, for instance, in state of Oregon there is a ditch that has been built for a number of years, but takes water from upper tributaries of Burnt River and carries the water across the divide into Willow Creek. Willow Creek is a tributary of Matheur River. There are other projects on Rogue River in southern Oregon, these I may have mentioned previously, but I have recently obtained fuller information concerning them.

Rogue River runs from southern Oregon into Pacific Ocean. Kalamath River starts in Oregon and runs into California. There is one case where a ditch has already been completed carrying water from Kalamath basin into the Rogue River valley and there have been one or two others that are projected, surveyed, permits granted and some steps taken towards construction. There are two or three of these projects which are of considerable size.

There is another known as the Teel Irrigation District in
3903 Umatilla County, Oregon. In this case they propose to take water from tributaries of John Day River, carrying it across the divide into Butter Creek and then to irrigate land with this water near the Umatilla Government project in Oregon. This enterprise is projected. It is in a state of suspense waiting for funds, but the permissions have been granted and everything is ready to take up construction upon obtaining of funds. These projects are in Oregon. I have maps of all these projects but unfortunately have mislaid them.

There are a number of illustrations of inter-watershed diversions in the Islands of Hawaii that are indicated by a recent government report of the U. S. Geological Survey, that is, one of the water supply bulletins, on the Island of Oahu. This island is about 35 miles north and south and has a rainfall much larger on one side than on the other, so that in this case they are taking water from the side where rainfall is greater or at least are applying water to lands intermediate. They take water from the watershd flowing into the Pacific Ocean over to another stream which flows into
3904 the Pacific Ocean at another place. They divert water and apply it in entirely different watersheds. On the Island of Kauai there are quite a number of similar cases. The Kehaha Ditch carries water of at least one stream and over into an entirely different watershed for application. The Olokele Ditch takes water from river of same name at elevation of about 1300 feet and carries over to the south, crossing a number of intermediate streams each of which empties into the Pacific by its own channel. There are other ditches, for instance, the Hanapope Ditch, the Kamoola Ditch, Wilcox Ditch and several others, all of which are constructed to supply land that justified expense. On the Island of Maui are a number of similar cases as also the case on the Island of Hawaii.

These cases of inter-watershed diversions on Hawaiian Islands, I think are simply illustrate- of the application of the general principle I have mentioned. Some of the cases of transfer of water will run back for many years and some are recent. It shows again

that when water was needed and they have conditions that justify the expense, the construction is completed.

Of course operations of the U. S. Reclamation Service are matters of record, but what they are doing in Nevada in the Truckee-Carson Project involves carriage of water from one watershed to another. In fact in one of these transfers the water is taken from a stream that runs normally into one basin or sink, over into a stream or watershed which runs into another and entirely different basin or sink. That is done by authority of the U. S. Reclamation Service and in those, as in other cases, where divides have been matters that have come in connection with these enterprises, they have not been considered as a different condition and water has been carried across them as freely as across minor divides or ridges.

They have carried the water in this case just the same as
3905 they have in the case of the Strawberry project and the Gunnison Project, as previously referred. This diversion is of less importance from one standpoint *from* those above mentioned of those which are in northern Montana.

In all those cases the water has been carried across the divide wherever the conditions justified it.

In my former testimony upon the subject of inter-watershed diversions, I spoke of such diversions being made within Wyoming in vicinity of Sheridan from Tongue River for application on lands of drainage area of Powder River. It seems that there are ditches in Montana on both of those streams below the Montana-Wyoming line, that is, in Montana after these streams running from Wyoming into Montana enter the latter state and before either of them join the Yellowstone. There are also ditches in Wyoming. I ascertained those facts from county officers in Montana counties.

Other cases of inter-watershed diversions in Wyoming, in addition to those I have previously mentioned, have been proposed by officials of Wyoming, apparently without objection. Thus, State Engineer Bond of Wyoming, in the Fifth Annual Report of the Wyoming State Engineer, suggests that the deficiency in Owl Creek might be met by diversion of the North Fork of Wind River and suggests that the cost of the survey would be money well expended.

There is the suggestion in the same report, of carrying water
3906 through the divide from Boulder Lake into Big Sandy, which, while they both finally are tributaries of the Green, are entirely independent tributaries and when they reach the Green, there is no question of any deficiency of water in the Green, but there might be in either of these two streams. There are several other similar propositions leading to utilization of water which have been surveyed.

In foreign countries there are a number of other cases of inter-watershed diversions, than those I noted. It is perfectly safe to assume that wherever conditions exist, such transfers of water will be found. I might mention several that I have run across without making any research. For instance, in Island of Ceylon in the Ambonganga series, such seems to have been the case. In Professional Papers of India Engineering, Number 217, there seems to

have been an attempt to bring water from Mulpurba to Dharway-Cottom Plains carrying water across a ridge which is typical of many that they seem to have though not as important as some of those that I mentioned in my previous direct examination. Near Bombay the large reservoir, the Bhatode Tank, Professional Paper Number 184, described an unfinished project of unknown date on the Meheree River which is carried from one watershed to another. Of course the transfers between the Tigris and Euphrates have been very extensive and are of historical importance and have recently attracted more or less attention because of the re-building, as it were, of some of these ancient diversions.

There are, however, quite a good many of the ancient canals still in existence and quite a good many take water from one of these streams and carry across the country between and terminating
3907 in another. There are, as a matter of fact, canals in existence which take water from one of these streams and run it into the other. During recent developments of past few years, there have been projects running up to a good many millions of dollars, that are in course of construction and in fact some of them I believe are completed, where reports have been made by English Engineers plans have been formulated, money has been raised and construction has been started. They are not really the re-building of old canals but they are new works, which, however in some cases are pretty near the lines of old ones that have fallen into disuse, probably from the lawlessness of the locality or political considerations, but they are simply other instances illustrative of the general principle.

No doubt further research into the subject would develop information concerning large numbers of these inter-watershed diversions wherever proper conditions exist. Diversions of this kind will be found where water is needed on one side and where land is so valuable as to justify the expense. Such diversions in such cases will be made just as naturally and just as a matter of course as we know that a thirsty man will drink water.

Even assuming that ultimately, by use of waters of both Poudre and Laramie Rivers, all of lands of Greeley-Poudre Irrigation District should be reclaimed. There are other and additional lands in drainage area of South Platte River contiguous to the Greeley-Poudre Irrigation District lands and lying to the eastward with almost unlimited acreage subject to reclamation. There are, as matter of fact, equally valuable lands lying to north and further away from main stream, than lands of the Greeley-Poudre District, but which topography of country would make very expensive to bring
3908 water for reclamation from Poudre River. When lands of Greeley-Poudre Irrigation District are reclaimed, the canals may be extended just as easily and naturally as the Cache la Poudre No. 2, the Larimer and Weld and the Larimer County Ditches have been extended in years past and just as other ditches along all of streams have been extended and waters applied to more land further down the streams.

Statement made in Bulletin No. 100 of Agricultural Experiment Station of Wyoming, at Laramie, and particularly on page 87

thereof, that average date of last killing frost in spring is May 30, indicates that the date of last killing frost in spring is very much later at Laramie than at Fort Collins or Greeley. This is true by something like 4 or 6 weeks. My recollection from records kept for many years is that average date of last killing frost in spring at Fort Collins is prior to April 15. There are, of course, some years when it falls later and some earlier. I do not have the record at hand. As matter of fact, in keeping record, we had some difficulties as to defining just what was a frost, but the average date of the last killing frost in spring is at some time in earlier portion of April.

Mr. Delph E. Carpenter: Before further examination of Professor Carpenter, with permission of counsel, I would like to introduce certain exhibits into the record. I now read into record Section 2 of Article VII of the Constitution of Wyoming, which is as follows:

"Sec. 2. Board of Control. There shall be constituted a board of control, to be composed of the State Engineer and superintendents of the water divisions; which shall, under such regulations as may be prescribed by law, have the supervision of the waters of the state and of their appropriation, distribution and diversion, and of the various officers connected therewith. Its decisions to be subject to review by the courts of the state."

I now read into record Sections 724, 727, 728, 729, 730, 732, 734, 739, 741, 743, 744, 750 and 794 of Compiled Statutes of Wyoming, 1910, as follows:

Here follow, in the record in hæc verba the statutes referred with the following numbers and titles:

3910 No. 724, Water right defined;
3911 No. 727, Application for permit;
No. 728, Duty of State Engineer;
3912 No. 729, Approval of application;
No. 730, Application, how endorsed;
No. 732, Limitation of time of completing work;
No. 734, Maps to be filed;
3913 No. 739, Date of priority;
No. 741, Rights limited to use;
3914 No. 743, Reservoirs—application for—permit;
3915 No. 744, Procedure;
3916 No. 750, Priority;
No. 794, Water right claimants must appear;
3917 From First Biennial Report of State Engineer of Wyoming to Governor of that State for years 1891-92, I read as follows from page 40:

"All persons desiring to appropriate water are required, before beginning its diversion, to secure a permit for the same from the State Engineer, the method of procedure being defined in Sec. 34, Chap. 8, Session Laws of 1890. It requires the State Engineer to furnish a blank for the application, which is to be filled out by the intending appropriator and returned to his office. It is then the duty of the State Engineer to examine this application and to ascertain if it states all the facts required to determine its character

and if the proposed use is a beneficial one and not detrimental to public welfare. If it complies with these conditions, it is his duty to approve the same, fixing the limit as to the amount of the appropriation and the date when the same must be completed.

3918 On the approval of the application the appropriator must file, within six months from the date of such approval, a plat of the proposed ditch and the lands to be reclaimed, in a scale not less than two inches to the mile.

The engineer is required to refuse permits on streams where there is no unappropriated water, or where the character or location of the proposed diversions would make it detrimental to public interest. Where permits are refused the applicant has the right of appeal to the Board of Control.

* * * Under the present law the appropriator is restricted, in the permit, to the amount actually used within the time designated, and in this way all claims to the ownership of water for speculative purposes is averted."

Also as follows from page 42: "An ap-roved permit is a guaranty from the state of the following facts:

(*a*) That the engineer believes there is an adequate water supply.

(*b*) That if the conditions of the approval are complied with, no question can arise as to the date or amount of the appropriation.

(*c*) That within the period fixed for the completion of the appropriation other appropriators will not be permitted to divert and absorb the water supply, and that a limit will be placed on subsequent appropriations, thus obviating future conflicts with the owners of ditches for which there is no water."

I refer to the testimony of the witness, R. I. Meeker, submitted by the plaintiff at Laramie November 22, 1913, and reported in Volume three of the testimony in chief for the plaintiff, and particularly to the following answers given to certain questions requesting the numbers of the permits under which the Laramie Water Company's water system has been or is now being constructed and completed, which said answer giving said numbers is in words and figures as follows:

3919 "A. 8518, 8519, 8521, 8613, 10363, 10364, 10365, 1331 reservoir; 1372 reservoir; 1373 reservoir; 1883 reservoir, 2051 reservoir; 2052 reservoir; 1939 enlargement; 2113 enlargement; 2538 enlargement; 11016, 11017, 11018, 11019, 11020, 11021, and 11022, 11016 to 11022, are attached to 2538 enlargement; 2719 enlargement; 2720 enlargement.

Q. What office are these permits issued by?

A. State Engineer's office, Cheyenne, Wyoming.

Q. These do not include any filings or claims of the Laramie Water Company outside of the State of Wyoming?

A. No.

Q. They do include the permits issued by the State Engineer's office of Wyoming?

A. Yes."

For convenience in offering all these permits in evidence for purpose largely of preventing any misconception of the status of

the so-called Pioneer High Line Canal, I will introduce certified copies as follows:

First, those diverting water from the Big Laramie;

Second, those diverting water from the Little Laramie river; and

Third, those diverting water from Douglas Creek a tributary of the North Platte River, and also other permits mentioned.

The permits included in these three divisions covering all of the permits mentioned in the above testimony of Mr. Meeker.

Concerning permits issued covering appropriations granted by State of Wyoming from Big Laramie River, whereby the
3920 priorities of such works are fixed within the State of Wyoming, I offer in evidence a certified copy of permit Number 8612 for "The Lake Hattie Supply Canal" diverting water from Big Laramie river and filed in office of State Engineer of State of Wyoming on 21st of April, 1908, and duly recorded in Book 27 of Applications on page 297, and also a blue print copy of map accompanying said application, said map also being the map which accompanies Permit 1372 Res. hereinafter introduced.

(Permit and map marked Defendants' Exhibit 159.)

Mr. Carpenter: I desire the record to show that paragraph five of said application gives the sources of the proposed appropriation as "Flood waters of the Laramie River." Also that paragraph one of said applications names Z. E. Sevison as the applicant. Attention is also called to the assignment appearing on page three of the copy of the permit showing the various conveyances and assignments which apply to this and subsequent permits.

I desire the record to show that by terms of grant of permit by State Engineer, Permit 8612 filed April 21, 1908, being the first and earliest permit filed by the Lake Hattie system, said permit is limited as follows:

"Supply canal for reservoir permits numbers 1372 Res. and 1373 Res. see also permits 8613 and 1939 Enl."

Attention is called to fact that said grant of permit does not incorporate any other permit in said grant by reference or otherwise save those above specified. Attention is called to the fact that the map accompanying said permit shows only one canal, that being a ditch from the Laramie River to and terminating at Lake Hattie reservoir, said ditch being on the map designated "Lake
3921 Hattie Supply Canal," and that no reference is made upon the map to either the Pioneer or any other canal and attention is particularly called to the fact that neither by lines, figures or words is there any reference to any "Pioneer High Line Canal," but that said map indicates solely and exclusively an application to appropriate water from the Big Laramie River through said canal as an inlet to Lake Hattie Reservoir and not otherwise. Also to the fact that at no place in said application for permit or on said map, or in the grant of permit by the State Engineer is there any reference to any other or prior filing, claim, application or permit of any other survey or canal projected or completed other than the mention made of permits, 1372 Res., 1373 Res., 8613 and 1939 Enls. which will be hereafter introduced in evidence, but none of which

have any reference to any "Pioneer High Line Canal" or any other canal having location or survey line similar to "Pioneer High Line Canal" as shown on Permit 2719 Enlargement which will be next introduced in evidence.

(Application for permit and blueprint marked Defendants' Exhibit 160.)

Mr. Carpenter: Defendants offer in evidence Exhibit 160, a certified copy of application for permit and of permit for an enlargement of "Lake Hattie Supply Canal" designated in the application as "The Pioneer High Line Canal" said application having been filed in the office of the State Engineer of the State of Wyoming July 11, 1912, and duly recorded in Book 10 of Enlargements on Page 235 in the records of that office, and bearing Number "2719 Enlargement." Defendants also offer in evidence as a part of said exhibit a blueprint copy of the map accompanying the said application. The grant of permit on said application reading as follows:

"This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following
3922 limitations and conditions: * * * 'Waters diverted from the Big and Little Laramie Rivers under the terms of this permit in excess of the amount covered by permit heretofore issued, must be immediately returned in equal amount to the Laramie River from the Lake Hattie Reservoir, in such manner as to in no way interfere with prior rights on the Big and Little Laramie Rivers.'

Attention is called to the fact that the grant made by this permit is specifically subjected to the terms of previous grants of permit made to Z. E. Zevison and others beginning with, and the earliest of which is Number 8612, Exhibit 159 of date April 21, 1908, and permits subsequently filed, and that the right to the use of water to this canal covered by this permit, Exhibit 160 is limited to water already appropriated by permits 8612 and subsequent thereto, and that the right to the use of water is limited to water diverted under and by virtue of the grants contained in said permits and not otherwise.

(Application for permit and blueprint copy of map marked Defendants' Exhibit 161.)

Mr. Carpenter: Defendants offer in evidence their Exhibit 161 being a certified copy of the application for permit No. 8613 for "Hattie Canal Number One" filed by Z. E. Sevison with the State Engineer of Wyoming September 11, 1908, and recorded in Book 27 of Applications on page 298, also a blueprint copy of the map accompanying said application 8613.

(Application for permit and blueprint map marked Defendants' Exhibit 162.)

Mr. Carpenter: Defendants now offer in evidence their exhibit 162 being certified copy of application for permit Number 1372 Res. By Z. E. Sevison for Lake Hattie Reservoir, filed in the
3923 office of the State Engineer of the State of Wyoming May 11, 1908, and recorded in Book 5 of Reservoirs on page 118; also a blueprint copy of the map accompanying the said application

for permit. Said exhibit also contains the grant of permit by the State Engineer.

(Application for permit and blueprint map marked Defendants' Exhibit 163.)

Mr. Carpenter: Defendants offer in evidence their exhibit 163, being a certified copy of the application for a grant of permit Number 1273 Res. for an enlargement of Lake Hattie Reservoir filed in the office of the State Engineer of the State of Wyoming by Z. E. Sevision, September 18, 1908, and recorded in Book 5 of Reservoirs on page 119, also a blueprint copy of the map accompanying the said application for permit.

(Application for permit and blueprint map marked Defendants' Exhibit 164.)

Mr. Carpenter: Defendants offer in evidence their Exhibit 164, being a certified copy of application for a grant of permit Number 1939 Enl. for the Hattie Canal (South Lateral) being a portion of the outlet of the distribution canal from Lake Hattie Reservoir, made by Z. E. Sevison and filed in the office of the State Engineer of the State of Wyoming September 18, 1908, and recorded in Book 8 of Enlargements on page 53, also a blueprint copy of the map accompanying the said application for permit.

(Application for permit and blueprint map marked Defendants' Exhibit 165.)

Mr. Carpenter: Defendants offer in evidence their exhibit 165, being application for a grant of permit Number 2113 Enl. for the enlargement of the Pioneer Canal made by Z. E. Sevison and filed in office of the State Engineer of the State of Wyoming,
3924 July 3, 1909, and recorded in Book 8 of Enlargements on page 227, also a blueprint copy of the map accompanying said application for permit.

Defendants call attention to the fact that in none of the exhibits 161 to 165 inclusive is there any reference to any "Pioneer High Line Canal" or any appropriation for such canal, or any evidence by words, figures, or lines of an intent to construct any such canal or to claim appropriations of water for the same, and,

Further that the conditions fixed by the granting of permit on Exhibit 160 on July 11, 1912 long after the commencement of this suit, absolutely limit the right of use of water through the Pioneer High Line Canal to appropriations of water, if any, made by virtue of permits Exhibits 159, 161, 162, 163, 164 and 165, and not otherwise except such other appropriations as are covered by other grants of permits which will be hereinafter offered in evidence; but in none of which is there any claim of an appropriation of water for the "Pioneer High Line Canal" or any mention thereof.

(Application for permit and blueprint map marked Defendants' Exhibit 166.)

Mr. Carpenter: For consideration of alleged appropriations from the little Laramie River by the Laramie Water Company and its predecessors in interest, the following permits will now be considered.

Defendants first offer in evidence in this behalf their Exhibit

166, being a certified copy of application for a grant of permit for diversion and appropriation of water for Lake Hattie Supply Canal Number Two, being Number 10363, and filed with State Engineer of State of Wyoming, December 5, 1910, and recorded in Book 33, of Applications on page 247; also a blueprint copy of the map accompanying the said application for permit.

Attention is called to the fact that this is the first permit issued for diversion from the Little Laramie River for filling and supplying Lake Hattie Reservoir.

3925 (Application for permit and blueprint map marked Defendants' Exhibit 167.)

Mr. Carpenter: Defendants further offer in evidence their Exhibit 167, being a certified copy of application for a grant of permit Number 2720 Enl. for the Lake Hattie Supply Canal Number Two, filed by Lyman E. Bishop with the State Engineer of the State of Wyoming on July 11, 1912, and recorded in Book 10 of Enlargements on page 236; also a blueprint copy of the map accompanying such application.

Attention is called to the fact that neither on Exhibits 166 or 167 is there any reference to the use of water from the Little Laramie river by means of the Pioneer High Line Canal, and,

Further that the plats accompanying the said applications wholly fail to indicate the intersection of the line of any such canal, with the lines of the Lake Hattie Supply Canal Number Two as indicated on the maps and accompanying and being a part of Exhibits 166 and 167, as required by statute, thereby evidencing the fact that no such canal as the Pioneer High Line Canal was considered by the Laramie Water — or its predecessors prior to or at the time of making and filing the applications contained in said exhibits 166 and 167.

(Application for permit and blueprint map marked Defendants' Exhibit 168.)

Mr. Carpenter: Defendants offer in evidence their Exhibit 168, being certified copy of application for a grant of permit Number 8518 for the Bell Supply Ditch Number One, filed in office of State Engineer of the State of Wyoming, July 19, 1908; also blueprint copy of the map accompanying the said application.

3926 (Application for permit and copy of blueprint map marked Defendants' Exhibit 169.)

Mr. Carpenter: Defendants offer in evidence their exhibit 169, being a certified copy of application for a grant of permit Number 1331 Res. for the Bell Reservoir, filed with State Engineer of the State of Wyoming, July 19, 1908; also blueprint copy of map accompanying said application.

(Application for permit and blueprint map marked Defendants' Exhibit 170.)

Mr. Carpenter: Defendants offer in evidence their exhibit 170, being certified copy of application for a grant of permit Number 8521 for the Stewart Ditch, filed with State Engineer of Wyoming June 29, 1908; also blueprint copy of map accompanying said application.

(Application for permit and blueprint map marked Defendants' Exhibit 171.)

Mr. Carpenter: Defendants further offer in evidence their exhibit 171, being certified copy of application for a grant of permit Number 1883 Res., for the Bath Reservoir, filed September 15, 1909, in office of State Engineer of the State of Wyoming.

(Application for permit and blueprint map marked Defendants' Exhibit 172.)

Mr. Carpenter: Defendents offer in evidence their exhibit 172 being a certified copy of application for a grant of permit Number 2052 Res. for the Bell Reservoir Number Three, filed in the office of the State Engineer of Wyoming December 5, 1910; also blueprint copy of the map accompanying said application.

Attention is called to the fact that in none of the applications or maps accompanying such application included within exhibits 169 to 172 inclusive is there any mention of the "Pioneer High Line Canal" or any indication to appropriate water from the Little Laramie River or otherwise for any such canal or for lands situated beneath any such canal, and further that as evidenced by Permit Number 2719 Enl., a total failure to note the points of intersection of line of said canal with lines of canals noted on any other of these exhibits is indicative of the fact that no such canal as the "Pioneer High Line Canal" was considered by the applicants for said permits at or prior to the time of making said application securing said permits.

(Application for permit and blueprint map marked De-
3927 fendants' Exhibit 173.)

Mr. Carpenter: Defendants offer in evidence their exhibit 173, being certified copy of application for a grant of permit Number 8519 for the Bell Supply Ditch Number Two diverting waters from Douglas Creek and tributaries, which said Douglas Creek is a tributary of the North Platte River, said application being filed with the State Engineer of Wyoming July 6, 1908; also blueprint copy of the map accompanying said application.

(Application for permit and blueprint map marked Defendants' Exhibit 174.)

Mr. Carpenter: Defendants offer in evidence their exhibit 174 being certified copy of application for a grant of permit Number 2538 Enl. for the Bell Supply Number Two from Douglas Creek, filed with the State Engineer of Wyoming March 7, 1912; also blueprint copy of the map accompanying said application.

(Application for permit and blueprint map marked Defendants' Exhibit 175.)

Mr. Carpenter: Defendants offer in evidence their exhibit 175 being certified copy of the application for a grant of permit Number 11,016 for the Bell Supply Ditch Number Two from Podunk
3928 Creek, a tributary of Douglas Creek, filed with the State Engineer of Wyoming March 7, 1912; also a blueprint copy of the map accompanying said application for permit, being the same map which likewise accompanied the application for permits numbers 11,017, 11,018, 11,019, 11,020, 11,021 and 11,022. And

certified copies of said last mentioned permits are not introduced for the reason that the map acompanying exhibit 175 is indicative of the appropriations made and included within the above applications including 11,016, all of said applications for grants of permits being substantially a part of Exhibit 174, permit Number 2538, Enl.

Attention is called to the fact that in none of said permits or on the maps accompanying the same, is there any reference to any "Pioneer High Line Canal" for the use of water diverted from Douglas Creek and tributaries and to be applied on lands situated on any canal to be known as the Pioneer High Line Canal.

(Application for permit and blueprint map marked Defendants' Exhibit 176.)

Mr. Carpenter: Defendants offer in evidence their Exhibit 176, being certified copy of application for a grant of permit Number 10,364 for Interstate Canal Number Two from the Big Laramie River, filed with the State Engineer of Wyoming August 30, 1909; also blueprint copy of the map accompanying said application.

(Application for permit and blueprint map marked Defendants' Exhibit 177.)

3929 Mr. Carpenter: Defendants offer in evidence their Exhibit 177 being certified copy of application for a grant of permit Number 2051 Res. for the Robertson-McConnell Reservoir, taking waters from the Big Laramie River, filed in office of State Engineer of Wyoming, October 15, 1909; also blueprint of the map accompanying the same.

(Application for permit and blueprint map marked Defendants' Exhibit 178.)

Mr. Carpenter: Defendants offer in evidence their exhibit 178, being certified copy of the application for a grant of permit Number 10,365 for the Sand Creek Diversion Canal, by the Interstate Reservoirs Construction Company, filed in office of the State Engineer of Wyoming, December 12, 1910; also a blueprint copy of the map accompanying the same.

DELPH E. CARPENTER, a witness for defendant:

In connection with testimony already offered by introduction of exhibits in this case covering permits issued to The Laramie Water Company and its predecessors, and particularly with relation to alleged claims of appropriation for a certain "Pioneer High Line Canal," in company with Professor L. G. Carpenter, I made investigation of records of offices of State Engineer at Cheyenne, Wyo., Secretary of the Board of Control for the State of Wyoming at Cheyenne, and Clerk of District Court of Laramie County, situated at Cheyenne, to ascertain what, if any, statements of claim for appropriations of water from the Big Laramie River or any of its tributaries had been made and filed with the Board of Control in the proceedings for the adjudication of priorities of water rights from the streams mentioned.

3931 Professor Carpenter, owing to a previous engagement was called away before examination was complete and hence I

was compelled to complete same by myself and thus offer this testimony. I examined records, statements of claim and transcript of evidence introduced before Board of Control in adjudication of priorities for water rights from Big Laramie River and its tributaries, and find no statement of claim filed in said proceedings in behalf of or making claims for any canal designated as the "Pioneer High Line Canal" or any other canal which might be claimed as the "Pioneer High Line Canal", but appearing under some other name. I also found that no evidence had been submitted before Board of Control in said proceedings for or in behalf of any "Pioneer High Line Canal" or any similar canal by any other name.

I likewise searched statements of claim and evidence submitted in connection with the "Pioneer Canal" and failed to find in either of those claims or the evidence submitted in support thereof, any reference to any "Pioneer High Line Canal".

I further examined proceedings had before District Court on appeal from decree given by Board of Control, and, after an examination of all of motions, appeals, statements of claim and other documents filed in said proceeding, and after a thorough examination of all evidence submitted before District Court in such proceeding, I failed wholly and absolutely to find any reference whatever to any "Pioneer High Line Canal" or statement of claim of appropriation of water for any such canal under that or any other name and failed to find any evidence introduced in support of any
3932 claim for any such canal.

I further examined all papers and evidence relating to "Pioneer Canal", and filed and produced in such proceeding, and failed to find any reference to any "Pioneer High Line Canal" in any of such papers, documents or evidence. I examined proceedings on appeal from Board of Control to District Court with proceedings reviewing decree entered by Board of Control and terminating with decree a copy of which was heretofore introduced in evidence by plaintiffs over objection, and marked Exhibit N. I made search throughout decree entered by Board of Control from which appeal was prosecuted and found no mention of a decree in behalf of any "Pioneer High Line Canal" and no mention or decree on behalf of any such canal as a part of the "Pioneer Canal" or otherwise. I made search of decree entered by District Court, Exhibit N, and failed to find any mention of said "Pioneer High Line Canal" in said decree, either as a canal diverting water from Big Laramie River or as a part of the Pioneer Canal.

I will further state that in making said search I observed that records of Office of State Engineer of Wyoming indicate that permits Nos. 11,016 to 11,022 inclusive, are a series covering the same general appropriation and therefore, in ordering certified copies of permits, did not order copies of said permits other than the first thereof, 11,016, Exhibit 175, for reason that map accompanying that permit is same map that accompanied permits Nos. 11,017 to 11,022 inclusive.

3933 **Mr. J. D. Clark:** No cross-examination.

(Defendants' Exhibit 179, decree district court Larimer County Colorado, offered in evidence.)

Mr. Carpenter: Corporate defendants offer in evidence their exhibit 179, being certified copy of decree of District Court of Larimer County, Colorado, entered in Matter of Adjudication of Priorities of Water Rights in Irrigation District No. 48, of State of Colorado, for irrigation and other beneficial uses, February 20, 1914, insofar as same concerns system of ditches and tunnel of the Greeley-Poudre Irrigation District on Laramie River in Colorado. Attention is called to fact that by provisions of said decree priorities therein awarded begin with priority Number 65, priorities numbers 1 to 64 being covered by decrees previously issued out of said court, October 11, 1906, and a previous decree.

Mr. Fred Farrar: Defendant, State of Colorado, joins in offer of Exhibit 179, subject however, to ruling of court upon objection made to introduction of decrees of Board of Control and District Court of State of Wyoming in and for Laramie County, offered in evidence by plaintiffs herein.

L. G. CARPENTER.

3933 • Cross-examination by Mr. John D. Clark:

In 1909 and 1910 I made an examinatoin of the Greeley-Poudre project including an examination of the water supply, a portion at least of which was printed and circulated. The project as I considered it did not include a proposed extension of the West Side Collection Ditch so as to include more than a small portion of the drainage area of McIntyre Creek. My conclusions as to the water supply were derived from all available records including the records of the flow of Laramie River at Woods Landing for several years at Jelm, for three years at Glendevey and on McIntyre Creek for two years and through the Skyline Ditch for five years, and my conclusions relative to the supply available from the Poudre River were drawn from records covering a much longer period of time. My conclusions as to the amount available from the Laramie River were stated as follows:

"From these records, and taking the elevation and character of the watershed into consideration, it would seem that we can consider that the watershed of the Rawah and the McIntyre can be depended on to furnish a run-off equivalent to a depth of two feet:

That the area tributary directly to the reservoir can be depended on to a depth of 1.5 feet:

And that the east side area tributary to the East Side ditch can be depended on to a depth of one foot. This would make a total—from the Upper Rawah, 12,600 acre feet; from the Lower Rawah, 10,000 acre feet; from the small streams through the Rawah ditch, 8,800 acre feet; from the East and West Laramie and tributaries to reservoir, 7,440 acre feet; from Nunn and Deadman Creeks and east tributaries to the East Side Ditch, 21,800 acre feet; or a total of 62,660 acre feet.

In addition to the above the amount from the West Laramie de-

veloped above the Skyline Ditch and not developed by that ditch, an average of about 7,500 acre feet. This is obtained by deducting from the total amount produced 20,400 acre feet, the amount diverted, which averages 13,000 acre feet. Total available from the Laramie watershed, 70,160 acre feet."

3935 My conclusions relative to the amount of water available from the Poudre River were based in part upon records of the amount of water passing down out of the district for the years 1904 to 1909 inclusive and upon my own knowledge of the river for a much longer period of time, and I concluded that there was available from the Poudre in 1904, 120,000 acre feet; in 1905, 145,880 acre feet; in 1906, 22,483 acre feet; in 1907, 130,080 acre feet; in 1908, 30,590 acre feet; and in 1909, 235,000 acre feet, making an average amount of available water 120,000 acre feet, and relative to this water I stated my conclusions as follows: "This whole 120,000 acre feet of available water cannot be diverted by the proposed means of diversion, for some of it must be lost by the fact that it comes at times when it cannot be taken into the ditch and sometimes because the quantity coming from the North Poudre may be more than can be taken down directly. But the equalizing of the Stove Prairie Reservoir will be a very material assistance and will
3936 lead to a much better development of the system of exchange and to methods for preventing the loss of much of this water. It would seem that this should be able to supply at least 60,000 acre feet on the average, and probably could be depended upon for 80,000 or 90,000 acre feet, at least, within a few years." In this report my conclusion as to the amount of water available from the several sources was as follows: from the Laramie River, 70,100 acre feet; from the Poudre River, 60,000 to 90,000 acre feet; from Dowdy Lakes, 2,990 acre feet; from Douglas Reservoir, 5,833 acre feet; and from the flood waters of Lone Tree and Crow Creeks, 3,000 to 10,000 acre feet, a total of from 142,000 to 179,000 acre feet.

3937 I am not sufficiently familiar with Lone Tree and Crow Creeks to give an estimate as to the amount of discharge of either of them. Crow Creek apparently is of considerable size, as there are a number of Wyoming adjudications some of which are for 1,000 acres or more, and aggregate 21,462 acres, and there are also a number of appropriations, but not so large nor so many, from Lone Tree Creek in Wyoming. I do not know whether the Crow Creek adjudications were adjudicated by the Territorial Court, nor whether the appropriations actually exist in fact. It is my impression that the State Engineer of Wyoming has mentioned Crow Creek as an instance where appropriations were adjudicated for lands that were not irrigated.

3938 Dale Creek is quite a stream, having a bed that is probably 15 or 20 feet wide or even more, the bridge at Virginia Dale, a few miles south of the state line, being 50 feet wide. The
3939 Wyoming appropriations from Dale Creek number 111 in the list I have, all excepting one being for less than 50 acres. There are also appropriations from it in Colorado, and it is tributary to the North Poudre, from which there are large appropriations.

The diversions in other countries and in other states has been gained from the same sources generally as my previous testimony—that is, published works and correspondence, and not from personal observation, although I have been personally familiar with some of the instances referred to in my first testimony.

3940 I have supervised in person quite a number of the stream measurements made in 1912 and 1913, at every station excepting Forrester. The discharge through the several added channels at Boswell's during the high water period of 1912 was determined by the use of a current meter, in exactly the same way as on the river itself. The larger channel was 18 feet wide and something like 4 or 5 feet deep. There were three or four discharge measurements taken of these added channels. We did not maintain a gauge rod thereafter on these separate channels as we expected to depend upon the automatic register.

3941 I had independent gauge readings made at that station as a basis for my computation of discharge. They were made when my assistants went up there. I took for the basis of this sheet, in computing the discharge record, first the record given in the State Engineer's Report, in which they have worked out the depth from week to week, correcting these heights; they corrected these heights sometime after their attention was called to it, and then got what is probably or nearly the correct height. I have previously explained the discrepancies.

3942 Corrections seem to have been made fairly well. But, of course, to convert these into quantities of cubic feet per second would require the use of the rating curve, which rating curve was formed by the State Engineer's office for the depth and the quantity under the bridge. The discrepancy, I found, was about equal to the amount we give as passing through those culverts and I assume, as shown on the chart, that the discrepancy is equal practically to the amount that went around the bridge. If the stream left the channel and the water went out gradually, would start gradually, it would probably not be shown by any sudden change in the rating curve. I have made for this particular station, two curves, one for the water where it goes entirely under the bridge and one for the points representing the flow, including that outside. In both cases regular curves are formed. A single rating curve for the stream might be spoken of as the resultant flow through the

3943 several channels. The three discharge measurements taken of the whole river, including these added channels at the time the water was flowing through them, gives us a fairly satisfactory rating curve. I would have preferred to have had more observations, but the result is far better in these cases where we have these discharges at these great depths and high quantities than could possibly come from making a rating curve without any high discharges. Whatever criticism may be made of the number of measurements, the fact is that the results are far better than could possibly be had with them left out of account, and, furthermore, they agree very satisfactorily, which is one test of the value of such a series of measurements.

3944 Three of these measurements were taken when water was going through the culverts and the amount of water going through the culverts was measured at these three times. There was evidently a fourth time when water was going through the culvert, May 29, but the amount at the culverts other than the first was not ascertained, as the others were unknown at that time. When I did discover these other culverts, I was very much surprised at the amount of water passing through them, as the flow was rapid and I was quite deceived in the depth, which was much greater than I expected.

My meter measurements at Boswell's in 1912 were made from the bridge. No particular difficulty was experienced in making these measurements at high water. We contrived a way of determining the depth and holding the meter and as the meter recorded only once in five revolutions, we had no trouble on that score. That is one of the serious difficulties with waters running quite rapidly. Meter was suspended by cord from the bridge. We attempted to obtain average velocity for each section and meter was raised and lowered so as to get the velocity for whole section.

3945 Meter swung somewhat laterally owing to pulsations of current, but that did not affect the record to any particular extent.

I made measurements either in 1906 or 1908 at Decker's, but am not positive of the year. Readings were made in that year by Mr. Decker. Mr. Decker furnished the depth for the Decker station and I think evaluated them with a previous rating table that he

3946 had. I never checked the rating table. Mr. Lamb was there during the summers of 1904 and 1905. He was a competent young man, but whether or not he had sufficient data at that station I do not know.

With regard to financial practicability of construction of reservoirs on Poudre River capable of conserving extraordinary floods, will state that they call for an expenditure that could be utilized only occasionally. It would be similar to financial proposition of people in Florida preparing to heat their houses in the same manner as those in the northern part of the United States. For years of unusually high flow in the Poudre River, conservation works, to utilize the excess waters in that stream, would have to count on carrying water over more than one year. The utilization of this water means the presence of population on the land; that population must have a living from year to year and they are not justified in going out on to the land and settling to raise a crop only once in three or four years. They must have sufficient to make a living from one year to another, and consequently the investment

3948 must be such that there can be sufficient water every year to keep these people on the land, and when water can only be conserved once in every three to five years, there must be provision for carrying over water or the people cannot live. It is a question of population as well as investment. The population has to exist and stay on the ground. From standpoint of investment, conser-

vation of flow such as extreme flow of 1884 would be im-
3949 practical to the extent that it exceeded the ordinary high year. Of such character would be the floods of 1885, 1900 and 1909, three years in thirty.

Irrigation in Poudre Valley ends latter part of September for most agricultural crops with a subsequent irrigation for gardens and fruit trees and there are various demands which take practically all water of stream during September. September is usually month of lowest flow. Supply for filling reservoirs comes from flow of October and subsequent months and floods during summer.

Practically no water is held over in reservoirs in Poudre Valley from one irrigation season to another. Referring to the printed report of the Division Engineer that on November 1, 1912, something in excess of 83,000 acre feet of water was stored in the reservoirs in the Poudre Valley, discharge records at mouth of canon
3950 for 1912, found at page 239 of Report of State Engineer for 1912, only contain in part information of flow of water in Poudre River during October and September. These records may be correct as to amount of flow at cañon mouth alone, but other factors and flows from other tributaries are to be considered.

I have no reason to doubt the record for 1912 showing that the flow of the Poudre at the mouth of the canon in September was 6345 acre feet and in October was 5059 acre feet. Without some consideration, I could not state how much water in addition to this flow in the river would be available in the Poudre Valley drainage area in those two months. The total watershed of the Poudre at the gauging station at the mouth of the canon is a little more than one thousand square miles. There are tributary to the reservoirs in the Poudre Valley several streams, including Dry Creek, which is quite a tributary to Terry Lake and Douglas Reservoir, Box Elder, which at times carries a good deal of water and was the source of the largest flood which the Poudre has ever recorded, and Fossil Creek, which at times flows a great deal of water. These are largely flood streams and the floods occur usually after heavy storms. The Box Elder heads in Wyoming, I think, and sometimes it is subject to floods when there are no local storms whatever below. Streams like Dry Creek contribute enough to be a good deal of a factor in reservoir storage. The area tributary to the watershed below the canon gauging station is quite large in square miles; for instance Box Elder watershed is probably ten or fifteen miles wide and at least thirty miles long, that being añ under-estimate. The principal supply to the Poudre from these streams comes after storms, but they afford a supply at all seasons of the year. The thunder storms which contribute to them are mostly from June to September and may be as late as the first of October, although not frequently.

There is considerable water going into reservoirs from
3951 seepage that is not counted in that passing canon mouth.

3953 Reservoirs in Poudre Valley are filled as early in season as possible. The water thus stored is depended on to irrigate sugar beets, potatoes and market gardens and last irrigation of alfalfa in some instances. Water in reservoirs is held in reserve for irrigation as needs require. In some years, during latter part of July and August, there are rain storms sufficient in quantity to give an irrigation and that relieves the necessity of calling on the reservoirs to that extent at least. It accordingly results that if they have held this water in reserve for the average dry season and a few rain storms come during August, they then have some water in store that, under the circumstances, they do not need, and this water may be carried over. Most commonly, however, they exhaust their
3954 water supply and are scant. Practically all the reservoir sites in the Poudre Valley, construction of which would be justifiable from standpoint of water supply from Poudre River alone, are already developed. Some sites now impossible might become feasible at some future time. The same law of economic necessity governs reservoir construction that causes taking of water across divides all over the world. I think the construction of one of the channel reservoirs proposed by the Greeley-Poudre system would be justified where it is to be used for storage of available water both from the Poudre and the Laramie.

Redirect examination by Mr. Fred Farrar:

3956 Report from which Mr. Clark read in cross examination in which I stated "At Woods Landing with watershed of 404 square miles, the annual run-off for a period of 11 years averages about fourteen inches. This is after taking away of the amount diverted by the Sky Line Ditch and also the amount lost by irrigation," was made in December, 1909, and January, 1910, 14 inches run-off over an area of 494 square miles would be about 300,000 acre feet. The petition shows 301,353 acre feet or in round numbers, 300,000 acre feet. To get total amount above Woods Landing, Sky Line Canal would have to be added, 13,000 acre feet per annum, and also all irrigation water consumed in valley itself. These would have to be added to 300,000 acre feet.

70,160 acre feet, estimated by me in that report to be available for the Greeley-Poudre Irrigation District from its Laramie River system of works, is the figure upon which I based my estimate this afternoon that that system would divert only 23½% of the total run-off of the Laramie River in Colorado. This is rather 23½% of the net run-off after the Sky Line Ditch diversion has been
3957 deducted. If Sky Line Ditch Diversion were included the percentage would be about 22%.

Aside from reasons which I have given why reservoir designed to catch only these rare high water flows of Poudre River are not feasible, it is a fact that no farmer would be able to anticipate the high flow and therefore could not depend at all upon water for irrigation until it reached him. If he undertook to so divert water it would become a gamble rather than a safe guide for living.

I consider Mr. Field's estimate as given in his testimony, of flow of Laramie River as being very conservative.

3957 JOHN E. FIELD, recalled.

Direct examination by Mr. Delph E. Carpenter:

In Exhibit 124 I omitted records of Sky Line Ditch and North Poudre Canal prior to year 1899, for reason that I had not discharge of North Poudre except in one case, that being year 1892. I omitted it on Sky Line for reason that I was forced to omit it on North Poudre Canal, not having records, as I said, I observed that discharge of these two canals was not very different and that, by omitting both, they would compensate. It would have led to a greater error to have included the records which I had on the Sky Line canal, than to have treated it in the manner I did.

I omitted Sky Line Canal additions to Poudre River flow for reason that they about offset North Poudre Canal diversions from Poudre River flow, during years which I have no accurate record for North Poudre.

3958 DELPH E. CARPENTER, recalled:

In searching records State Engineer's office at Cheyenne, in connection with permits made for the James Lake enterprise and Sodergreen High Line Canal, appropriation for the Northwestern Land and Iron Company, from the Big and Little Laramie Rivers, I found that appropriations of James Lake System were included in permits Nos. 8385, 8386, 8387, 8388, 8389, 1279 Reservoir, 8874, 1872 Enlargement, 1971 Enlargement, 1972 Enlargement, 2325 Enlargement, 2326 Enlargement, dates of filing being between April 29, 1908, and November 19, 1910 inclusive.

Sodergreen High Line permit 2368 was filed December 27, 1907.

Wheatland Industrial Company permit, 1681 Enlargement, was filed April 18, 1907; 8531, August 7, 1908 and 11446, September 11, 1912. I found that the Northwestern Land and Iron Company claimed under permits 10,149, 10,150, 10,423, 2,304 Enlargement and 1,962 Reservoir, between dates June 3, 1909 and June 25, 1910 inclusive.

All of above are set forth on following table this day forwarded me by State Engineer of Wyoming and which has been verified
3960 by comparison with my notes.

Permit No.	Name of Applicant.	Name of Ditch.	Date of Filing.	Date of Approval.	Date of Completion.	Standing of Permit.
8385	G. S. Speer.....	James Lake Supply.....	April 23, 1908	May 19, 1908	1912	Completed.
8386	G. S. Speer.....	James Lake Supply #1..	May 1, 1908	May 19, 1908	1912	Completed.
8387	G. S. Speer.....	James Lake Supply #2..	May 1, 1908	May 19, 1908	1912	Completed.
8388	G. S. Speer.....	James Lake Supply #3..	May 1, 1908	May 19, 1908	1912	Completed.
8389	G. S. Speer.....	James Lake Supply #4..	May 1, 1908	May 19, 1908	1912	Completed.
1279 R.	G. S. Speer.....	James Lake	Mar. 27, 1908	May 19, 1908	1912	Completed.
1872 E.	G. S. Speer.....	4-Mile Flood	Feb. 17, 1909	Feb. 20, 1909	1909	Completed.
8874	G. S. Speer.....	Oasis	May 6, 1908	May 25, 1908	1909	Completed.
1971 E.	James Lake Irr. Co.....	Bellamy	Nov. 24 1908	Nov. 25, 1908	1912	Completed.
1972 E.	James Lake Irr. Co.....	Loback	Nov. 24 1908	Nov. 25, 1908	1912	Completed.
2325 E.	James Lake Irr. Co.....	Oasis	Nov. 19, 1910	Nov. 26, 1910	1910	Completed.
2326 E.	James Lake Irr. Co.....	James No. 1.....	Nov. 19, 1910	Nov. 26, 1910	1910	Completed.
8328	Oscar Sodergreen	Sodergreen Highline....	Dec. 27, 1907	Apr. 14 1908	1910	Completed.
8531	Wheatland Industrial Company	Wheatland Industrial Co.	Aug. 7, 1908	Aug. 8, 1908	1910	Time extended to Dec. 31, 1915.
1681 E.	Wheatland Ind. Co.....	Enl. Wyo. Dev. Co. #1...	Apr. 18, 1907	Apr. 18, 1907	1910	Completed.
11446	Wheatland Ind. Co.....	J. Boyd (Blue Grass)...	Sept. 11, 1912	Sept. 12, 1912	1912	Completed.
10149	N. W. Land & Iron Co....	Outlet No. 1.....	June 3, 1909	Oct. 17, 1910	....	Extended to 1914.
10150	N. W. Land & Iron Co....	Outlet No. 2.....	June 3, 1909	Oct. 17, 1910	....	Extended to 1914.
10423	Denver-Laramie Realty Company	McDonald	June 25, 1910	Mar. 7, 1911	1911	Completed.
2304 E.	N. W. Land & Iron Co....	King Water	June 3, 1909	Oct. 17, 1910	....	Extended to 1914.
1962 R.	N. W. Land & Iron Co....	Hutton L. Res.....	June 3, 1909	Oct. 17, 1910	....	Extended to 1914.

(End of Transcript, Vol. 8, Defendants.)

The complainant offered the following evidence, in rebuttal, before Clyde M. Watts, special commissioner, commencing at Laramie, Wyoming, May 12th, 1914.

THOMAS S. PARSONS, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

3963 Agronomist in charge of field crop and farm at University at Laramie, Wyoming, since March 1st, 1910. Raised on a farm in Wisconsin and a graduate and post-graduate of South Dakota Agricultural College. Had more or less experience with farm work since graduation; also ten years in High School
3964 agricultural work. Lived ten or eleven years in South Dakota, engaged in agricultural work. Had experience in irrigation in connection with High School at Durango, Colorado, 1904-1910. My Wyoming experience was both in dry and irrigated farming carried on at agronomy farm about two and a half miles west of Laramie, both above and below Pioneer Canal. The
3965 dry farm has the better soil. Up the river the soil becomes more gravelly, but except in a very few places not enough to do any injury, being mostly on the surface. The agronomy
3966 farm has been under irrigation twenty-two years under the Pioneer Canal. Crops of wheat, oats, rye, spelts, emmer, field peas, alfalfa, various grass crops, root crops including rutabagas, turnips, beets and potatoes have been raised, generally in experiment plats from ¼ acre up large enough to base reasonably accurate estimates of production. We have used ordinarily good farming methods in plowing, cultivation and irrigation. In especially wet
3967 years we obtained very fair crops on the dry land, notably in 1909. The next two years were very dry and the crops were rather small but produced considerable forage in oats, field peas, wheat and barley. The grain crops would not be considered paying crops, but the forage would. Rye was the best crop, averaging about ten bushels to the acre for three years, wheat and oats less. Crops were not threshed, but an estimate was made of the quantity. I don't consider dry farming profitable on the Laramie Plains unless under certain conditions where forage is raised to feed the stock. Grains cannot be raised in paying quantities by dry farming methods.

During the same years, we had good results on the irrigated farm with all grains and crops except potatoes, where the same trouble occurred as in Colorado. Oats 46-103 measured bushels,
3968 barley 30-78 bushels, winter and spring wheat 15-43 bushels, alfalfa 3-5 tons per acre. We usually plant about the first
3969 week in April and I have never seen any damage to grain from early spring frost. In 1910 frost caught some unharvested crops August 24th. In no other year has the frost injured any of our grain crops. July 31, 1913, frost injured potatoes and buckwheat, etc.; we never put out beans because we only get green beans. Have sent out each spring in 1913 and 1914 about 3,000 pounds of seed grain. Prevailing wind is from southwest, some from

the west. Wind is not as heavy during the growing season as before planting. North or northwest winds do not prevail to any extent during the summer. I have not made any personal observa-
3970 tions. The general climatic conditions are perhaps not as favorable as in some sections, but for general mixed farming there is no reason why a man should not be successful—that is, in stock raising, dairying and growing a variety of feed for stock. All crops produced are of good quality, the grasses and grains being higher in food value than those grown at lower altitudes. The crops raised have been fed to stock on the University farm.

Have observed, to some extent, the methods of irrigating which will compare favorably with the method of handling water elsewhere, especially Colorado. Have observed methods of grow-
3971 ing crops in San Luis Valley, Colorado. At first only field peas were grown. Later, they have developed higher altitude grains and they are grown in considerable quantities.

Comparing methods and results in the Laramie Plains region with those in Colorado, South Dakota and Wisconsin, I have observed that conditions are as favorable here as in most of the other sections for general mixed farming, stock raising and feeding of grains, dairying, hog raising, etc., but not for grain raising. The methods and results here have been profitable under good management such as prevails on experiment farm.

3972 Direct examination by Mr. John D. Clark:

In Durango, Colorado, I did some special observation work and other work in connection with Prof. Olin and others in preparing a small monthly for use of teachers in the Agricultural College at Fort Collins.

The agronomy farm at Laramie is very heavy clay soil on the lower bench and of a very gravelly nature. The North Canal runs through a corner of the dry farm, but none of it can be ir-
3973 rigated. The soil is much the same as the land under ditch farther up the river. Have sampled the soils each year and also some of the soils about a mile West and South in Township 15, Range 74, where the surface appearance is much the same. A little gravel on the surface, but not enough to do any harm.
3974 Observed practically no difference between the surface soil and the sub-soil to a depth of four feet. Some gravel on the surface, a little all the way down. The soil is lacking in humus but good soil for agricultural purposes. The amount of gravel contained is a benefit, making the soil easier to work. As far as I observed, the soil farther up is generally of the same character. Taken as a whole, the land is on this little gravelly order. Don't know of any place where gravel is sufficient to injure soil except a few very small areas where there are rocks and larger stones on the surface. Field peas are one of our best crops, being raised for hay or ensilage and not threshed. It is one of our hardiest crops, not easily
3975 affected by frost, high in feeding value and being one of the legumes, benefits the soil, a valuable crop for feeding purposes. Potatoes in 1910 yielded on one half acre plat at the rate of

90 bushels, being best that year on the dry land. I estimate yields at an average of 150 bushels per acre on our irrigated land. In 1911 we had no crop, due to the blight which also prevailed in Colorado and other regions. In 1912, the injury was not so extensive. In 1913, frosts on July 31st stopped the growth. The state farm
3976 records extend over twenty-two years, giving some higher yields. I think farming in connection with the raising of cattle and the dairy business would be successful in tracts of 80 to 160 acres, giving the farmer a proper living. Our methods on the agronomy farm have not been exceptional, but were adopted to demonstrate the best method of farming and successful crop raising. They need not involve any extra expense.

Cross examination by Mr. Fred Farrar:

3977 Was teacher at Durango High School. Durango vicinity one of newer sections in point of agricultural development in Colorado. Durango in former years was largely dependent upon mining as source of commercial revenues. Ute reservation in that vicinity opened in 1898 and time I was there considerable farming was being done all through that reservation and upon what was called Florida Mesa and Upper Animas Valley above Durango. Of course, considerable fruit raising was done there even at that time.

When I testified that in 1909 there was extraordinary precipitation in Laramie, Wyoming, region, I merely stated that upon impression from my talk with Mr. McWethey, my predecessor and fact that rain came down during growing season.

Upon consulting Bulletin No. 100 issued by Agricultural Experiment Station of University of Wyoming and referring to tabulation of precipitation shown on page 33, covering 20 years from 1891 to 1910, inclusive, I find that 1909 was rather below normal according to records. I have not compared records at all. It is below normal as to entire year and also during growing season. I am not able to state with certainty whether Laramie Plains area produces enough grain, wheat particularly, to supply local demand.

Do not know whether or not local mill is in operation at Laramie. I know it has been in operation a part of time during recent years. Think some of wheat they were utilizing was brought in from dry farm region east of Cheyenne, for they have an elevator there. Have no knowledge or information relative to importation of wheat to the mill. Laramie Plains area has not produced sufficient potatoes to supply local demand.

3979 In my judgment from knowledge which I have, Laramie Plains area does not produce sufficient quantity of wheat to supply local demand. This emphasises point I made, that grain raising will not pay and we do not use wheat to feed stock.

We do not claim we are a great wheat raising section although we can raise fair crops of wheat but do not class wheat as a crop in mixed farming method.

Mixed farming is raising of materials that can be fed directly to

stock. It is my idea that farming can be made successful on Laramie Plains when crops are raised that are fed locally. I encourage custom of building silos and preserving forage. Because that is best paying part of farm for dairying and stock feeding. Dairying and stock feeding are essentially necessary to success in farming in this area same as it is in any area, unless it is in some specialized area where they can raise sugar beets or something of that kind. I don't think cost of producing such crops would be any greater than in other states and recognized farming areas, especially as time comes when more land will be under cultivation and more feed will be raised in a locality and, with mixed farming, a certain amount of feed should be raised, enough to supply home demand.

3980 Experimental work which I have been conducting consists of cultivation of plats from a quarter of an acre to an acre in our experimental work. The acts require that we do that along line of variety work. These experiments are designed to secure very best possible results conditions will afford same as on any farm. The farming methods pursued in any experiment station are actually of higher type than that followed by farmer in commercial way, because we emphasize scientific side of it and are working for something more than ordinary farmer is working for. Experimental farm here certainly was not selected with care. They could not have selected a poorer piece of land in whole valley than the agronomy farm, that is the one that is irrigated. It is a very poor piece of land. I merely emphasize fact that even that land can be made to produce and if we can do it there, they can do it anywhere on other land in the valley. Plats on experiment farms are scientifically and carefully prepared. We run some fertilized plats for purposes of comparison with plats that are not fertilized. We do not

3981 practice best methods of irrigation any more than any farmer should. We practice better methods than average farmers does. That is what experiment farm is for, to teach farmers themselves better methods.

We do not expect commercial returns from experiment farm because it is an experiment and not a demonstration farm. Were we running a demonstration farm, we would get returns, we would raise varieties that would produce largest amount and sizes, but Department at Washington lays down definite laws which we shall follow in regard to our experiment work and they do not advocate demonstration work. The state has to carry on demonstration work, if it is carried on. This is strictly and purely experiment work, testing different varieties, different soil treatment and for that reason our plats are not uniform. You may go over to the station and see one plat with very large yield and one with very small yield. That would not be case with an ordinary farm. For that reason we do not expect to get returns. We would expect to receive same returns from demonstration farm that average farmer would receive. It should be higher. No higher than farmer could attain if he used same methods. That is universally true in making comparison between some crops and some varieties. Average farmer will not

do his work as carefully as experiment or demonstration farm.
3982 Returns from demonstration farm are hardly typical returns for average but would be nearer than returns from experiment farm.

I stated that a few years ago field peas were only successful crop raised in San Luis Valley in Colorado. I was there in 1906 or 1907 last time. I made trip from Alamosa west by railroad. Was not away from railroad. There has been some wheat raised in that section but I never considered it a wheat country.

Did not know that as far back as 20 or 30 years enormous quantities of wheat were raised right in section I traversed in San Luis Valley. Saw mill at Monte Vista. Don't know as fact that area extending 20 to 30 miles north of Monte Vista returns enormous yields of wheat, but it may possibly be so. Never heard of Sylvester Boys or of them raising wheat that threshed over 50 bushels per
3983 acre for a number of years. Did not traverse valley north of Monte Vista. Was not there or at Mosca or Hooper. Did not know that had been wheat producing country for 20 years. I am basing my idea on advertising of what San Luis Valley has done with field peas. Field peas are commonly grown as nurse crop or in alternate years with grain in order to secure nitrogen. Have no knowledge of that being case in San Luis Valley.

My observation of San Luis Valley in Colorado was limited to one trip on railroad from Alamosa to Creed. Did not go away from railroad on either side. Didn't pass on railroad north from Alamosa. I stated from hearsay that methods are better in San Luis Valley now and from talking with Mr. Workings of Denver, who is district manager of work, when he was here week or two ago. He spoke of good work done by agent in San Luis Valley. San
3984 Luis Valley is about 300 feet higher than Laramie Plains. General topographical situation is somewhat similar to Laramie Plains.

I have heard it stated that a large area of San Luis Valley has become water logged owing to free application of water, and that it becomes necessary to drain immense area in order to reclaim it. That will be true of any section where water is not carefully handled. It is apt to be true of any section.

Made no critical general examination of methods of irrigation used in Cache la Poudre Valley or of methods of distribution of water. Merely judged that they had shortage of water a good deal of time in that section. That is what they call shallow well section in vicinity of Ault. Good many farmers are putting down shallow wells and irrigating from wells rather than ditches in that, which is poorer irrigated section.

Center of San Luis Valley is nearly 300 miles south of Laramie. Generally speaking it is width of Colorado. Durango is not very much further south than San Luis Valley. Altitude at
3985 Durango is 6500 feet.

Imagine difference in altitude would about offset latitude in San Luis Valley. It is merely my impression that there is difference of about 500 feet in altitude and that this difference in alti-

tude compensates the 300 miles in latitude. Laramie is 7150 feet and it is my impression that altitude of San Luis Valley is 7500 feet. Average through Laramie Plains is about 7000 feet.

Do not know whether or not my conclusions on this subject are borne out by experts, it is merely my own impression.

Louis Holliday Farm is crossed by North Canal. 40 acres of this farm are under my control and direction. Know nothing at all about balance of it. The 40 acres in question is north and west and above the canal. Do not know where north corner is. Think
3986 land which I have is ½ mile or further from land under canal. Am not clear as to location of canal. Canal is on this (east) side of tract of which I have control. In going out to our tract you would cross canal. My observation of matters in that locality has been limited to 40 acres under my control. We had nothing to do with any other part of his farm. Referring to map, it is 40 acres in east portion N. W. ¼ Sec. 2, Tp. 15, N., R. 74 W.

Only have hearsay knowledge of yield of potatoes in bushels per acre, aside from potatoes on experimental farm which have come under my immediate observation. The 150 bushels per acre record to which I testified is hearsay and also from our records of former years at experiment station. I had Mr. Ausperger's state-
3987 ment for average of 150 bushels per acre on 40 acres for 1909. I could not state how large proportion of home grown potatoes are sold in stores in Laramie. Do not know of any other considerable area of potatoes. A number of men out on Little Laramie raise very good potatoes. They bring them in for me to see, but I have no knowledge of areas. They were merely showing me potatoes they had raised as a matter of pride. 40 acres raised on Blackburn Ranch in 1909 were Early Ohios. Blackburn is good place, could not say best on Laramie Plains, but they have used better methods of farming than most farmers, because they were better farmers in charge of it.

Cross-examination by Mr. Delph E. Carpenter:

Disease which affected potato crop in 1911 in Greeley vicinity and generally throughout Rocky Mountain region, including Laramie Plains region, has been designated by scientists as Rhizoctonia or Fusarium. Scientists have disagreed as to just what it is. I think Colorado men have generally agreed to call it Fusarium.

It is a form of blight, whether it is the old original form of
3988 blight as they know it in east, am not able to say.

That unfortunate disease destroyed potato crop throughout whole Wyoming section, as well as in Colorado section in that year. Also as far east as central part of Nebraska. Laramie Plains region has diseases to contend with in potato crop. We have no potato bugs. There are practically no other diseases. Year 1911 was first year that disease affected potato crop of Greeley and Wyoming districts.

It is true that diseases which effect potato crop in Greeley district might also affect potato crop in Laramie Plains district.

Cannot give date of harvest of potatoes raised on Blackburn

Ranch in 1909. Think potato harvest at agricultural college that year was probably during latter half of September, because potatoes are usually left in ground as long as possible, even after heavy
frosts have come. Have thermometer at University Station
3989 6 feet above ground and they also have ground thermometer.
Have been unable to keep one at experiment station. We are getting all records we have at university and we keep no records at experiment station except rainfall at farm. Ground thermometer has been used at University four years at least.

Have read bulletin 100 issued by Agricultural Experiment Station of Wyoming, September, 1913. I have read everything in it. I read proof on it when it was being published. Could not say whether or not table appearing on page 41 of this bulletin No. 100 ("Mete-rology for Twenty Years") table entitled "Table V. Lowest Temperatures at Laramie for Twenty Years" was computed from records taken at thermometer which is situated 6 feet above ground. I have nothing to do with taking of records. I might say that if it were taken with thermometer 6 feet above ground that would be rather an advantage because ground thermometer would naturally be warmer than one above direct radiation from soil. My impression is that records of ground thermometer would show rather
higher temperatures than records obtained at thermometer
3990 six feet above ground.

Know Mr. James F. Wilson, the observer. According to his statement lower thermometer would register lowest temperature, but that does not necessarily mean, however, that frost would be injurious because we have radiation close to ground, and I still maintain it would make it warmer than above, although I merely stated it was my impression, I know nothing about it without making observations. I am not a meteorologist and profess no learning in that regard. Mr. Wilson's report of meteor-logical summary for year 1912 at bottom of page 125 of Twenty-third Annual Report of Agricultural Experiment Station of Wyoming for 1912-13, states; "The minimum at the ground shows the lowest temperature at the ground and may register a frost which will kill some vegetation, while official record, taken six feet above, will indicate no frost."

No grain at experiment farm was caught by frost in 1912 by freezing weather that came early. Everything was harvested before frost. I am not very familiar with conditions throughout Laramie Plains that year. However, most farmers put their grain in too late. We advocate early seeding. They must seed as early as they can and there is very little chance of being caught with frost. We have
not been caught with frost in last four years, except early
3991 frost of 1910. Also early frost of July, 1913 for the potatoes,
none of the grains. If Mr. Wilson on this same page 125 of the 23rd Annual Report of Agricultural College Experiment Station of Wyoming states, "Freezing weather came on so early that much grain was caught and threshing was carried on with difficulty," I don't believe he was in a little better position to know facts in that regard than I was. He was student and was not away from

university while I was over country to considerable extent. I would not say he was wrong, but possibly he got it from hearsay.

Upon reference to the official report of the Experiment Station I find that on page 125 the language that is quoted appears. Threshing was carried on late but that does not necessarily mean to say grain was destroyed by frost. Threshing can be carried on even next summer of grain that was raised previous year. We had early snows that fall and I saw one piece of grain on experiment station that was cut after it had three snows on it and grain was not hurt. That grain was used for seed and I tested grain and it was good. Mr. Wilson was not wrong in saying that threshing was carried on late but it does not necessarily say that grain was injured by storm. Storm came September 13. We threshed grain at experiment station after that and grain was cut after that. It was quite
3992 a heavy snow. Following there was storm about September 20. Grain was matured at time first snow storm came, so it did not receive any injury.

As general thing we seed grain earlier on Experiment Station that most ranchmen do in valley. They don't seed early enough, that is something we are trying to get them to do. If grain of ranchmen, such as for example Mr. Oscar Sodergreen, were killed before maturity, I ascribe that to later seeding.

Potatoes produced on Holliday Place in 1909 were of Early Strawberry variety. They are a red potato. I know of no other potato that is very nearly like them. They are one of earliest varieties. It is a variety in itself. Agricultural College experiment station at times shows about 150 bushels of Early Ohio potatoes per acre. That is variety grown on largest scale. I think that Early Ohio potato has demonstrated itself to be best potato for Laramie
3993 Plains region. Early Ohio potatoes are planted on Laramie Plains from May 15 to last of month. Our experiments have shown we get best results by planting about that time. Early variety should be planted earlier.

Blackburn Ranch of which I spoke in connection with 1909 crop, is large ranch that has been purchased by people who are seeking to sell it to people in smaller holdings. Cropping that is done there is naturally for purpose of demonstrating, insofar as possible to those prospective purchasers, just what soil and land will produce. I do not know how they measure their grain, for example. There may be a great deal difference and variation between machine measure of a grain crop and the theoretical point measure. At any rate Blackburn people are making particular efforts to sell off this ranch in smaller tracts because smaller farms are better farms than large tracts. It is a colonist project same as you find any
3994 place. Don't know anything about prices, I never inquired. Suppose it is reasonable to presume they are trying to sell it out at a higher price than they paid for it. Presume they are trying to sell it at a profit.

Frost in spring did not injure grain planted in April. It is fact that grains, and particularly some varieties of wheat and also oats, are crops peculiarly frost resisting in their earlier stages and growth.

They are different from other plants in that regard and we only intend to grow these frost resisting crops.

Problem we have is to produce crops that are frost resisting. We do not make a business of growing sugar beets. Stock beets
3995 can be grown later in season. We plant them early part of May. Have never noticed that frost injured any root crops on farm. My observation in this regard is not very extensive. Few people here try to grow those crops. Conclusion from common experience, in regions where those crops are extensively grown, that late spring frosts destroy such crops, is not erroneous, in their locality, because altitude makes a difference. On account of drier atmosphere frosts do not have damaging effect upon any crops at this altitude that they do in lower altitude with more moisture. Severe frosts will kill crops anywhere.

My recollection is that first killing frost in Laramie Plains region is from September 1 to September 15. I do not know date
3996 of average last killing frost in spring for Laramie Station.

Average date last killing frost in spring at Agricultural College Experiment Station at Laramie is given on page 87 of Bulletin 100 of Agricultural College Experiment Station as May 30. As matter of fact if average date of last killing frost at Laramie is May 30, it would be presumed that fragile plants would on an average be killed on May 30, provided they were what we class as fragile or sub-tropical plants, such as corn, tomato-s, egg plants, but not grains or root crops or potatoes. I have had a little experience in South Dakota with all crops. As a professional agronomist, my work at Laramie Agricultural College has been first experience during my life when I have devoted my entire time to the
3997 work. This has extended only four years.

Oats is probably a little more frost resisting than barley and wheat. There is not much difference between oats and barley. Emmer and spelts are equally resisting as oats. Rye is equally resisting. Wheat probably is least frost resisting. It is a fact that certain varities of wheat, known as winter wheat, are planted and propagated under heavy freezing conditions.

Beans do not mature at Laramie Station as a rule. On account of frosts in fall. Growing season is not quite long enough for beans.

Mixed farming, as I understand term, is a system of farming including raising of hogs, dairying and raising of crops on farm that are consumed and fed directly. Mixed farming is combination of stock growing, grain or crop raising. It could be characterized as farming in connection with raising livestock. College
3998 Farm has been using field peas, which do quite well in this region, for ensilage and hay during time I have been here. In 1912 think grew about 15 acres at stock farm and probably 2 or 3 acres at experiment farm. They are grown strictly as forage crop at stock farm. In 1912 they were cured for hay. They were not used for ensilage until 1913. I consider them the best paying crop for forage and ensilage. About 2 to 4 tons is probably obtained from an acre.

Pea hay is weighed when it is hauled. It is always weighed when

hauled to stock farm. Our crops at upper farm are usually hauled to stock farm immediately after cutting. Last year grain crops were hauled down immediately after cutting, when they were in such condition they could not go into barn and be stored for hay. In such condition they would ordinarily be put in stack in field.

It has been custom to weigh alfalfa hay immediately after cutting same as with peas.

Only one crop of peas is harvested each year from the ground.

Two cuttings of alfalfa are obtained on Laramie Plains.
3999 Could not estimate acreage. Alfalfa is grown on experiment farm, Hart Ranch, Frazier Ranch, owned by Mr. Buntin at this time, south of experiment farm, and on Blackburn Ranch. These are only ranches I could mention definitely except some farms in Bosler region were seeded to alfalfa in last few years. Could not state acreage. Mr. Sodergreen has small alfalfa field. Do not think Hart Ranch alfalfa fields are typical.

The 20 acre alfalfa field on south end of experiment farm would probably be best in valley. Next to that probably fields on Blackburn Ranch. These are only fields I have visited and examined. Have never been nearer to Hart Ranch field than along road. Could not say how that field would average. Have never been on Grable or old Fischer Ranch and do not know how his alfalfa field averages.

Weights of alfalfa raised on experiment farm are obtained
4000 on hay scales at time they are hauled to barn or hauled to stock farm. In other words, crop is weighed in condition in which it would ordinarily be stacked in field or stored in barn for hay, well cured. Of course that hay is not as dry as it would be some 2 or 3 months later, if left in field in stack. Have never made experiments to ascertain how much loss there would be between that hay and similar hay taken from stack in field four months later. Could not give any knowledge on that subject except state laws make difference in weight when measuring hay in number of cubic feet per ton after it has been in stack a certain period of time. That involves not only evaporation and shrinkage but settlement as well.

This yield from the 20 acre alfalfa field in 1912 was obtained in the way I have mentioned. Same is true from similar yields from small plats at college farm. They were obtained from two
4001 cuttings of alfalfa. Have not made critical and thorough study of growing of alfalfa in the Cache la Poudre Valley.

I know three cuttings of alfalfa are annually obtained in Poudre Valley and in addition that a forage crop is obtained. We get a forage crop at Laramie after second cutting. Never obtained three cuttings at Laramie. I know that they obtain a fourth cutting of hay in Cache la Poudre Valley.

Under same conditions, I should imagine first and second cuttings of alfalfa hay in Cache la Poudre Valley would be about same as in Laramie. Growth starts earlier in Cache la Poudre Valley than at Laramie. Crop also has advantage in Poudre Valley of more heat during growing season.

It would be reasonable to presume that, in point of growth, first and second cuttings of alfalfa in Cache la Poudre Valley are as good as at Laramie. Am not aware of methods used in Cache la Poudre Valley to determine production of hay per acre. Could not state whether they weigh it at time it is ready to go to stack or ascertain actual dry contents of hay in stack during early winter.

4002 Soils of Laramie Plains region do not contain great amount of humus and are deficient in that regard. That is true of all arid region soils where irrigation has not been carried on for considerable time and crops have not been grown. At any rate that is true at Laramie. On lowest land it is rather hard to keep soil in condition so that fragile plants like sugar beets may push through soil at time of seed germination. It is not true on higher bench lands. It was true at point we had beets in 1912.

It was difficult to keep plat devoted to sugar beets in 1912 in condition so that plants could push through soil at germanation. That is true on the land that is on the level of the same bench as the experiment farm. Soil of Laramie Plains region and particularly in region of College Farm is benefited to great extent by addition of manure to soil, same as any soil would be that is lacking

4003 in humus.

Have not made critical examination of soils of Cache la Poudre Valley to ascertain comparison with Laramie Plains soil. Only know from general observation and reading. That valley has been under cultivation much longer period of time and there is consequently more humus in soil.

I know that considerable areas of new land, native, prairie sod, are being converted into farm lands in that region every year. That land is lacking in humus compared with other land that has been under cultivation for many years, just as our land is. I do not known the actual analysis, physical and chemical, of soil in two regions, but anyone who has made study of soils in general way in United States knows in general way difference between arid region soils and humid region soils. I class in general way all arid region soils as practically same. So far as formation of soils is concerned, there is a great difference between soils in arid region, but not so great so far as humus is concerned.

I have previously stated, in speaking of soils of Laramie Plains region and particularly those in connection with College Farm, as follows:

"At certain seasons of year, no plow except a deep tilling plow could puncture them" (Speaking of soils at College Farm) "and they carried a large proportion of gravel which made cultivation more difficult than it otherwise would be."

I wrote such a letter to Spaulding Tilling Machine Company of Cleveland, Ohio.

Made investigations of soils in sections 9 and 2, Tp. 15, N., R. 74, W. Soil samples have been taken on College Farm immediately west of Laramie. The two places I mentioned were places where I made investigations. Those are only places I made such investigations. Samples have been taken from all parts of experiment farm

in former years, for analysis. It so happens that both Sections 2 and 9 of which I have spoken, are located on that higher bench to north and west of Pioneer Canal area, known as bench land between Laramie River and Big Hollow.

I did not go over into Pioneer Canal area and area under outlet ditches of Lake Hattie system, that is situated south of old original line of Pioneer Canal, to ascertain soil conditions or depth of soil in that region. When I have testified in this proceeding relative to soils and my examinations of them, I have referred to my examinations on these two sections on this higher bench. I have been over soils on Experiment Station farm in casual way. Have not examined them at all. My observation of these other soils would be that observation that might be had by any person traveling over them. Such a person would have the same knowledge of soils that I have. Consider I have some knowledge of soils. Do not think agronomists are the class of professional men who are exempt from errors, but they are studying what soil will grow and engineers are studying what soil is at the time. Agronomists consider what the soil will do under proper treatment. After all they are both looking at soils. It would not be presumed that an agronomist who traveled casually through the country would have as intimate knowledge of the soil of the country as would an engineer who had made a critical analysis and examination.

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I would not assume to speak with as much knowledge of soil of Laramie Plains region as would, for example, Mr. N. P. Niel who made Soil Survey of Laramie Valley area of Wyoming for Bureau of Soils of United States Department of Agriculture in 1903. This was work of Bureau of Soils. Soil Survey is different from simply passing over and observing condition of soil. At same time must take into consideration formation and kind of soil. Do not think they take into consideration future treatment of soil for growing crops. On other hand it is fact that their principal duty is to ascertain value of these soils for agricultural purposes. They are sent out by Department of Agriculture for that purpose and that after all is object of soil survey.

4007

Soil obtained on Sections 2 and 9 was not underlaid with gravel at depth of 4 feet. There was mixed soil. There may be gravel deeper down. There is a little gravel, but not enough to do any harm. I made these examinations with an auger. This is the only auger of that character we have at the station.

It is a fact that Professor Freer of Agricultural college at Fort Collins, Mr. John E. Field, State Engineer of Colorado, Mr. E. B. House, head of Department of Engineering, Agricultural College at Fort Collins, borrowed this same auger through my courtesy during season of 1913.

As matter of fact you can only bore down about 4 feet in soil with that auger. Any sub-surface water reached by that auger would necessarily be within 4 feet of surface, if there was any water there.

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I did not go up into the Pioneer Canal area and further west up

toward Sodergreen Lake and in that community and try to bore down in the soil with the auger. You can find places where the auger would utterly fail to penetrate for over 4 or 6 inches. I do not know whether or not I would have universally failed in the region I mention.

There may be a very gravelly sub-soil under that entire area down to the Experiment Station Farm, in so far as I know. There is better drainage if soil is underlaid with gravel. Not so much danger of alkali. Notwithstanding that fact, there are small lakes of waste water and seepage water standing throughout that area.

4009 I never went over area lying between Laramie River and Pioneer Canal and to examine soil as exhibited in cellars and excavations. My travelling over this area has been mere travel along highways in usual manners. There have been a few farms on which I have gone for examination of crops. I made no examinations there as to depth of soil and soil conditions. Have made no special investigation of where ditch cuts through excavations. Never went out especially for purpose of making observations of such places.

As a matter of fact, my examination of soil of Laramie Plains region is confined to Sections 2 and 9 above mentioned, and College Farm immediately west of Laramie, except in general way.

Necessity of application of manures to soils is covered briefly in my report of 1912 and 1913 and published on pages 57 and 58 of Twenty-third Annual Report of Agricultural Experiment Station for University of Wyoming. That relating to manuring is as follows:

"Another application of barnyard manure was given all of the plats this year and effect is being seen in the marked improvement of the physical condition of the soil as well as in the increased yields.

4010 The past season is the first in which a plow would scour when the soil was at all wet. The soil also has less tendency to bake after irrigation. The plats have received 30 tons of manure per acre in the last three years, and another application of at least five tons per acre will be given this winter. The plats are now beginning to become more uniform."

This simply emphasizes what I said yesterday in regard to that particular soil on Experiment Farm being a heavy clay soil. It needs barnyard manure to loosen it up. Manure increases yield of plats on this tract. It would be just as beneficial on gravelly soil.

This very stiff clay soil of College Farms is located on Section 1, Tp. 15 N., R. 74 W. Soil Experts of Bureau of Soils of Department of Agriculture are entirely wrong if in their Soil Survey of Laramie area they have classed the soil on the Experiment Farm as "Laramie Sandy Loam" because I know that soil for 2 feet down is calcium sulphate, almost a cement.

There certainly are spots throughout the remainder of the Laramie Plains region that are exactly the same. Spots on lower

4011 benches are that way, on upper benches not so, they are gravelly.

Soil Map attached to report of Soil Survey of Laramie Area being

Defendants' Exhibit 154, indicates that soil on this section 1 is "Laramie Sandy Loam" but that is soil on upper bench rather than on low bench. Same map shows that majority of soil shown on exhibit is of the character designated "Laramie Sandy Loam". I would class bulk of soil on upper regions lying west of Laramie River and shown on map as that class of loam, but not so with soil on first bench near river. First and second benches are much heavier soil. This is case near Experiment Station.

Mr. Niel and his soil survey party should have made a thorough investigation of area. They were sent out by the government for that purpose. I have not been up in Plains region to ascertain whether or not soil was quite similar in various portions south and
west of station, except in general way. Have been over sec-
4012 tion and noticed surface.

A critical examination of these soils might confirm the United States Government investigation in that regard.

My examination of irrigation in Cache la Poudre Valley has been very limited. I would not assume to speak with accuracy as to methods employed throughout that region.

Professor L. G. Carpenter is considered one of best authorities on irrigation and would naturally be in position to speak with much more definiteness and certainty in that regard. It would naturally be presumed that having spent most of his years in Cache la Poudre Valley, he would know something about it. He ought to be able to tell what irrigation methods prevail in that valley.

ALPHEUS P. FAVILLE, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

4013 Animal husbandman in charge of University Farm six years last past. Was born and raised on a farm in southern Wisconsin, and lived there all my life previously. B. S., Lawrence College, Wisconsin, 1902. Summer of 1903 I spent crop reporting for a New York firm. The next three years on a farm in southern Wisconsin. 1906-1908 I spent taking purely agricultural work at
the University of Wisconsin. In the summer of 1903 my
4014 work consisted principally of traveling up and down through the middle western states from southern Texas to four or five hundred miles north of Winnipeg, Canada, making three trips over most of that country, in the spring, summer and harvest seasons. The survey was a hurried one, and a good deal of information was gathered from conversation with farmers, reports being sent in each day. Was engaged about three months. Crops were extra-
ordinarily good that year. Have been growing and feeding
4015 crops on the University stock farm. These crops were grown under irrigation and we have fed the surplus from the agronomy farm, including some green crops for silage.

4016 We have gotten other crops from the Plains here very often. Practically all grown under irrigation. Have fed beef and dairy cattle, hogs and sheep, some of them every year since I have been here. Alfalfa, native hay, barley, spelts, silage, field

peas and rape have been fed or pastured. We have ensiled oats, peas, alfalfa and barley. We experiment with substitutes for
4017 corn. The results have been generally very satisfactory in comparison with other places. Based on this winter's feed-
4018 ing experiments with beef cows, oat silage, putting an arbitrary value of $15 per ton on alfalfa, showed a comparative value of a little over $10 per ton. Range steers fed seventy days native hay in the evening and silage in the morning showed gains of 645 pounds, as against 250 pounds for those fed on native hay alone, and placing an arbitrary value of $12 per ton on native hay and the value of 8 cents per pound on the grain, gave estimated value of $9.76 per ton for silage.

4019 Fed to lambs silage with arbitrary value of $15 per ton for alfalfa, showed an estimated value of $7.80 to $9.70 per ton. Fed to dairy cows, fifteen pounds of silage replaces eight pounds of exceptionally choice alfalfa, and is estimated to be about half as valuable. The market prices assumed were probably somewhat low in comparison with eastern prices. Corn silage in
4020 the east is estimated at a value of $3 to $4.50 per ton. Oats silage has not been looked upon favorably there, and is not regarded as practicable. I estimate four or five tons per acre of silage grain fed the past year, and I believe that for sections similarly situated, silage of this kind is going to prove very beneficial.
4021 I do not think it can be raised without irrigation. Field peas as a pasture crop for pigs give very good results, also alfalfa hay and barley. The alfalfa hay grown locally is of very fine quality and I always prefer it to hay shipped in. I regard it as practicable and profitable to produce these crops under irriga-
4022 tion farming conditions prevailing here, and commercially profitable to carry on this kind of farming. The local alfalfa compares favorably with that raised in southern Wisconsin, and the barleys here are remarkably good, the oats much superior to those raised in southern Wisconsin.

4023 Cross-examination by Mr. Fred Farrar:

Graduated from Lawrence College in 1902. Started following summer in crop reporting. Reported for A. Houseman a firm in New York. They were stock brokers and a commission house in New York. Do not know what they did with information. I was simply to give them general information and to general condition of crops. My age is 34.

4024 In making ensilage of oats some of oats were green and some of them were ripe enough to thresh. There is no usual practice with harvesting oats. It is too new. Accepted practice with all ensilage crops now is to let them get pretty well matured. Some of oats were so dry we had to use water. Ensilage is necessarily a wet food. As rule we utilize our crops before stems harden. We encourage practice of siloing crops in this region. Oats put in silo are worth more, if fed on farm, than oats that are threshed for grain. With exception of where oat field is very heavy, think

greater returns would be returned by using oats for ensilage than by threshing them for grain. We find this difficulty, if we thresh oats they don't take straw for anything. If we take oats or hay they don't eat straw readily, whereas if we put it in silo straw
4025 is all utilized. As to whether or not this practice is advisable in this district, rather than to let oats go and to thresh them for grain, depends on circumstances. You cannot lay down any hard and fast rule that will apply to all cases. Speaking of average crop, if man is running dairy and wants some succulent feed, he will find that silage will work into his rations very well, on other hand if he wants cash crop he would not think of putting his oats in silo.

We have used alfalfa. I stated that 15½ pounds of silage (oats) were used for dairy cattle. We put in a very little alfalfa with the oats, just at top of silo. Stock relished alfalfa but we had our experiment under way and could give no definite results on alfalfa silage. I am not satisfied with it. I only know that it comes out satisfactorily and stock cleaned it up. I don't know what alfalfa silage turned out. Succulent feed is valu-e to stock where they have been getting lots of dry feed. In actual practice we find
4026 succulents have value that is not shown by analysis. What I mean is if you use 2 feeds of equal value, one of them succulent and the other dry, you are apt to find that you will get better returns from succulent food. It seems to keep animal in better condition. Whether or not alfalfa is to be used for ensilage depends on how a man puts up his hay, whether there is lots of rainy weather, whether the hay is coarse stemmed, etc. If man puts up his hay in very best shape, saves all leaves, has no bad weather and has hay of fine quality, I fail to see where there would be any advantage in putting it in silo. In actual practice we find that great many farms do not properly cure their hay, many of leaves are lost. There is loss in bad weather through leaching and where stems are coarse stock are liable to leave coarser parts. Under conditions of that kind it seems to me making ensilage of alfalfa would effect a saving.

Whole plan of siloing feed is of necessity predicated upon theory that it will be fed to livestock. There is no commercial value for ensilage that I know of. It does not furnish subject of purchase or sale in any other form than livestock to which it is fed.
4027 It gives a method of securing feeding value of stems as well as seed. It is not a commercial possibility distinct and separate from feeding livestock. All sorts of crops are not utilized by farmers in their silos. In some sections of country they have experimented with fair degree of success with Russian Thistle. It is ordinarily a pest. Conditions are practically same everywhere, that is, if allowed to grow and come to seed it becomes very serious pest. It depends whether you want it for dry farm crop or not. We question whether Russian Thistle is similar in value to Sweet Clover, for instance. When I left Wisconsin Sweet Clover was classed as a noxious weed, I suppose it still is, yet under certain conditions it is considered a useful crop. It is possible Russian Thistle may be found to have certain field of usefulness. It has been made into hay,

and while I don't know that station tests have been made, private individuals have reported that stock eat the Russian Thistle hay readily. Aside from sweet clover and Russian thistle, in corn district of southern Wisconsin you will find that almost every weed that grows in corn field goes into silo, in case corn is grown for that purpose. In practice a great many different crops have been
4028 utilized at different times for silage.

We shipped alfalfa in to this station for experimental feeding because we could not secure it locally.

4030 Cross-examination by Mr. Delph E. Carpenter:

I assumed arbitrary value of $15 per ton for alfalfa hay throughout our investigations, simply as result of this class of work.

If I had assumed a value of $6.00 a ton for alfalfa hay, my other values would be proportionately decreased. In the lot of steers we fed native hay which I valued at $12 per ton, if I had used a value of $8 per ton, value of silage would be reduced 1/3.

In lambs I gave value of $9.70 per ton for silage as against $15 per ton for alfalfa. Had I assumed a value of $5 a ton for alfalfa, value per ton for silage would have been $3.26.

In fattening of lambs with alfalfa at $15 per ton, I gave value of ensilage as $7.80 per ton. If I had taken alfalfa at a value of $5 per ton my values for ensilage would have been reduced proportionately.

No attempt is being made to compare oats silage I used with corn silage of Wisconsin, for values. Corn silage is the standard
4031 silage throughout the corn belt, so in comparing another silage with it, we would compare it as we compare fattening grains with corn, simply because corn has come to be acknowledged as standard fattening grain. We compare barley and all other fattening grains with corn, that would be all comparison that would be attempted in comparing oats silage. We have made no investigation of comparative values as between corn and grain, except in this way:—Last winter we fed one lot corn and alfalfa and another lot of lambs alfalfa and silage, feeding no grain. I cannot give you exact figures on that, but, of course, alfalfa and silage lot made less gain in given time than the lot which were fed corn. We do not, as a rule, compare silage with grain crop. Silage is classed as a roughage so we compare it with other roughages rather than comparing it with concentrates. Silage is valuable as a condi-
4032 tioner. It also has a good deal of feeding value, depending largely on material which is used in making the silage. As a matter of fact, the experiments I have this day reported and values I have given have been values in which both the theoretical feeding value of the silage and its effect as a conditioner were included. By these experiments we obtain the full feeding value.

Henry is one of foremost authorities on feeding and is generally taken as quite reliable.

To take reverse of arbitrary standards fixed by me, suppose value of alfalfa in a community were taken at $5 per ton and the values

of other food fixed accordingly, to obtain value comparative with one fixed by me here today, where I used alfalfa at $15 per ton, you would have to multiply the values obtained in the other communities by three in order to arrive at a value such as I have given.

Dry matter in oats silage was 40%.

4033 It would be possible to compare our feeding results in a general way with results of other agricultural college experiment stations. Conditions in stock feeding vary so that two experiments performed in different places would show more or less variation. Results obtained in practical operation may vary one way or another from results obtained in theoretical and technical tests.

Have only been familiar with irrigation farming since I came to agricultural college at Laramie. When I declare that certain crops are profitable. I do not make that statement from comparison generally through the irrigated west, but simply from local conditions as I found them at Laramie. Also as result of tests made at agricultural college station. In general way took into consideration fixing of land values.

Returns obtained by agriculture on $10 land might be profitable, whereas like returns from $200 land would be a total failure. Value is not entirely fixed by production. You have to figure capital invested. In the ultimate the land value is finally fixed upon the net return obtained.

Further cross-examination by Mr. Fred Farrar:

Stock are occasionally fed solely on ensilage. It is possibly not as successful as it might be with mixture of feeds. The figures I have given are those on silage. The lot I first mentioned in direct examination was of beef cows and we had four in each lot. In the steer lot we had six to each lot. We had two lots altogether. Total number of steers on experiment was 12. For milk cows we simply took the same cows and reversed rations. We had three on this trial where rations were reversed at end of two weeks. We only had three cows in experiment. On experiment with lambs

4035 we had 25 in each lot and all contained in two lots. The silage experiment work was conducted during this past winter.

In my investigations for New York firm during 1903, traveled through states of Texas, Oklahoma, some in Indian Territory, Kansas, Nebraska, the Dakotas and a little in Minnesota and up through Canada. All of this travel was through grain belt region, the wheat district you might call it. It was all in a district where irrigation does not prevail.

AVEN NELSON, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

4036 Professor of Botany at University of Wyoming some 27 years last past, excepting one year's absence. Educated at

State Normal School and Harvard University. Have traveled very extensively in connection with my work over Wyoming, and
4037 to some extent in Colorado, Idaho, Nevada and Montana. Have collected specimens of native flora for the University at all available altitudes, and have been over Wyoming a great many times in connection with my duties as Secretary of the State Board of Horticulture for the past 8 or 9 years. Have published "Key to the Rocky Mountain Flora," (Appleton), and in connection with Dr. Coulter "Complete Manual of the Botany of the Rocky Mountains;" More recently, "The Spring Flora of the Inter-Mountain States" (Ginn and Co.). The Manual is used, I think, as a text book in all of the colleges and Universities of the Rocky Mountain
4038 States, Colorado, Wyoming, Utah, Montana and to some extent in Idaho. Have observed quite extensively the effect of climate and soil on the growth of plants in the Rocky Mountain region and the variations occurring in different zones of altitude and in different soils in climatic conditions. Have observed the effect of irrigation. Have taken note of the frost conditions, length of growing season, etc. A large number of native grasses, sedges and rushes, several hundred flowering plants, altogether 1200 to 1500 different kinds of seed plants on the Laramie Plains,
4039 and the adjacent foothills. I estimate at least 100 different species of grasses grown on the Laramie Plains and the foothills and mountains adjacent. The sedges and rushes are also abundant but not so numerous. All these plants, sedges, grasses and rushes are cut for hay and pass as grasses with the average farmer. By analysis the more frequent species are found to have high food values in comparison with timothy grasses. The grasses some years do not blossom and bear fruit unless irrigated.
4040 Some of them do not head out at all except when furnished with water, when they produce an abundant crop of hay. In very few places is the growth of hay without irrigation sufficient to be worth cutting. Until recent years, the ranchmen were dependent altogether upon the native hay. It has been cut in large
4041 quantities for many years and fed to stock. This includes the sedges and rushes as well as the grasses. On most of the meadows I should think the quantity is usually increased from five to ten times by irrigation. On the uplands only pasturage grows until irrigated. I have observed the gradual development of meadows under irrigation, and the replacement of the original growth with other species as irrigation developed. Timothy is unusually well adapted to the conditions of the Laramie Plains, having originated in high altitudes. It grows near timber line in
4042 the mountains west of Laramie. Have never seen heavier timothy crops anywhere than on the Laramie Plains. The size and stand of the plants is greatly increased by irrigation. Under most conditions alfalfa is fairly successful. The grains adapted to short seasons, such as earlier varieties of oats, barley and rye products produce fair crops. Very good alfalfa is grown at as high

or higher altitudes in the Star Valley in Lincoln County,
4043 Wyoming. Practically all kinds of root crops are grown on the experiment farm here, including sugar beets, turnips parsnips, carrots and rutabagas. Potatoes usually mature, depending upon the variety and the time of planting. Late varieties will usually be caught by the frost. Very successful gardens are found throughout the valleys of the Big and Little Laramie Rivers, and in Laramie, including lettuce, radishes, carrots, parsnips, peas and string beans. Beans do not mature but reach the cooking stage very nicely. Flowers of various kinds are grown very extensively.

We select hardier varieties such as pansies, sweet peas, nas-
4044 turtiums, calendula, the shasta daisy and many others. The variety of flowers grown successfully is largely the same as in other northern latitudes to the east, say Minnesota and the Dakotas. The same is true of garden vegetables, except string beans, which do not grow to maturity and furnish seed. I have practiced as well as observed the growing of garden vegetables and flowers. At other places of greater altitude in the Platte Valley and in North Park, Colorado, I have seen grass crops, alfalfa, timothy, grains and also potatoes grown very successfully. These altitudes are ap-
4045 proximately 8000 feet in places. Indigenous plants adapt themselves to frost conditions and the higher the altitude the more frost they will endure without detriment. Even at altitudes where frosts occur every night, the effect of frost seems to be somewhat proportioned to the atmospheric pressure. The lighter the atmospheric pressure, the greater degree of frost the plant will
4046 withstand. This is true of all plants so far as I know. It happens every once in a while that potatoes on Laramie Plains are killed by frost. The early varieties of crops planted are seriously damaged by frosts not more than once in five or six or seven years. I have never kept any records of damage by frost to crops on Laramie Plains. Oats, barley and rye almost invariably mature, and usually wheat of the earlier varieties. It requires what is ordinarily called a "freeze" in contact with a "frost" to seriously damage crops. With the grains mentioned and alfalfa, two or three degrees of frost or more will do no damage, but if the temperature drops ten or twelve degrees below the freezing point, many of the crops are injured of course. About four years ago a
4047 very marked freeze occurred on August 24th, damaging some of the cereal crops considerably. The temperature for practically the whole night was twelve degrees below the ordinary freezing point. Apples on Mr. Lund's trees that apparently had suffered greatly during the freeze seemed to have recovered themselves and reached a fair state of maturity. Plants seem to mature more rapidly in the high altitudes than in low, and the seed production will take place in a shorter time, in fact, the plants seem to take the whole season afforded them, whether it be long or short.
4048 Indigenous plants adapt themselves to the length of the season. Judging from the crops grown, I think the soil on the Laramie Plains is of fair quality, mostly a sandy loam, warmer than some of the muggy soil in parts of the state. As to the profit-

ableness of farming, I know that ranchmen are raising crops and apparently finding it profitable year after year. I am refer-
4049 ring particularly to the forage crops needed for stock.

Cross-examination by Mr. Fred Farrar:

4049 I used the term "ranch" in general sense that they use it here in the west, a place upon which men grow crops and more or less stock in connection therewith. Particularly a place upon which stock is principal industry and which needs certain amount of feed to carry stock through winter. Agriculture on Laramie Plains is an incident to stock business. Do not think I could separate stock raising from agriculture. If stock raising were eliminated from Laramie Plains I would not consider the Laramie Plains an agricultural section from commercial standpoint with markets we have now accessible. I mean, we do not have population here to consume enough to make it profitable for man to grow ordinary root crops and barley and the like. I do not understand that most agricultural sections are limited in their supply to their local needs. Practice of agricultural sections is to export, but I thought you were referring to growing of garden crops and truck farms.
4050 Think certain crops might be made profitable on Laramie Plains, for instance, oats. No oats or barley are exported from Laramie Plains because there is plenty of stock to take it up. Do not think oats or barley have ever been exported from Laramie Plains.

Laramie Plains have never produced enough food stuff for human consumption to supply local demand.

I do not know whether one would want, under conditions on Laramie Plains, to grow crops for any purpose apart from its connection with stock industry; it is more profitable to do that than to grow for export. I know that in many sections of country principal business is commercial agriculture. Some of grains
4051 could be grown at profit, judging by numbers of bushels and regularity of crops grown. If you limit the Laramie Plains region to crops to which it is adapted, I consider it a region favorable to agriculture aside from stock raising.

Crops which may be grown on Laramie Plains are limited by climate. Not necessarily by soil. Every locality is limited to what it grows. It is a fact that there is an almost complete absence of trees even along streams on Laramie Plains region. Am unable to account for this fact. Have no theory upon which to account for it. Only a few miles out of Laramie cottonwoods grow and then skip again and then near the foothills streams are cottonwood bordered, and it is cottonwood bordered to north end of plains and then when you get through these hills there is a stretch of about 50 miles in about Laramie without trees. It certainly is not due to climatic conditions. What killed them off in first place I do not
4052 know because trees occur at both end of plains. Trees that have been planted have grown in City of Laramie. They are of size and development as you observe. Trees right across street

were set out in early nineties, probably ninety-two or ninety-three, and they have attained height of 50 feet and diameter of 1 foot at base. They are cottonwoods. I think that a fair growth. It is not the rapid growth you would get in lower altitudes, certainly not. The climate certainly has something to do with it, the altitude.

Atmospheric pressure determines growth in a certain measure. The optimum condition for growth is below sea level; that has been determined experimentally and otherwise.

Entire absence of trees, even along streams on Laramie Plains, is possibly due to adverse climatic condition. It may have been due to prairie fires as some have suggested, that young trees were killed out repeatedly at time in possession of Indians. It has been about 50 years since Laramie Plains were in possession of Indians.

4053 Whether or not there has been sufficient time for trees to become reseeded depends upon distribution of seeds. There are cottonwoods upstream. Cottonwoods are very prolific, but conditions for germination may not always be present. Water is one requirement for trees on Laramie Plains. If you plant your tree correctly and give it fair chance and some water it will grow. I stated that plant adapted itself and its time of maturity to climatic conditions. I am speaking of indigenous plants. I would hardly think it reasonable to believe that with exotic plants, naturally accustomed to growing season of four months could accustom itself to growing season of three months and in that time produce same amount of seed or fruit it would produce in its native condition. It seems as though natural consequence would be lessening of production, but not so for indigenous plants. We would have to use indigenous plants for comparison. Native plants tend naturally to produce same kind of seed as same plant did at lower altitude, but it may take more years to reach that condition.

4055 High altitude of Laramie Plains are naturally adapted to grasses. I think they grow more abundantly at that altitude than they do in many instances at lower altitudes, if you give them sufficient water. During some years, as I previously stated, they fail to mature seed at all for lack of water. I think it is true that, except in some favorable localities, you find a heavier sod of native grass on Laramie Plains than you find outside of plains in the mountains. Native grasses even grow luxuriantly at altitudes very much in excess of Laramie Plains. Result is that an altitude such as that of Laramie Plains naturally adapts itself to production of native hay.

Lowest temperature is registered at surface of ground, ordinarily, on still nights at stations established for recording temperatures, rather than a little above the ground. In day time temperature is higher next to ground, if air is still.

Scientific term for sedges is "Carex."

Am acquainted with Professor Elliott Bailey, formerly of Cornell University, New York. He is considered an authority on "Carex" but has not worked in the genus for a number of years.

4056 Cross-examination by Mr. Delph E. Carpenter:

I spoke of early frost prevailing throughout high altitude of Laramie Plains, singling out 1910 as particular instance. In that year frosts occurred on May 2, May 3, June 4, and June 9, and set back all crops except more hardy grains, while frost of August 25 caught even grain, so that very little of it was fit for feed although many places on Laramie Plains, it could be used for feed. I am sure that the August freeze was rather an exceptional condition.

A killing frost and the freeze I spoke of on August 25, 1910, are two entirely distinct things in my mind. A killing frost is one that would catch nasturtiums, potatoes, and things of that kind. The frost of 1910 was a freeze. It naturally froze stems through. There must be a difference in degree of frost shown in the two. I would not say that killing frosts frequently occur in the Laramie Plains in August.

Twenty-second Annual Report Laramie Experiment Station reports killing frost August 25, 1911. There was a freeze August 25, 1910. This freeze is one thing impressed on my mind. Do not remember about 1911 killing frost.

I read from page 75 of Twenty-second annual Report of Agricultural Experiment Station for University of Wyoming for years 1911-12, for meteorological summary for 1911 as follows:

"There were light frosts on the 3rd and 28th of August and a killing frost reported on the 25th, that did not affect anything more than the tender plants. Grain matured perfectly. The fall was very disagreeable and cold and soil froze up by the 15th of October."

I read from the meteorological summary for year 1912 as published in Twenty-third Annual Report of Experiment Station:

"Low temperatures prevailed throughout summer and freezing weather came on so early that much grain was caught and threshing was carried on with difficulty. Ten inches of snow fell September 13 and about a week later another storm made threshing practically impossible. By October 15th the ground was frozen so that plowing was abandoned."

The Laramie Plains is a region where frost may occur in any month in the year.

My attention has been given almost exclusively to indigenous plants of Laramie Plains, except as I have observed crops. Am botanist at Experiment Station and naturally know something of crops. Indigenous plants found in Laramie Plains district are practically same as those found over Boulder Ridge to south and at headquarters of Cache la Poudre River. Different species of course come in in different localities. On those headwaters of Cache la Poudre River, generally speaking, we expect to find same grasses, sedges and flowers and same indigenous plants as exist on Laramie Plains. I think same character of agriculture might be carried on at headwaters of Poudre as on Laramie Plains.

4059 In Cache la Poudre area plants that are indigenous to altitude of Laramie Plains are confined largely to what are called the mountain regions. Some species extend through much wider

range of altitude than other species. Plains of Cache la Poudre drainage are at much lower altitude, but you will find a considerable number of same indigenous grasses you find on Laramie Plains. These indigenous grasses as a rule, are those of quite meager growth from standpoint of annual production. On Laramie Plains, for example, it takes a number of acres of indigenous grass land to support one animal during season unless you irrigate lands, when quantity is vastly increased, in proportion to natural arid condition. I mean that several times amount is produced as would be without irrigation. The production in tons or otherwise per acre, is best known by those who own land and are familar with yield. I am not particularly advised on that subject but have heard estimates made. I never made any measurements. Never made any particular investigations.

4060 A large number of grasses and plants grow even above timber line. In neighborhood of timber line there are a great many beautiful flowers. There are a few above timber line. We find flowers even in region of perpetual snow. We certainly would not class that country as agricultural simply because we find flowers there. During summer months there are a few cattle and other animals which feed at timber line and above and live on the grasses there. Some of the so-called parks are practically meadows. Some of these parks even up at timber line yield very heavily in hay. They yield hay to much greater degree, without irrigation, than do the Laramie Plains region. I think hay production on Laramie Plains would be as abundant if as much water were furnished.

4061 Native hay is raised in Laramie Valley in Colorado from irrigation.

Grasses are a form of plant life that thrive at very high altitudes and in cold climates with short seasons and equally well where seasons are longer if you furnish them with same soil and amount of water. A greater yield in tons is expected in lower altitudes.

Alfalfa grown under short season conditions in cold climate of Laramie Plains does not produce so many tons per acre as it would in lower altitude. Tendency of plant like alfalfa is to mature a little quicker in a more rigorous climate.

Garden truck has been imported into Laramie Plains region for a great many years and still is. While garden truck is raised in some private gardens it is not cultivated on any extensive scale on Laramie Plains. Same is true of fruit, such as apples.

4062 Laramie Plains is by nature a country naturally given to low temperature and short growing seasons. Consequence is that plant life must be of character adapted to such a locality. Feeding of crops grown on Laramie Plains to livestock is about only practical and most profitable way of farming, judging from experience extending over last 40 years.

In ascertaining amount of growth on plats from standpoint of natural fertility, at experiment station, one should not overlook fact that grounds of that section have been manured. Do not have definite knowledge of soil conditions of that station and do not know whether or not plants were ever manured.

There are very few manured fields in Laramie Valley. Best potato crops which have come under my observation have been on unfertilized new land. I presume same is true in the potato producing region of the Cache la Poudre Valley.

4063 Stimulus to plant growth by irrigation is same throughout arid west as on Laramie Plains. Water is necessary ingredient in constitution of plant.

During 27 years I have been at Laramie there has been very little grain exported; most of grain has been consumed at home. If any had been exported it would be in form of grain, oats or barley. Some wheat has been grown but has been used at home.

During these 27 years, a large portion of grain consumed in valley has been imported.

AVEN NELSON.

4063 Redirect examination by Mr. Corthell:

I have frequently noted the temperatures at the University station. The observed difference between the temperature at the surface of the ground and at the standard height of six
4064 feet varies in the extreme from two to five degrees on still nights at Laramie. Referring to the testimony of Professor C. P. Gillette, concerning a species of plant lice observed by him on the Laramie Plains (the cottonwood Aphis), I have
4065 observed this species in connection with my work. Have occasionally found specimens in galls on trees in Laramie, but most generally distributed upon the leaves in the open. Have never examined the gall to determine whether there were
4066 several broods in the gall or not. That certainly is not the usual condition with plant life on cottonwood trees. Successive productions are the usual occurrence, six or seven in the course of the season. The difference occasioned by altitude would consist in the number of broods in a season. The phenomenon observed by Mr. Gillette indicates a condition in that gall abnormal for this region. The prevailing winds at Laramie are southwest to south. In the summer season they are comparatively warm. Very
4067 chilly southeast winds occur occasionally in March, April and May. Southeast and east winds are the most disagreeable. The southwest wind is warm, as compared with the east and northwest winds.

Recross-examination by Mr. Fred Farrar:

4067 Am not particularly familiar with rule commonly known as "Ferrel's Law" governing winds. I should suppose that presence of mountain ranges, particularly higher ranges to west of Laramie Plains, makes considerable modification in direction of wind throughout valley, although prevailing winds in this part of state, as I have stated, one year with another, rarely come from north, except occasionally at beginning of storm or at the clearing of storm.

4068 Southwest winds are our warmest. They are the winds that blow when dry weather may be expected, following a storm.

Winds are very prevalent on Laramie Plains. As matter of fact it blows greater portion of year.

Have not considered tabulation contained in Bulletin No. 100 of Agricultural Experiment Station of Laramie, Wyoming, entitled, "Meteorology for Twenty Years," with reference to prevailing winds.

I have before me Table 36 of Bulletin which covers years 1898 to 1912, inclusive. My conclusions that prevailing winds are from southwest is not borne out by this table. According to table southwest winds are limited to five months out of total months in those 20 years. There are ten months during this period when prevailing winds are from northwest. This does not modify my answer in least. I am not responsible for this table. These records are made by students employed at $20 per month and I do not base
4069 my testimony on records that appear here.

It is true that, with exceptions mentioned, general prevailing wind at Laramie is from west as shown by table covering 12 months for each year.

I think my observation is more apt to be accurate than observation of meteor-logist at Experiment Station. Correctness of my statement can be borne out by way our trees lean. They lean as they would if wind was from southwest to northeast.

Cross-examination by Mr. Delph E. Carpenter:

Professor Gillette of Colorado Agricultural College is recognized as a world authority on "Aphidæ." In other words he is a recognized authority on tree lice. He has written on the subject. He is rather a specialist on that subject. I am therefore the more surprised that he would have passed judgment on one gall. I evidently misunderstood the reading of counsel and would not have been so surprised had he based his record on a number of galls. I based my judgment entirely upon the fact that I thought the reading stated that in one gall this condition was observed. I misunderstood.

HENRY G. KNIGHT, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

4071 Dean of Agricultural College and director of the Experiment Station University of Wyoming for about four years past. Previously chemist for about six years. Collegiate edu-
4072 cation University of Washington, with graduate work in the University of Chicago. Have lived in Kansas, Washington, Illinois and Wyoming. Born and raised on a farm, and during college work, spent my summers there and have been directing the farming operations since I have been director of the Experiment Station. We attempted to carry on a non-irrigated farm for two years after I was director, and a year prior, but I would consider the farm a failure. Our irrigated farming was a success along

many lines. Without irrigation we got no yield of any note, and under irrigation we got a very fair and good yield of crops. Have
4073 traveled over forty thousand miles in the last three years, principally upon the Laramie Plains, which has brought me
4074 much in contact with farming and ranching operations. Irrigated farming and ranching has been successful, some of the principal crops being native hay, alfalfa, barley, wheat, rye, oats, potatoes, field peas, etc. These crops have been raised in various places on the Laramie Plains, some of which I have observed for nine or ten years. The spring and summer frosts apparently do not affect the ordinary crops grown in the valley. Frosts that come the latter part of August do considerable damage to grains occasionally. This has occurred only once since I have been here, I think three years ago. I observed that the same frost had hit the crops in Northern Colorado from a point between Fort Collins and Longmont northward. It did considerable damage in Montana. Crops grown in this region usually mature
4075 and are usable and profitable, producing seed of excellent germination. I have a general knowledge of the soils of the Laramie Valley, having made a general study of them, and soils on the bottom land and on the mesas are generally fertile, such as in the east would be considered a wheat type of soil. Have analyzed
4076 the soils at the Experiment Farm for nitrogen and organic matter. Bulletin No. 7 Wyo. Exp. Sta. "Soils of the Agricultural Experiment Farm, by Professors E. E. Slosson and W. C. Knight," at page 16, gives the following analysis:

Potash	.53 — .64	per cent
Lime	.82 — 3.77	per cent
Phosphoric acid	.14 — .15	per cent
Humus	.16 — .25	per cent

Bulletin 82 entitled "Soil Nitrogen" by H. G. Knight and Frank Smith, on page 24, shows:

Nitrogen	.032 — .126	per cent
Organic matter	2.99 — 5.15	" "

4077 The elements here spoken of, potash, lime, phosphates and nitrogen, are elements which are liable to be deficient in agricultural soils. Iron, magnesium, etc. are usually sufficient. The figures given would indicate the following supplies in weight per acre in a depth of 6¾ inches, viz:

Potash	10,600 to	12,800	pounds
Lime	16,400 to	75,400	"
Phosphoric acid	2,800 to	3,000	"
Nitrogen	640 to	2,526	"
Humus	3,200 to	5,000	"
Organic matter	59,800 to	103,000	"

out of a total of two million pounds of soil.

In a rotation of wheat, oats, alfalfa and potatoes, covering seven years, the supply of potash would be sufficient for 20 rotations; lime sufficient for 16; and phosphorus for 14. This is potash 140
4078 years; lime 112 years, phosphorus 98 years in the top 6¾ inches of soil. In three irrigations in 1895, using 68,185 cubic feet of water per acre, 93 pounds of potash, 174.9 pounds of lime were deposited or more than would be taken out by the crops mentioned. The potash and lime, therefore, are sufficient for all time; phosphates for 98 years nitrogen would have to be added in the form of manures or organic matter. Compared with soils generally in the agricultural regions of the United States in respect to potash, phosphates and lime, would be classed as a good agricultural soil, while somewhat low in nitrogen and organic matter. There is very little difference between the native fertility of the soil over a considerable portion of the Laramie Plains. I found no gravel in lands adjoining the Experiment Farm on the mesas. I found some gravel on the sides of the hills and some of the valleys, but the valleys or river bottoms are all under irrigation and most of them are composed of the most productive soil they have. For the past twenty-two years the prevailing direction of the wind
4080 at the station has been southwest. In January, February, March, April and May that is the general direction. For June, July and August it is southeast. For September it is south, and October, November and December southwest. In May, 1913, the general direction was South, June, July, August and September, southeast; in October, southwest. There was no month when the prevailing winds were north, northwest or west. I have continued experiments or investigations at the University to determine the relative values or cost of crops grown at different altitudes, and found after analysis of a considerable number of samples of grasses of the same species of different altitudes, there was a tendency for the nitrogenous matters in plants to increase with altitude, and for the crude fibre to decrease, and for the carbo hydrates to increase with altitude, in a marked way, indicating that grasses at
4081 higher altitudes are more nutritious. We have carried on digestive experiments with native hay and alfalfa, finding the digestibility high. The report of these investigations is found in Bulletin 69, Wyo. Exp. Sta. I found that the digestibility of the second cutting of alfalfa for the total dry matter was higher than that found by Dr. Heddon of the Colorado Exp. Sta. reported in Bulletin 93.

4082 Cross-examination by Mr. Fred Farrar:

Soil analysis is not a theory which can be relied upon in giving definite idea of fertility of soil, unless taken in conjunction with other things. If you have complete soil analysis, chemical, physical and bacteriological, you can pretty well place the soil.

Physical analysis has as much to do with soil as does chemical. Presence of bacteria has a great deal to do. In arid region where very little bacteria is in soil, we must give greater weight to chemical

analysis than we would otherwise. We must give about equal weight to chemical and physical analysis of soil.

Climate controls crop production largely, it controls it however only within limits. A 50 bushel wheat soil, no matter what your climate, would only give you 50 bushels of wheat. I cannot tell number of bushels of wheat soil will produce from chemical analysis,
but I can tell what limit is. Where I use the term "50
4083 bushels of wheat" in a table I was not referring to amount of
inorganic plant food which a 50 bushel crop of wheat would take out from soil. In other words adopting an arbitrary number of bushels of wheat I have simply adopted a fair crop of wheat that would be developed from chemicals in soil.

Terms "50 bushels of oats," "3 tons of hay" or "5 tons of potatoes," are arbitrary terms, which show that if other things are equal, your soil could stand a drain of that much without taking out all the plant food, nitrogens within a certain time given.

Taking question of soil fertility on chemical analysis alone, you might find even more fertile soil, theoreticially, on top of Pike's Peak than I found in my analysis of soils which I mentioned. It is a fact that some of our mountain valleys at high altitudes are extremely fertile.

Our alkalis appear principally in form of sodium sulphate or Glauber salts, mixed in their quantities with other salts. In my table I only accounted for the potash alkali which is present. My analysis from those samples do not show other forms of alkali.

Laramie Plains is exporter of native hay. Cannot give idea of amount of native hay or alfalfa exported. Some alfalfa has been exported. Could not give amount or am not positive of any being exported since 1912 or more than once. Could not give quantity or
number of years.

4085 As a matter of fact we have been compelled to import considerable alfalfa for feeding purposes at experiment work in connection with agricultural college.

Do not know of any other agricultural products being exported.

Cannot say whether local flour mill at Laramie is in operation nor amount of grain utilized. Do not know how much of the grain is imported and do not have even an indefinite idea. Do not know whether mill operates throughout the year. Some of flour produced in mill is marketed at Laramie but could not state where else.

Fruits, garden stuff and other food stuffs are imported into Laramie Plains. Garden stuff is both imported and grown locally.

Laramie Plains region does not produce sufficient food
4086 stuffs in way of vegetables to supply local demand.

Great amount of flour is imported in to Laramie Plains region.

Other than production of sheep and cattle, Laramie Plains region does not produce sufficient amount of food necessary for human consumption to supply its own needs. It supplies sufficient sheep and cattle for its own need and for export.

Laramie Plains is quite noted as livestock country and has been for a great many years. Livestock is one of principal industries.

From first settlement it has been principal industry of the region. There is no other industry to compare with it in local importance.

High altitudes naturally produce very fine grass. Laramie Plains is blessed with very good grade of native grass.

4087 On Laramie Plains they usually get a first and second cutting of alfalfa and some pasturage.

I mentioned a frost of August 25, 1910, as being serious. I now recall a frost that cut down potato vines but did not otherwise seem to affect crops at Experiment Farm on July 31, 1913.

From memory I will state that average velocity of winds in this section is something around 13 miles an hour.

Winds blow here almost throughout full year, I think that is true at high altitudes. Wind is usually shifting somewhat. Wish you would take one thing into account when you ask that question, that higher altitudes where we are at Laramie, 7200 feet, air pressure is only about 2/3 what it is at sea level, so a 13 miles wind at 7200 feet elevation is equivalent to very much more velocity at sea level because of air pressure. In other words you do not have the air weight behind it.

4088 Nevertheless the wind does blow almost constantly and is usually shifting.

Never heard of Ferrel's Law covering subject of air currents. There is always a revolution of wind about a "low" of storm center. You will also find that there is a change of direction of wind in the Laramie Plains due to contour of mountains and higher elevations surrounding us. We may have, for example, a wind from northeast. When you get next to mountains it may change its direction altogether, which of course, does not conform to the law you speak of.

Have seen winds around 60 miles an hour but would say our average winds here run about 20 miles an hour when we are having fair blow.

4089 Temperature of winds depends upon season of year and direction from which they come. Our winds from south in summer are warm. Winds from southwest are usually warm. Our cold winds are usually from east and north. In early spring when snows lie heavily on mountains we have rather cold winds from southwest.

Fact that plants in higher altitudes are more nutritious applies to native plants and tendency is to apply to plants brought in and grown for few seasons. I should judge there are certain limits to any such statement. I would not make a sweeping assertion.

There are altitudes at which it would be impossible to raise anything and altitudes at which it would be impossible to raise anything except indigenous plants. One must put limitations upon successful cultivation of any particular plant, that is true of any altitude or of any parallel north of the equator. We cannot have tropical plants in Kansas, for example. Neither could we raise bananas in the Laramie Plains. I understand that you are not speaking of extreme but reasonable limitations of plants that might be successfully raised at lower altitudes.

It is possible that while introduced plants might be cultivated at higher altitudes with greater nutritive value, it would be accompanied by loss of volume or quantity of yield. That depends altogether upon species of plant and opportunities for growing. Plants do not yield to rapid changes. They have to be changed slowly. Corn is traveling northward at rate of 5 miles per year. They are growing corn and getting big yields now up in Michigan and Wisconsin at points to Canadian border. So with your production, it does not depend upon altitude, it depends as much upon getting plants acclimatized as anything.

Going from lower altitudes to higher altitudes has same effect as going from south to north.

Altitude at Laramie, Wyoming, figured out according to our best knowledge, is equivalent climatically to somewhere
4091 around Edmonton, Alberta, Canada.

Opportunity for growing for long seasoned plants is necessarily less, but that does not apply. As you go south you find you have not grass country and seasons are long. You have better grass countries further north. It is because at south it gets too hot. In some of states we have difficulty in getting grass started at all, some of our northern grasses, but go up in the Himalayas and there are whole nations of people living there who are growing agricultural plants. I refer you to geographical magazines. That altitude is not altogether compensated by latitude. In Thibet they have high altitude and are further north. I want to state that great many things must be taken into consideration with regard to agricultural crops. Economical conditions must be considered, as to what has caused crops to go up, which has an important bearing upon whether higher altitudes should be used or not. If you go back into history of China you will find in "King's Twenty Centuries of China" he has found in northern China farmers farming dry lands which Americans would not consider worth touching, and the Chinese have farmed them for centuries. You will find in old countries at high altitudes lands used which we would not use in this country because of climatic conditions, but they use them.

On Laramie Plains you find economical condition has been such that farmers or ranchmen, rather, could actually make more money handling stock than they could in growing crops. In fact, one acre of irrigated meadow permitted him to control anywhere from 30 to 100 acres of range lands with small amount of water and so rough broken country throughout surrounding plains is an economical proposition for them to continue at that time and so it leads to production of cattle and sheep. We had good transportation
4092 facilities. But times are changing. My idea is that need creates economy, demand or pressure.

United States Census Report for year 1910 shows rural population of Laramie Plains to be 8/10 per square mile. I cannot argue economical pressure is heavy from that population but it is from east, not from us. 8/10 of a man can't live on nine inches of rainfall per acre, that has been proved.

Records of direction of winds are based on automatic wind machine that takes record every half minute. It gives both direction and the velocity. If wind changes from one direction to the opposite direction you have no equal velocity or prevailing direction, except for those periods and they would cancel each other. If wind was in south and veered only 90 degrees during day, prevailing direction would be southeast, that is case that very seldom arises. I think it has risen two or three times in wind record. If wind velocity is different during day, mileage of greatest velocity is taken. We would consider velocity mileage and time. In other words, if we had wind of velocity of ten miles an hour for five hours from south and wind of 5 miles an hour for same length of time from east, we would compute record upon greater number of miles that wind had blown from south and would call it southeasterly wind. During day you will usually find wind will prevail in certain direction throughout certain period of day. It will vary from southwest to south and we compute it usually by visual observation from our charts for greatest mileage and time as from southwest; we consider it from south if it is from west and blows an hour and finally gets around in south we call it a south wind. It is simply computing time and mileage together. I find a few cases where it is rather difficult to tell what prevailing wind is.

4094 Do not recall having published any wind velocities in my reports. We don't publish them for reason that our records have not been complete throughout. During one year we left out something like half a year and we got out of habit of computing velocity. There is no real cause for knowing or paying attention to velocity of wind since we kept record for twenty years. There seems to be no very great change from year to year and no special reason for publishing them.

4094 Recross-examination by Mr. Delph E. Carpenter:

All wind observations I reported were recorded at station at college at Laramie. General slope of country at that point is from Laramie mountains down toward Laramie River, the slope being westerly.

Digestibility of first cutting alfalfa, dry matter, was 60.39% for Laramie and Colorado Bulletin 93 of Dr. Heddon gave Alfalfa 62.05% for total dry matter, but in this he finds that he has of crude fibre, which is ordinarily considered valueless as a food, 49.94% digestibility, while we get 44.37%. Crude protein in Wyoming alfalfa was 73.33% digestibility and Colorado alfalfa 73.54% digestibility. Nitrogen free extract which includes starches and sugars was 71.80% digested for Wyoming and 70.74% digested in Colorado alfalfa. Percentage of digestibility of dry matter means little if not taken into consideration. This all applies to first cutting of alfalfa.

Do not have the Colorado record of digestibility of second cutting of alfalfa. I only have ours.

Digestibility is determined by actual analysis of feces and analysis

of food that is eaten. First food which is eaten is analysed, a compost simply is taken and analyzed, and then the sheep, cow or animal is fed the food and the feces are saved and are analyzed and this waste matter from body of animal will show undigested food.

I assume Professor Heddon followed same method we did. We used same method he describes. In fact it is standard method for all those who are engaged in digestion work. Doctor Heddon
4096 has been making other investigations and using some other method since. The artificial digestion method is used in some laboratories but neither Doctor Heddon nor I have resorted to it. Alfalfa is bulky food and we could not get competent results unless we make it with animals.

I have enumerated principal crops of Laramie Plains. Various areas devoted to growing of various crops I have named on Big and Little Laramie Valleys in 1913 would represent slight increase over proportion of acreage used for growing of crops during various years I have been here. Average devoted to each of various crops has not increased. I do not know acreage of various crops in valley. I do not know acreage of native hay crop. I refer to valley of Laramie River in Laramie Plains region including Little Laramie River.

4097 Native hay is the great crop of Big and Little Laramie Valleys.

We occasionally have light frosts in August. The freeze of August 25, 1910 affected whole Rocky Mountain Region. Twenty-second Annual Report Wyoming Experiment Station at page 75 shows killing frost reported August 25, 1911. It also says: "Killing frost, however, did not affect anything except more tender plants. Grain matured perfectly." And I may state that is one of peculiar things about our summer frosts here, most stuff seems to recover, it does not seem to affect them, just why we are unable to determine.

When I have spoken of killing frosts for the Laramie Region I have referred only to those frosts which kill everything, grain
4098 and all. In other agricultural regions when they speak of killing frost they use the government rule, where they kill tender plants or plants that usually grow in that district. So that a frost in one district might not do the damage it will in another.

In my official report for 1912 I do not give the date of the killing frost but do report that freezing weather came on early, so that much of grain was caught and threshing was carried on with difficulty. That was condition throughout Laramie Valley and some sections of grain were caught in dough and they had difficulty with it. We had no difficulty with ours at Experiment Station but we had difficulty in threshing because of early snows and whole region here to west of us was affected in same way. Early in September they had everything frosted at Baggs, Wyoming. It is possibly true that July 31, 1913, we had one of these frosts that killed tender vegetables. We have these killing frosts occasionally. I will say they have occurred in the last four years, 1910, 1911, 1912 and 1913.

In fact experts and myself in testifying are inclined to speak of frosts in manner I have already stated, rather than of frosts that

kill everything when we speak of killing frosts. That is natural outcome of observing plant life at this place.

4099 Occasionally grains and potatoes do not reach maturity on Laramie Plains. Early potatoes are usually grown. In Spring plants can recover from frosts more readily, they are not so mature but as for accounting for it otherwise I have never tried to make an explanation. In speaking of garden crops I referred to those raised in home gardens of town.

There has been manure applied to agronomy farm past four winters, but to my knowledge before that time and from records, there were very few plats which had any manure applied to them at all. Bulletin entitled "Soil Nitrogen" of Wyoming Experiment Station gives data concerning that.

Application of manure produced very marked increase for plats, showing land needs organic matter and nitrogen. We went further and tried artificial commercial fertilizers, phosphates, potash and nitrogen on series of plats in Agronomy Farm and compared those. We tried plat with manure and are finding that soils to which artificial fertilizers alone are applied are decreasing in yield while those upon which organic matter in any form is applied, are increasing.

4100 Recross-examination by Mr. Fred Farrar:

It is true that agriculture or crop growing, outside of crops directly consumed by man, on Laramie Plains is conducted in aid of livestock business rather than livestock business being an incident of agriculture. That is true here and at other places.

Importing of agricultural products for feeding of livestock is an aid to livestock industry. It is almost impossible for me with my general idea of agriculture, to distinguish between a country where agriculture is not associated with livestock feeding and one where it is. Agriculture simply means producing food for man and, in the end, through interventions of man, either with plants or animals. I would say that agriculture is in aid of livestock industry. I am unable to disassociate livestock from agriculture on Laramie Plains. We would carry on livestock industry under the old regime without any agriculture as you try to explain.

HENRY G. KNIGHT.

Redirect examination by Mr. John D. Clark:

4102 The average annual rainfall from the records of the University is between ten and eleven inches, about five to seven inches less than in the dry farm districts in Laramie County east of Cheyenne, a little over half occurring from May to August.

4103 Recross-examination by Mr. Fred Farrar:

Records from which I testify to rainfall in Laramie Plains are those obtained from one station and at one spot only.

JAMES MCGIBBON, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

4104 Ranchman on the Willow Creek and Five Mile Creek, about nine miles south of Laramie, since 1885. Have also owned farming lands right north of Fort Collins, Colorado, under the Larimer County Canal of the Water Supply and Storage
4105 Company in the Poudre Valley. Have conducted the farming operations at the latter place about ten years, and about the same time on the Wyoming ranch. At the latter place we have put in alfalfa and oats; have cut the alfalfa twice a year, and figured it out a ton to the cutting, and fed it to our own live stock. I think you can't beat it. Raised alfalfa on our land near Fort Collins
4106 and fed lambs. The alfalfa in both places is good, but we consider that produced in Wyoming worth more than that produced in Colorado, as we have more need of it along with our ranches. I think $5.00 would be about the average price in the stack in Colorado. We haven't been able to buy any here. I think the Hart Ranch sold it for $8.00 last year. The situation has everything to do with the price, there being far more range here than in
4107 Colorado. That increases the value of crops raised here. One year it was touched with frost here in September, but I don't think it hurt it any. That was the only occasion. Thirty-five bushels per acre would be about the run of oats production. We have grown them for about twelve years. They are heavier and better for feeding than the Colorado oats. Frost has never damaged them. Potatoes were the only thing that was injured by frost.
4108 We have grown them right along every year for fifteen years, three to six acres. Our experience is that a frost in August upsets the growth, but if frosts do not occur by the second week in September, they are pretty well grown. They raise something like three tons or one hundred bushels per acre. I estimate, perhaps on the average every other season, not so good as at Greeley. The frost stops the growth but does not otherwise hurt them;
4109 makes them smaller. J. W. Collins put in some alfalfa on the upper part of Five Mile Creek, which was given no attention, but remained for years, showing very well. This was at an altitude of about 7800 feet.

4110 Cross-examination by Mr. Fred Farrar:

Reason alfalfa hay is more valuable at Laramie is that there is more demand than there is supply. We need all the feed we can get. We have a good many sheep and cattle to feed here. We need more alfalfa. I had a farm in Poudre Valley ten years. I was not living there myself. I used to go down in winter and feed lambs there. My home is in Laramie and we have a ranch at Red Buttes. Temperature in Collins is warmer than at my ranch. Do not think there is much difference between temperature of my ranch and at Laramie.

411 Cross-examination by Mr. Delph E. Carpenter:

We raise Early Rose potatoes. Am not well posted on potatoes. We raise the most early varieties of potatoes. We have been harvesting potatoes second week in September.

Do not know price of alfalfa hay at Greeley, Ault and Eaton. Did not know that it had sold around Ault year after year as high as $10 to $12 per ton in stack. Have not kept track of hay market at Fort Collins by day or month. I bought my alfalfa hay
4112 there in years 1899 and 1900, 15 years ago. I know what prices were there last year but do not know for this year. Don't think they are selling any hay this year. Do not know of price of alfalfa in stack. Would not be suprised if I was informed that alfalfa hay sold at $8 to $9 per ton in stack at Fort Collins because Laramie Plains hay sold for $14 per ton for native hay and they were glad to get it. Think in fall of 1912 I sold hay at Fort Collins for $7 per ton in stack.

Alfalfa hay is measured as a rule in Fort Collins region after it has been stacked and settled for quite a while.

4113 It is measured in early winter. Sometimes alfalfa hay is cheaper in fall in Cache la Poudre Valley than it is in spring. I suppose it would hold good as a rule. Value of alfalfa hay in Cache la Poudre Valley is fixed by demand.

LEWIS J. HOLLIDAY, a witness in behalf of the Complainant.

Direct examination by Mr. John D. Clark:

4114 Have been farming 5½ miles southwest of Laramie (Sec. 10, Tp., 15, R. 74), 1910-1914, inclusive, on dry land, and in 1913 on irrigated land also. In 1910 I had 15 acres of spring rye yielding about thirty pounds to the acre; seven acres of barley, which was a total failure, growing from three to five inches high.

4115 In 1911 sixteen acres in rye, cut for hay, yielded about one-fourth of a ton to the acre. Also tried some alfalfa, the ground being in good condition. It sprouted well but a good part of it died out during the summer for lack of water and the rest of it winter-killed. Probably twenty-five plants came up the next year. One acre of garden beets yielded about 200 pounds, averaging about two inches in diameter. Three acres potatoes yielded about 1500 pounds; one acre of carrots was an entire failure, only a few coming up; one acre of rutabagas about 3½ tons to the acre, running up to four inches in diameter.

In 1912, 22 acres of rye and oats yielded about half a ton of hay per acre in two cuttings. The oats grew about six inches high.

In 1913 about 20 acres of oats yielded nothing. About one-fourth of the field grew to a height of about six inches, about one-half only three or four inches, the rest did not come up at all. Cut about five acres in which Russian thistles grew, which made a mat thick enough to rake. In 1913 two acres of sweet clover did not come up at all. About 500 pounds of seed potatoes planted
4116 on two acres yielded 37 plants, producing 1¼ pounds. These were all on unirrigated land. In 1913 I had same irri-

gated crops under the North Canal of the Lake Hattie System, just completed. First delivery of water was about July 20th. One acre of rutabagas did not come up until the water was turned on. Irrigated about August 1st. They came up pretty well but did not develop beyond a fair stand about an inch in diameter. An
4117 acre of turnips, only a few of which came up before they were irrigated. Afterwards they came up pretty well and I harvested about a ton. 20 acres of oats and peas first irrigated about July 20th, when the gophers had eaten all the pea seed before they got sprouted. Some of the oats were on high land which could not be reached with water and grew from three to eight inches high. The irrigated part grew about 24 inches high, yielding about four tons per acre green weight; put in silo. Four and a half acres of sweet clover planted in 1913 did not make any growth until irrigated, when it became a pretty good stand, 24 to 36 inches high over about half of the plat. The other half did not have any water. Thirty-one acres of alfalfa planted after a heavy rain in July did not come up until it was irrigated. The irrigated part, about 23 acres, had a very good stand and this year is getting on nicely. I bought nine acres of oats that were planted on the Stickney farm under the Pioneer Canal, which threshed out 435 bushels, exclusive of four loads hauled home without threshing. The latter fed
4118 six horses a little over six weeks. After fairly covering the cultivated land with water, I turned it on the native pasture grass that had been pretty well eaten off and gave the grass a new start and I had a second growth that was about equal to the first. This year it is fully fifty per cent higher than the grass that was not irrigated, though having no water since last September. A farmer about two miles north had in about 20 acres of oats last year without irrigation which I tried to cut but found them too short. There was practically no grain in the heads, and above the sickle there was only about four inches of stalk left. My brother had some millet on dry land that came up pretty well, but was too short to rake after it was cut with the mower. He also had in oats, sweet clover and potatoes, and mixed oats and peas, from which he got nothing and they were not harvested. On a little patch of land that had been in rye previously, he had a scattered volunteer stand which grew up pretty well and headed out. From my experience, it is not possible economically to raise crops in the Laramie Plains region without irrigation.

4119 Cross-examination by Mr. Fred Farrar:

Several of professors at University told me of great stands of sweet clover that had been raised around Laramie but in fields I have planted I have not seen a success on dry land. Sweet clover is cut for hay. In other sections it is to certain extent considered a pest. Have understood it was formerly included in noxious weed list but has been taken out. Have seen it praised quite highly as feed. Russian Thistle is considered a pest over practically all of United States where it prevails. Sweet clover is good crop for preparing

land for other crops on account of its large roots that go down considerable depth and break up and loosen soil.

Sweet Clover or Russian Thistle are not raised where anything else will grow. I am a farmer in the sense of one who tills the soil. Have been in the lumber business.

JAMES HARDMAN, a witness in behalf of the complainant.

Direct examination by Mr. N. E. Corthell:

4121 One of the original Union Colony settlers at Greeley, Colorado, in March 1871, living there in '71, '73 and '74. Came to Wyoming in the fall of '74 and have been a resident on the Laramie Plains ever since; 22 years on Sand creek, where I
4122 took up some land in '78 and I have lived there and carried on a ranching business there for 22 years, raising principally native hay and about five acres of oats. The native hay was the best crop, irrigated land yielding about a ton to a ton and a quarter an acre. The first ten years I had about 150 acres of meadow. Later on I had more, up to about 230 acres, and about 40 or 50
4123 acres irrigated pasture additional. Could not grow hay without irrigation. I raised potatoes five or six years, the first three years on bottom land, where I lost my seed. Afterwards I moved up on to higher land and raised some very good crops of potatoes; yield, 80 to 100 sacks per acre. Also raised some turnips, yielding about 15 tons to the acre. Had very good success raising oats several years, as good as I ever saw on the Poudre. The
4124 potato vines were nipped once or twice so slightly that no damage ensued. One year it froze and the potatoes near the surface were touched. They matured previous to the frost, however. A neighbor raised fine oats and one crop of fine barley and always had a fine garden for 12 or 14 years, including radishes, onions, cabbage, cauliflower, spinach and such. These crops matured.
4125 In 1898 he raised 10 rows of sugar beets, which yielded, I estimate, from observation of Colorado crops, at the rate of about 15 tons per acre. Another neighbor, Mr. Hoge, raised good crops, including wheat, yielding fully 44 bushels to the acre, which fully matured. I bought some and put it in on my place and lost it through lack of water. Hoge had some exceptional alfalfa, yielding about 3½ tons to the acre. During 1906, '7, '8, '9 and
4126 '10 I had a place in town and every summer used to go out in the country and follow the Pioneer Ditch, looking at the crops and passing through them to examine them. I visited six or eight places I suppose between Laramie and Sheep Mountain, seeing some fine crops of alfalfa, oats, potatoes, beets, turnips and garden stuff at six or eight places, including the Experiment Farm. The crops have good yields. I would say an average of 40
4127 bushels of oats per acre, three or four tons of alfalfa (in two cuttings). The altitude in my neighborhood on Sand Creek is 7250 feet. During the four years I lived at Greeley they tried to farm a good deal and failed for want of water. I was offered

the use of land if I would put a crop in. On the tract near
4128 the residence of N. C. Meeker, I raised a nice crop of potatoes, some corn, cabbage, cauliflower and a few onions and radishes; some wheat was planted which was a failure for want of water. In '72 they got water through No. 3 ditch but not enough, and it washed out once or twice playing havoc with the crops. One man raised 44 bushels of wheat to the acre that year. As a general thing the yield was not very good. In '73 crops as a rule were good, and would have been good in '74 if the grasshoppers had stayed
4129 away. They destroyed the crops with the exception of those of a few parties in one locality. Since 1874 I have been in the Poudre Valley at different times each two or three years observing the crops grown.

In 1871 or 1872 potatoes yielded 80 to 100 sacks, which was about the general yield in that neighborhood at that time, and until they began to turn the alfalfa under when the yield began to rise with most of the crops. They had been sowing wheat so often that
4130 they got down as low as 15 bushels to the acre; when they turned the alfalfa under it began to go up and I have seen as high as seventy bushels to the acre. Wheat is rather too recent here to run the risk, but oats come up pretty close to the Greeley crop. Alfalfa about a ton to the acre less than at Fort Collins or Greeley. Potatoes do not yield so much here as there, but they are very little different from what they were there before the alfalfa was turned under.

4130 Cross-examination by Mr. Fred Farrar:

I consider wheat a risky crop on Laramie Plains because wheat is a much slower growth and requires longer season.

4131 Cross-examination by Mr. Delph E. Carpenter:

In determining tonnage of alfalfa on Hoge Ranch we measured stack and computed tonnage by assuming 422 cubic feet to the ton. I would be somewhat surprised if I knew that Mr. Hoge had frequently stated that he averaged two tons of alfalfa per acre for the season. Have seen alfalfa that think would cut more than that on that ranch.

Have not been up along Pioneer Canal this year.

Raised Early Rose and Early Ohio potatoes on my place. Harvested potatoes October 1, depending on season.

Do not remember acreage Mr. Hodge had in alfalfa. Have traveled over Cache la Poudre Valley from La Porte to Delta. Was down there in '76, '80, '86, 1900 and 1903. In 1900 was
4132 down there on a visit for a week or two. Am 77 years of age. Did not go out and measure crops in Poudre Valley but knew people and found out by asking and found that my guess was not far from wrong. Inquired from Mr. Goetz and Mr. Moore who is now dead. He was farming in 1872. He started in
4133 with Greeley colony. Refer to Squire Moore. He lived and died at Greeley. He died there several years ago. Also knew other men who lived at Greeley.

W. P. SCHOTT, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

4134 I have lived for four years on the John A. Fischer place about 17½ miles southwest of Laramie near the Big Laramie River and under the Fischer Ditch. Previously lived in Nuckolls County, Nebraska, about 15 years, and for 36 years (all my life before that in Pennsylvania on a farm. Have grown oats, potatoes, alfalfa and prairie hay in Wyoming under ditch.
4135 and when I had water I had good crops, better than I have ever raised any place else, which matured and yielded well,—about 45 bushels of oats per acre, maching measure, weigh-
4136 ing 43 to 48 pounds to the bushel. Potatoes about 100 bushels per acre matured and of fine quality. About two tons of alfalfa per acre and about one ton of native hay per acre. Had difficulty in getting water two years out of four, the gates being
4137 closed down by the Water Commissioner upon complaint of the Wheatland project, in consequence of which I lost about 3000 bushels of oats in 1913.

In 1912 we had water and got good crops. In 1911 the Water Commissioner closed down my gate for Hans Olson, when we were going to use the water for oats and we did not get much of a yield.
In 1910 I was a green man, the water was low, and I did
4138 not get much and did not understand how to apply it, but we got good hay. In Nebraska I farmed 200 acres of wheat and 200 acres of corn every year, and also raised potatoes. In Pennsylvania I raised clover, timothy, corn, oats, wheat and potatoes. In Wyoming the grain berries are larger and better and better filled than they are in either Pennsylvania or Nebraska, and the quantity was better. Nebraska was poor on account of lack
4139 of moisture. Potatoes also are better, both in quantity and quality. From my experience I believe it is practicable to raise cultivating crops under irrigation in Wyoming successfully from a farmer's standpoint.

In 1913 I had Section 8 and the North half of Section 21, Tp. 14, R. 74. On Section 12 there was a little alfalfa but it was pastured and run out. Last year I had oats on Section 21 and a few potatoes; 20 acres of oats yielded 50 bushels. In Section 8
4140 I had oats but only got about three acres irrigated. In Pennsylvania the oats raised weighed close to 32 pounds per bushel, in Nebraska 19 to 32 pounds. Last year in Section 21, for lack of water, we got only five or six tons of hay. In other years we got three or four big stacks from about 30 acres.

4141 Cross-examination by Mr. Delph E. Carpenter:

Raised a red potato, suppose they were Early Ohios.
Water turned off Fischer Ditch during forepart of July, 1913.
We obtain two tons per acre from two cuttings of alfalfa during each season. Alfalfa I raised was on what is known as Harley

Grable place. It is one of the good alfalfa fields of the valley. There is better alfalfa at Heart Ranch.

Alfalfa hay at Heart Ranch is better than alfalfa hay at Harley Grable Ranch. Alfalfa at Heart Ranch is newer sod. Alfalfa at Grable Ranch has been sewed for 15 to 20 years I understand.

R. I. MEEKER.

Direct examination by Mr. N. E. Corthell:

4142 I heard the testimony given by John E. Field, at Denver in relation to waste of water on Laramie Plains and recall roughly his testimony on that subject, applying to the area lying along the Pioneer Canal from a point South of Lake Hattie Reservoir to a point near Fraser's Ranch, taking in also the area in the neighborhood of the Soda Lakes, and the area to the North of the Pioneer Canal as well as to the south. Since this testimony, I have examined anew this section of country with this testimony especially in view. I was also over that neighborhood at different times in 1912, 1913 and 1914 and became reasonably familiar with it. A recent examination of this area shows 261 acres of
4143 seeped waste land. That land is pretty well saturated with water and has alkali on it, produced no plant of value for stock feeding; should be classed as thoroughly waste; of the general character described by Mr. Field, except that he went a little further and said that it was practically barren. It supports alkali weeds and very small vegetation of no value.

I also heard Mr. Field's testimony in regard to similar areas in the vicinity of the Bath and Alsop Lakes and the Little Laramie Valley, and have since made a particular examination of that region. Excluding land in the big basin not now covered but later in the season covered with water, I would say that in the vicinity of the Bath and Alsop ranches and through that portion of the country there is not to exceed 50 acres of seeped waste land. This region was examined on the 18th of May and the area under the Pioneer Canal on April 16th. Since Mr. Field's testimony, I have made a trip through the Poudre Valley in Colorado on April 20, 21,
4144 22 and 23 by automobile for the purpose of examining the irrigation and farming conditions in that valley, and also the areas of seeped waste land and water surfaces, etc. I took note and platted on topographic sheets the larger areas encountered of seeped waste lands, amounting to 1441 acres. I covered approximately 100,000 acres, about one-third of the irrigated lands in that valley. The seeped areas are very similar to those found on the Laramie Plains. I also examined the irrigation works, dams, headgates, reservoir embankments, etc. in the Poudre Valley, and made
4145 photographs. The notations or descriptions on the back of these photographs show when they were taken and describe the objects shown. The protographs were taken with the idea of getting some of the best classes of structures and also some of the inter-

mediate and poorer classes. They show also some of the seeped areas referred to and are fair representations of their subjects.

Photographs introduced in evidence and marked Defendants' Exhibit Q. 1 to Q. 20 inclusive.

4146 Exhibit Q. 20 shows Pile Division Dam of Box Elder Ditch on Poudre River below Fort Collins. It is in very poor shape, portions having washed out and some drift collected. The ditch when examined was not in use but showed evidence of having water flowing through it this year. It is a moderate sized ditch about eight feet on the bottom, carrying about 30 second feet. Name taken from Fort Collins Quadrangle Topographic Sheet of U. S. G. S. Headgate north of quarter section corner of Section 20, Township 7, Range 68. This dam is a poorer dam than those
4147 of similar size on the Big Laramie River in Wyoming, though originally a very good dam. A little increase in elevation would turn water into the ditch.

Exhibit Q 19 shows Rock Diversion Dam of the Ames Ditch at the city limits of Fort Collins, a temporary dam repaired
4148 from time to time after washing out. The ditch is one of the smaller ditches, three or four feet wide on the bottom. Dam would not be effective or efficient at low stages.

Exhibit Q 18 is a log crib and loose rock diversion dam for the Canon Ditch, located a short distance above the Poudre Valley Canal, a small ditch of a few second feet capacity. A semi-permanent dam, probably washed out occasionally by high water, and there are similar dams in Wyoming on the Laramie River.

Exhibit Q 17 is a log and loose rock diversion dam of the Greeley Municipal Water Supply, one of medium size, occasionally
4149 washed out and repaired from time to time as shown by piles of loose rock on the river bank, etc. Unless repairs are made from time to time, it would gradually lose its efficiency. At low stages the flow of the river is greater than the needs of the Greeley supply, so there will always be an excess of water there. There is always water wasting over this dam, required by other ditches below.

Exhibit Q 16 shows a log crib and rock-filled diversion dam and head works of the Poudre Valley Canal, located farthest up the canon of any of the ditches that supply the valley. This is one of the largest canals in the valley. The dam formerly extended directly across the river from the head-works, but portions have been washed out and a wing dam has been constructed, a semi-permanent structure subject to destruction in portions by heavy floods.
4150 The dam is efficient for its purpose as the diversion is one of the junior rights and a large amount of water must of necessity pass over the dam at times. There are similar dams on the Laramie River, i. e., Tunnel Diversion Dam of the Wheatland Project. The headworks are a fair type of construction, consisting of concrete abutments with wooden gates. It represents the intermediate class of structures, the best type being concrete and the poorer type loose rock dams with brush and logs. These three classes also prevail on the Big Laramie River in Wyoming.

Exhibit Q 15 shows wood diversion dam and headgates of Colony No. 3 Canal above Greeley, one of the oldest on the river.
4151 Most of the appropriations occur above this dam, which is of the intermediate class, and fairly permanent for a wood dam. The headworks shown in the foreground are constructed of wood piles, no concrete, and with wooden gates. A new concrete flume just below the headworks was put in this spring. The canal is intermediate in size.

Exhibit Q 11 shows the waste and stop gates of the Arthur Ditch above Fort Collins, in Section 3, Township 7, Range 69. It
4152 is a pioneer headgate constructed of piles and wood and was in fair repair. There are very similar structures both on the Big and Little Laramie Rivers. This is one of the smaller ditches carrying probably in excess of 25 second feet.

Exhibit Q 14 is a board diversion dam of the Arthur Ditch above Fort Collins. Would be classed as intermediate in type and represents some of the earlier practice in construction of diversion dams on the Poudre River, and is of a better type than a great many on the Big Laramie River in Wyoming.

4153 Exhibit Q 13 shows headgates of Spring Creek Ditch below Fort Collins, one of the older types of construction with wooden headgates dam. It is of the intermediate type of diversion works and serves a large canal 12 or 15 feet on the bottom. There is There is no concrete construction.

Exhibit Q 12 shows concrete and wooden headgates of Arthur Ditch, one of the intermediate type but with concrete abutments.

4154 Exhibit Q 10 is a joint concrete diversion dam of the Larimer and Weld Ditch, and the Larimer County No. 2 and the New Mercer Canals, an example of the more recent type of construction on the Poudre. All are large ditches, being the three principal ditches diverting water from the Poudre River, and representing the best type of construction found on the Poudre. The Pioneer dam on the Big Laramie River in Wyoming is directly comparable with that. The diversion dam of the Weatland Canal No. 2 on Sybille Creek is a similar type. Sacks of gravel on top of the concrete dam are shown in the picture, being a temporary experient used to increase the elevation of water in front of the headgate.

Exhibit Q 9 shows the concrete diversion dam of Larimer County Canal and Water Supply and Storage Company on the Poudre River. This is of the best type of construction, namely, concrete.

4155 This is also one of the larger and principal canals diverting water from the Poudre.

Exhibit Q 8 shows a section of the Poudre Valley Canal with an unrepaired break in the outer bank about three miles below the headgate, looking down the canal. This canal is one of the units of the Greeley-Poudre Irrigation System. The sacks shown in the picture were placed to protect the canal against water overtopping the bank. The ditch carries roughly about 200 second feet. If

more water had been turned down it would have endangered this unfinished break, which apparently occurred in 1913.

Exhibit Q 7 shows a loose rock rip-rap on Fossil Creek Reservoir Dam. The inside slope being very steep, the rip-rap is buckling and slipping in places. This is one of the largest reservoirs in the Poudre Valley. The embankment is in very good condition, but the rip-rap is in very poor condition in places.

4156 Exhibit Q 6 shows concrete facing of Terry Lake Reservoir, another large enterprise. This facing is of the best type and in excellent shape. The Fossil Creek construction would be classed as intermediate and Douglas Lake Reservoir dam would be classed as the lowest type of construction.

Exhibit Q 5 shows a house and barn within the irrigated area under the Larimer County Canal in S. W. ¼ of S. W. ¼ of Sec. 14, Tp. 8, R. 69. The buildings are vacant and dilapidated. I observed other similar buildings and lands adjacent of similar character, some poorer, some better.

Exhibit Q 4 shows seeped waste and alkalied lands in Sec. 33, Tp. 9, R. 69, indicated by the whitish tinge, showing an extreme condition. Some land in the foreground is also seeped and waste

4157 land.

Exhibit Q 3 shows seeped waste and alkalied land in Sec. 28, Tp. 8, R. 69, the light color indicating a portion of the alkalied area. This is one of the heaviest pieces of waste and alkalied land I observed.

Exhibit Q 2 shows similar land in Sec. 19, Tp. 8, R. 68, beyond the second fence in the picture, the foreground being plowed ground.

Exhibit Q 1 shows similar land in Sec. 19, Tp. 8, R. 68 covering also a portion of the lands shown in Exhibit Q 2.

The concrete facing on Lake Hattie Reservoir on the Laramie plains is of the same type as that on the Terry Lake Reservoir and compares very favorably. Examined the first four miles of the Poudre Valley Canal, the main diversion canal of that District. I believe there are also some small feeders from intercepted tributaries of the Poudre or South Platte. This canal is the primary means of carrying water though they can secure water by exchange from reservoirs above or below their canal lines. Water could be exchanged and carried through the extension of the Pierce Lateral and also through the Middle Lateral. The first sixteen miles of the

4159 Poudre Valley canal is practically completed, although in order to carry its intended capacity of about 800 second feet, a section constructed on a steep hillside through shale would have to be lined with concrete to insure safety. There was considerable seepage on the slopes below the canal. It was seeping heavily in Sec. 18, Tp. 8, R. 68 on the hillside, and a strip of land about a mile in width immediately below this canal shows seepage for a distance of about eight miles below the point where it leaves the Poudre cañon. The seepage has been considerable early in the season, when carrying less than one-third of its capacity, and at full capacity, the seepage would be large. Examined the extension of the canal for the Greeley-Poudre District, making examinations of sections from

time to time to a point about eight miles southeast of Wellington.

4160 A short distance west of Wellington there is an uncompleted section where shale is encountered. This is unexcavated and there are stretches beyond Wellington apparently where no right of way has been secured which are unexcavated. Some of these sections are about half a mile in length so that a large amount of construction must still be done before water could be run to the heart of the district through the main canal. In the vicinity of Wellington I would say that the seepage would be near that of existing canals, but farther on into the Greeley Poudre Irrigation District, where the soil is more sandy, the seepage losses would undoubtedly be greater.

4161 The soil in the District lying east of the Union Pacific Railroad branch from Camfield to Purcell is more sandy than the general run under the existing large canals in the Poudre Valley. I observed some lands being dry farmed within the irrigated areas of the district, numerous tracts, some of them large, some appearing recent and some of some years' standing. Considerable dry farming was also being carried on along the foothills and along the interstices of the irrigated areas overlapping into the irrigated portions, especially under the North Poudre Canal. Assume that dry farming is successful because of the large area so farmed.

4162 Cross-examination by Mr. Delph E. Carpenter:

Heard part of Mr. Wortham's testimony relative to improvements and enlargements contemplated on Poudre Valley connection with Greeley-Poudre System. Am not familiar with specifications as to fact that concrete lining is contemplated around the steep hill of which I spoke. If there were a mile of concrete lining it would cut off seepage.

I did not consult with those who have made careful and detailed investigation of seepage of Poudre Valley Canal. Did not know that such losses had been measured for canal. Know that seepage at Shipp's Hill area was large, but did not know 90% of seepage

4163 for entire canal was on Shipp's hill area or that this section is to be lined. Beyond section of which you speak, canal is seeping badly as I have heard. There is nothing surprising in canal constructed newly through region, even in Laramie Plains region, losing water from seepage. We expect some seepage from these canals constructd on side hill, especially in early years. Do not know how many years Poudre Valley has been constructed or operated.

Poudre Valley Canal is above all other irrigation canals in Poudre Valley. Water seeping from it is caught up and used by other canals, with exception of loss by evaporation. On portion extending along canal from one-half to a mile wide there are some ponds, occurring between Poudre Valley Canal and Larimer County Canal, which would intercept some of these seepage waters and they would never be utilized by other canals for irrigation.

Do not know seepage of Larimer County Canal immediately

below this Poudre Valley Canal, 20 years ago, when it was constructed, nor whether it seeped in early years about as bad as the Poudre Valley Canal. Know that canals fill up in measure and seepage decreases after they have been in operation a number of years.

4164 I observe Exhibit Q-16, a photograph of log crib and rock filled diversion dam at headworks of Poudre Valley Canal. Do not know what plans Greeley-Poudre System contemplates for construction of diversion dam at that point. I did not state that structure shown in picture is final structure of that system. I exhibited picture as representing existing conditions. Did not hear Mr. Wortham's testimony to effect that very expensive concrete or reinforced concrete structure was to be put across river at this point.

Did not know that section of canal shown as rock crib in picture where man is standing was supposed to be covered with concrete.

If a large concrete dam is put across river and new diversion gates of most modern pattern and general concrete bank covering and reinforcement where rock cribbing stands, costing upwards of $30,000, is installed, it would somewhat improve present condition.

4165 Did not know that that was part of the plan of the Greeley-Poudre System and do not know their plan of construction of improvements.

Portion of canal in vicinity of Wellington which is incomplete is where work must have stopped.

Believe I heard it alleged that construction of the Greeley-Poudre System was stopped as result of this suit. Have heard it so stated under oath in this case.

My knowledge of reasons for conditions I find on Greeley Poudre System is quite limited. Simply made field examination to find status of canal as it is.

4166 Knew it was intention to ultimately complete Poudre Valley Canal and to enlarge portion from headworks down. Presume when canal is repaired and concrete lining put in, capacity will be increased. This will be necessary if they are going to have ample water supply for area of land contemplated.

Poudre Valley Canal is principal canal of system. I stated capacity about 800 cubic feet per second. I did not consult Mr. Wortham's testimony to find out how large they intend to make this canal and of what carrying capacity. If he stated it was to be 900 cubic feet per second it is probable that he knew whereof he spoke. I am not disputing any statements made by him.

It would be necessary to carry greater portion of water through this canal in order to water Greeley-Poudre District. If canal were allowed to lose water by any means it would not reach district. I really feel that competent engineers in Poudre Valley are able to cope with that situation when they meet it and at the time when the canal system is completed.

4167 Did not follow line of Laramie-Poudre Canal, being extension of Poudre Valley Canal beyond Cobb Lake Region. Did not go beyond county line between Larimer and Weld

Counties. I only intend that portion of my testimony concerning sandy condition of soil to apply to portion of canal east of Nunn and Pierce. Was in vicinity of McGrew Lake. Did not notice character of ground excavated in ditch near that point. Saw some laterals that had been excavated and where furrows had been plowed and noticed sandy condition of soil and where sand had blown and lodged along fences and some other parts of district. Do not know that same condition prevailed on original Larimer and Weld Canal area. Did not know that all of the land under that canal was so light that it blew easily in early days of reclamation. Observed considerable sand up around Camfield and Purcell and east of there. Did not dig down to ascertain how deep it went. Saw two or three laterals where cut was 2 or 3 feet deep.

Did not investigate extension of Union Colony Canal No. 2 where it forms southern border of district near town of Barnesville. Did not know that that canal traverses a mile or two of localized sandy area commonly called sand hills. Did not know that water is conveyed through these sand hills easterly across Crow Creek and down on east side of creek in vicinity of Wadlin Reservoir where it irrigates some 3,000 or 4,000 acres. Am not familiar with conditions there. Am not aware of fact that in third year of use of that canal seepage was not any more in the sandy portions of the canal than it was along whole line.

If any water should escape from upper line of Greeley Poudre Canal, the lands that would be moistened by the water so escaping would be within the Greeley-Poudre District. If it should finally form into seepage or return water streams in the depressions, the lower portion of the Greeley-Poudre District could accumu-
4169 late and re-use the water. The middle or center lateral portion would so use it as would also the March Reservoir and Camfield Reservoir. It would be entirely feasible for the various land owners throughout the region to utilize the seepage water to the same degree and in the same manner as they do elsewhere in the Cache la Poudre Valley.

Observed some use and re-use of water by accumulation in seepage reservoirs and streams throughout Cache la Poudre Valley.

It is not my intention in my testimony to make prophecy of how the Poudre Valley Canal will appear when it is completed as contemplated by the Greeley Poudre Irrigation District.

Do not know what the loss of water is through the 80 to 100 miles of Union Colony Canal No. 2 in the Cache la Poudre Valley, or of the Larimer and Weld Canal. Know generally that it has been stated that losses in Poudre Valley approximate about 30% through canals in transit. Believe that includes both canals and
4170 general distribution works. Nevertheless this water which is lost in Cache la Poudre Valley from canals and reservoirs goes down into earth, reappears again and is put to use, several times over, before it finally returns to principal stream, when water table is built up sufficiently to bring it out upon lower lands.

Peculiar condition is that return and seepage water usually reappears in Poudre Valley.

Do not intend by my testimony to convey impression to court that what they see by photographs Q-16 and Q-8 would indicate appearance of principal canal or any of canals of Greeley-Poudre System. These are merely submitted to show present conditions. They appear as they did at time work was stopped. Referring to Exhibit Q-16, was not advised that portion next to headgate marked by crib fill was originally of different construction which was washed out by flood. This exhibit was submitted to merely show semi-permanent condition of structure.

Cross-examination by Mr. Fred Farrar:

Visited practically all headworks on Poudre River from beginning down to Greeley. Have photographs of other headworks.
4171 Do not recall number. Think there were something like 60 photos taken on trip. Don't know how many diversions there are from river. There are a number of diversions on Poudre River that I do not show in photos. Those shown in exhibits were submitted to show typical structures of the three types discussed.

Made photograph of headworks of Pleasant Valley and Lake Canal. As I remember it has no dam. Taps river at such grade as to be able to draw water at all stages without dam.

Took picture of Jackson Ditch headgate but did not introduce it in evidence. I recall headworks of that ditch. It is a very modern and well constructed piece of work. It could be compared with Larimer County diversion dam or Larimer County No. 2, all three of them being concrete structures. As I recall these were
4172 only three concrete structures I observed on river. I observed diversion works at head of Cache la Poudre No. 2 Reservoir Inlet. Did not visit headworks of North Poudre Canal or make any inspection of that canal at all. Did not visit Halligan Dam. I have heard that headworks of North Poudre Canal and dam at Halligan Reservoir are among most modern known to irrigation construction.

My instructions were not to include North Poudre System. North Poudre System is one of essential factors of irrigation of Poudre Valley. In treating subject of irrigation of Poudre Valley, I could not separate North Poudre from main branch of stream. There was no intention to omit that.

Diversion shown on Exhibit Q-16 is made from Poudre
4173 River. Main body of water shown in Poudre River. It correctly represents flow of river on April 21, 1914. This diversion is above all diversions on Poudre River except North Poudre Canal and municipal supply for City of Port Collins, which diversion is up in cañon of river. The Poudre Valley Canal is carried through lower portion of Poudre Cañon.

Shipp's Hill, which is shown on Exhibit Q-8 and to which Mr. Carpenter has referred, is on edge of natural cut or break through outlying foothills or hog backs of mountains. It is a short distance

above cañon in this range of hills through which river passes. It is within the cañon above Belleview.

The Larimer County Canal of the Water Supply and Storage Company cuts around edge of this hill. That and the Poudre Valley Canal lie parallel to each other. This is true from this point in general way till they enter plains. Poudre Valley canal runs along base of hog back from point shown in picture Q-8 for distance of about 5 miles. It passes through country which would require rock or loose rock work. Majority would be considered rock work. Observed wide 30 foot cut through limestone shale ledge a few miles beyond this point. From this point Larimer County Canal tends more directly east.

On Exhibit Q-19, photograph of dam of Ames Ditch, Poudre River is shown. Dam is located in outskirts above Fort Collins.

Lands formerly irrigated by this canal are northeast of
4175 town, outside of city limits of Fort Collins. I am not able to define corporate limits of that town so as to state whether portion of lands are at present in city limits. At any rate they were immediately adjacent to territory of Fort Collins.

Did not make investigation to learn whether or not this Ames Ditch is now used for irrigation of land. Did not know that water from this ditch had for a long time been transferred through change of point of diversion proceeding to other ditches higher up the river. Had no knowledge of the ditch other than field inspection. Do not know whether or not this is headgate of ditch commonly known as Ames Ditch. Did not trace the canal. I do not know of a Coy Ditch. Do not know whether or not water is now diverted from this headgate by means of this dam. From condition of ditch, I assumed it was diverted.

4176 Mr. Farrar: Would like to state, Mr. Meeker, that think you have made mistake in name of this ditch and that it is what was formerly known as Coy Ditch which formerly did irrigate piece of land which is now within city limits of Fort Collins.

(Witness continuing): That may be true. Dam is there and represents diversion and headgate is in condition to operate and ditch is in fair shape. The Fort Collins Quadrangle of U. S. Geological Survey indicates ditch of approximately 1½ miles in length. Greatest lateral distance from river is about ¼ mile.

Observed no connection between ditches indicated by photographs Q-20 and Q-13 known as Box Elder and Spring Creek Ditches. I observed a similar ditch indicated on map as Box Elder Ditch, was flowing across Spring Creek Ditch. Did not make observation to ascertain whether or not they were consolidated at upper end. It is possible, from conditions, that dam indicated by picture Q-20 as diversion west of Box Elder Ditch has been abandoned for number of years and water has been diverted through ditch called Spring Creek ditch. Upon examination of plat I find no creek called
4177 Spring Creek which rises in foothills to Southwest of Fort Collins and joins Poudre River short distance below Fort Collins. I find canal called Spring Canal coming from intermittant stream.

Mr. Farrar: I would like to advise you that the authority which you have consulted there is in error in this name and that the canal which you have mentioned is really the Spring Creek Ditch.

(Witness continuing): I find Spring Canal southwest of Fort Collins, if that's what you mean by this Spring Creek Canal on map. Did not follow this canal to see where it went or what land it irrigated. Observed it in crossing on road three or four places.

In observing headworks shown by Exhibit Q-13, was impressed with size of headgates and capacity of ditch. It is a large canal. Did not investigate to learn whether or not it was in fact inlet to Fossil Creek Reservoir.

Mr. Farrar: That is a fact, Mr. Meeker, that the ditch you have described here as Spring Creek Ditch is simply a feeder to Fossil Creek Reservoir. Let me call your attention to your exhibits Q-11, Q-12 and Q-14, all of which, according to legend, pertain to the Arthur Ditch. Where is this headgate with respect to the Arthur Ditch?

(Witness continuing:) Headgate of Arthur Ditch is mile and
half northwest of city limits of Fort Collins. Did not observe
4178 relationship of city to this headgate. Do not know whether
or not city extends almost to it. As I recall it was about 2 miles from city. Arthur ditch runs southeasterly to Fort Collins, through western half of city. Did not trace length of ditch. Know that the ditch runs through Collins. Do not hear it called City Ditch. I did not dig up pedigrees of these ditches.

I did not know that this ditch was an old ditch which formerly supplied water for irrigation of city of Fort Collins and which has now been practically abandoned because of more modern methods
adopted in that city. The waste or stop-gates shown on
4179 Exhibit Q-11 were about one quarter of a mile below the head-
gate. I am unable to answer how much land lies under this ditch. I did not know the major portion of the appropriation made by this ditch has been transferred to other ditches, notably the North Poudre.

From my observation I would not say that the small ditches of early appropriations which lie close to Poudre River are absolutely abandoned. I would say some water is being diverted through them at times. They did not have appearance of being kept up and maintained as did the larger ditches. That would not indicate that their use had been abandoned or superseded by upper ditches, without further examination. I did not go into that. I am not able to express any judgment on the matter from knowledge, other than from this condition and the fact that some water is probably diverted through them from time to time.

I would consider these small ditches close to river, such as Arthur and Ames Ditches, which I have shown in my photographs as typical of smaller ditches and of poorer type. I am unable to state whether or not these are older or later appropriations compared
with bigger ditches that head further up stream. I heard
4180 Professor Carpenter testify in this case relative to develop-
ment of irrigation in Poudre Valley. I recall that he testified

that early systems were those smaller ditches close to river, requiring no great cost of construction and that these were gradually superseded by ditches with extended use of water further out.

History of all irrigated areas along rivers is that some of these smaller ditches are abandoned from time to time. Have never made any investigation in Poudre Valley in order to ascertain what percentage of appropriations made by smaller ditches has been transferred to higher ditches and lower ditches practically abandoned.

Exhibit Q-18 shows diversion works of Canon Canal, about one mile down stream from headworks of Poudre Valley Canal. Land irrigated by this canal is within canon as compared with Plains area. This canal is really a small mountain ditch irrigating a small amount of land inside hogbacks. I so observed it. It is
4181 small ditch and could not irrigate very much acreage and that was adjacent to river. The land lies above point shown on my Exhibit Q-8. Did not learn how much land was irrigated or have any idea. I made some inquiries of a ranchman to ascertain whether or not this ditch had been abandoned or transferred and was informed that portion of its water had been transferred and conveyed through Poudre Valley Canal. That was only information I had on that point.

I am not aware of the fact that larger portion of appropriation originally made by this ditch but which has been transferred, has been subject to abandonment suit and which has resulted in adjudication of abandonment. Am not familiar with legal history of Poudre Valley ditches.

Referring again to Ames Ditch, I have no information to effect that abandonment suit is directed toward appropriation given to that ditch at present time.

With relation to Exhibit Q-7, will state that I never saw Fossil Creek Reservoir since its completion, when it was not filled or
4182 partially filled with water. Would say the dam is about 35 feet high. All of the rip-rapping, which I saw was that exposed above water level and shown in photograph. I did not know that this rip-rapping, which appears to be breaking in spots, is one of finest examples of rub-le rip-rapping in irrigation history.

Bulletin 134, Office of Experiment Station, Department of Agriculture, Plate 5, represents rip-rap facing on dam of Fossil Creek Reservoir. From photograph it appears to be continuous slope, but from personal inspection, slope is very steep above water line at time I observed it. From photograph appearing in bulletin, it is apparently continuous, moderately steep slope. Further referring to the same bulletin, I find that, according to the plans, it has a slope of 2 to 1 on both sides. That is a steep slope for recent practice of loose rip-rap. It is steeper than they put it on today. Natural slope of earth is about 1½ to 1.

4183 Did not hear testimony relative to dam of Wheatland Reservoir No. 2. Don't know what slope of that dam is. Upper portion of dam is 2½ to 1 on water side and on outer side slope is considerably steeper. Water slope on Wheatland dam is more than on Fossil Creek Reservoir and on outer slope is less.

Wheatland dam is rip-rapped with loose rock, thrown in promiscuously. Rip-rap is not as good as that on Fossil Creek Reservoir, which is shown in the plate in the bulletin. Do not know
4184 capacity of Fossil Creek Reservoir.

Mr. Farrar: I will state that capacity is approximately 525,000,000 cubic feet or approximately 12,000 acre feet.

(Witness continuing:) That is less than 1/5 of capacity of Wheatland Reservoir and about 1/5 capacity of Lake Hattie Reservoir. If capacity of Wheatland Reservoir were 126,000 acre feet, then Fossil Creek would be about 1/10 the capacity, but I know it to be fact that Wheatland Reservoir active capacity is about 100,000 acre feet. However that may be, there is absolutely no comparison in size. The Fossil Creek is very small as compared with the other.

Fossil Creek Reservoir is one of largest reservoirs in Poudre Valley. Am not familiar with capacity of all those reservoirs. Am not aware of fact that additional storage capacity is maintained in Fossil Creek in addition to that originally contemplated by earth dam at spill way.

Land shown in Exhibit Q-5 is irrigable. It is under Laramie County Canal and as I recall, is immediately to right of little
4185 orchard land cultivation. This land was a knoll and was too high. Observed a reservoir lying a little to the north of it but did not know its name. Observed a limestone-shale formation extending north and south through that immediate area. Think land shown on Exhibit Q-5 was agricultural land. Do not have any idea for reason of its abandonment. Saw number of buildings abandoned throughout area. All of them, while they might be under ditch, were without irrigation. Some were under irrigation.

I do not know F. C. Grable. Have heard of him. He was one of promoters of Lake Hattie enterprise; also promoted one of irrigation enterprise in Poudre Valley. I did not know that this place which I saw was part of Mr. Grable's promotion. Did not investigate to find out. I do not know what became of a number of places exploited and endeavored to sell to so-called dry farmers.

4186 Land shown on Exhibit Q-3 is about 2½ miles below mouth of Poudre in an easterly direction and on north side of stream. Hills in immediate background are hogbacks, an anticline formation. This wet land shown in picture is about ½ to 1 mile from hogbacks. Land at point from which picture is taken and lying to eastward of wet place is higher land. There is general depression through where water is collected. Object looking like tower in immediate background toward left end of picture is a derrick where they were attempting to drill for oil. I did not go to the well.

4187 Did not observe a flow of water coming from that well. Did not know that the well, instead of discharging oil is discharging water. Land to left of picture showing water might be affected by this well, but land to right could not be.

Lands shown on Exhibit Q-4 are a little northwest of Fort Collins and on Exhibits Q-1 and Q-2 a little to northeast of Fort Collins.

Q-4 is taken short distance below Poudre Valley Canal and above Larimer County Canal. Q-1 and Q-2 are taken below Larimer

County Canal. All of these seeped lands are in lower ground. I know where Box Elder Creek is. These lands are west of Box Elder Creek. Q-4 lies to west of Dry Creek. Q-4 lies within 2 miles of foothills. Other two lie 5 miles from foothills. Country in districts
4188 where these pictures are taken is of broken topography. It is not the smooth plains country that prevails a little further from mountains.

Embankment appearing in immediate foreground of picture Q-4 is Poudre Valley Ditch. Did not recall any other embankment there. Could not tell whether or not land was under cultivation or ever had been. Do not know location of proposed reservoir No. 14 of North Poudre Irrigation System.

Seepage water from the areas which I have shown in pictures is undoubtedly picked up by canals at points below. I observed a drain
4189 ditch and tile drainage being installed in Section 28-69. Do not know the name. Did not hear of the Fitzpatrick drain ditch or of the Earle Drain Ditch or the three Douglas seepage ditches. My investigation did not include drainage ditches. Am not able to give you any information at all on that subject.

I assume that water from these seeped areas is picked up and utilized for purpose of irrigation. It would be picked up automatically by some of those canals. I observed one specific instance where ditches are being constructed for that purpose.

By dry farming I mean cropping and cultivation of land without application of water from canals or ditches. Application of water builds up water table in soil. I would not consider as dry farming conditions of soil where water appears from building up of underground water play. I would call that seepage irrigation.

I spent four days in Poudre Valley.
4190 I do not mean to be understood as saying that irrigation is unnecessary in Poudre Valley.

Exhibit Q-17 photograph of diversion dam Greeley Municipal water supply. A conduit taps river directly for that. On further side of river there is settling basin. Some sort of dam is necessary to get water from river but just as to where the point of diversion would begin and end I am unable to state. Point shown on Exhibit Q-17 is about 37 miles from Greeley.

Did not produce a picture of diversion works of Fort Collins water system.

Heretofore during testimony I believe some land has been referred to that was irrigated from seepage, and I wish to make distinction, that seeped waste land is land that is not used for any agricultural purpose. My idea is that land might be termed seeped land and might be made available for some use and not entirely wasted. Under existing conditions some land in Laramie Plains is irrigated by seepage that produces pasturage or meadow, purely by seepage. In some instances the irrigation is augmented by application of water from laterals.

ANDREW POPP.

Direct examination by Mr. N. E. Corthell:

4192 I have been living on the high plateau between the Pioneer and the Big Laramie, Sec. 12-14-76, seventeen years, engaged in farming and raising cattle. I raised oats, wheat, barley and a kind of grain they call Polish wheat with a kernel about three times as long as rye, and a heavy long ear. Also alfalfa, native hay and potatoes. I have raised potatoes every year, exceptionally
4193 good crops. About fifteen years ago a patch of eight acres produced sixty tons. I had a letter from the Department of Agriculture at Washington, inquiring about potatoes. They would not believe my statement and wrote me again. Some years are better and some poorer. We have had 4½ tons and 3 tons to the acre and some poorer years, especially when the water supply was poor. The frost did not injure the crop much, though it will often happen in a good farming country. The potatoes that don't get covered over good with earth get touched a little, but I never lost a whole crop. Alfalfa, if we get it irrigated in time, we figure two or three tons to the acre. Have had good crops and some poor ones too, especially when the water supply got cut off, which was
4194 done twice in three years. Three years ago the Water Commissioner put a notice on the headgate that it was closed under order of the Water Commissioner. We got out of water and did not raise any alfalfa at all. The next year we got water and raised some alfalfa. Last year they shut off the water on the first of July. I had between 40 and 45 acres that cut four or five tons of hay. Some of it died out altogether. M. N. Grant's son was the Water Commissioner who shut off the water. I went into see him but he said he could not do anything about it. Have had fair crops of oats, from 28 to 75 bushels per acre. Raised oats every year
4195 except last year, and this year I did not put in any because I was afraid of the water. When I have water I don't need anybody to help me take care of the oats. When I have water they mature. Have had good success with barley, raising as high as forty-five bushels to the acre; also with wheat, as high as forty bushels to the acre, and had some of it left from cutting too late. We raise fine grain. My ground is full of gravel but if you get around in time with the water it is all right. If I have my water that is appropriated, I do not want any help from anybody. I do not believe that they raise any better crops in other parts of the
4196 country than I do. We have our own ditch, the Last Chance Ditch, built in 1882, 1886 and 1888, taken out of the Big Laramie River.

4196 Cross-examination by Mr. Fred Farrar:

I sell my barley to brewery in Laramie. Brewery is not running. There is nobody at the brewery now. Denver fellows ship all beer they want here. Do not know why they closed brewery. I believe on account of some fellows having more capital interested. Man

who conducted business had only small capital and he had
4197 to give up. I could not say whether they got all the barley they needed here. Do not know whether or not they shipped in barley. I sold all my barley there and he said he was well satisfied with it. Next year he gave me some seed, this Mr. Helbig, he gave me 4 or 5 sacks of seed and asked me to try them and he was going to take all barley I raised from that seed. He gave me seed free of charge next year. He was endeavoring to encourage me in raising barley. He encouraged me for his gain.

I believe I brought in a carload of wheat once.

There was mill here but it didn't work. Could not tell you why. I do not raise any wheat now. I raised some three years ago and got burned out and I raised a little two years ago. I didn't have much in I know because I put in most of alfalfa and last year I didn't put in any wheat. I had barley and oats.
4198 I only raised alfalfa and potatoes this year. I had in 4 acres of potatoes last year. If I had had water would have obtained about 400 sacks of potatoes. I had one ton off of four acres, small potatoes, because I wanted to irrigate potatoes when the water was shut off. My potato vines were not killed by frost last summer. I am 18 miles from Laramie River, between Pioneer Ditch and river. I am 6 or 7 miles from Woods Landing. Potatoes I raised last summer are about as big as end of my thumb

I had four or five tons of alfalfa last year, just enough to feed spring calves. I had to buy hay last year to feed my cattle through. I had about 33 head in all. This was horses and cattle. Fed
4199 them through winter on hay I purchased. Bought 8 tons from outfit of Laughlin and Dinman and bought about 14 tons from Benson on Big Laramie. It was native hay. I bought it in stack. With one outfit had to make 3 mile trip and with the other 6 mile trip. Paid $6.50 for 8 ton lot and $6.00 per ton for 14 ton lot.

Cross-examination by Mr. Delph E. Carpenter:

Last Chance Ditch irrigates about 1200 acres. The Lake Hattie Outfit were still running water after my ditch was shut down last year, they ran their ditch all right.

I don't believe we were short of water until after the Lake Hattie scheme was constructed.

We raised Beauty of Hebron and Early Ohio potatoes. The Beauty of Hebron is not any earlier than the Early Ohio but not quite such deep eyes. The Beauty of Hebron is a more salable potato. It is about as early as the Early Ohio. We generally dig potatoes the last week in September.

ANDREW POPP.

Redirect examination by Mr. N. E. Corthell:

4200 I don't raise more grain of late years because I am afraid they will cut off the water. What good is it to put in the

seed and burn the crop out. If they are going to take the water from us, they can take the land too. Running the water in the Lake Hattie Canal did not do us any harm, because the Pioneer Ditch had been running before that and we had all the water we needed. The Water Commissioner shut off three ditches, the Last Chance, the Parker, and Fischer ditches. I did not see water running in the Lake Hattie Ditch, but some of my partners told me it was
4201 running.

Z. E. SEVISON.

Direct examination by Mr. N. E. Corthell:

4202 Have lived in Laramie about six years. Recently made an examination of the irrigation ditches and works and some of the irrigated lands in the Poudre Valley, April 20, 21, 22 and 23, 1914, in company with R. I. Meeker. I was with him the entire trip, present when all of the photographs (Q1 to Q20) were taken. They are fair representations of the subjects, and
4203 the irrigation works shown are fairly typical of the different varieties of structures in the Poudre Valley. Examined all the dams and headgates and portions of all the canals from the Poudre Valley Canal down to the mouth of the river. I noted particularly the alkalied or seeped areas. Out of about 64,000 acres closely examined, we found 933 acres alkalied and worthless, caused by excessive application of water or standing water on land which could not be easily drained. On 35,000 acres not so closely
4204 examined, we found about 450 acres additional—all in the irrigated district in the Poudre Valley and under canals. We examined particularly the Poudre Valley Canal and the extension into the Greeley-Poudre Irrigation District as far as Wellington and various points below Wellington along the extension. The canal was finished from the headgate to a point about one mile east of Douglas Reservoir beyond which the excavation is completed, except where places for structures are still to be installed, as far as Wellington. Below Wellington it was completed in sections, and there were gaps of a few hundred feet to a half mile where no work had been done. It is not in a condition to carry water beyond Douglas Lake. No construction work is going on nor was there any evidence of recent work. On a section of the canal about
4205 three miles in length from a point about one mile West of the range line, between ranges 69 and 70, the seepage is very extensive. Below this section the seepage is about the average for a canal of that size. It was carrying about 200 second feet of water; not nearly its supposed capacity, but all it would carry without additional work, owing to low places in the bank caused by breaks. From a point about six miles below Wellington, the
4206 soil is porous and sandy. I would expect a very high seepage, much more than usual. The efficiency would be low compared with other canals in the same district. Running the canal full would increase the seepage. I recently examined the lands along the Pioneer Canal from Lake Hattie to the Fraser Ranch

and in the neighborhood of the Soda Lakes and between the Pioneer and North Canals to determine the extent of waste or seepage land. I found 325 acres in all the land between the Pioneer Canal and Big Laramie River east of the range line between ranges 75 and 76, and extending to the end of the Pioneer Canal; also in the territory between the North and Pioneer Canals. This acreage is from
4207 actual survey shown by a map prepared by me (Plaintiffs' Exhibit R), indicating the waste or seepage areas by shaded portions. Other areas outlined are small lakes and ponds. I applied the same standard in obtaining this area as in examining the lands in the Poudre Valley and the waste lands are of the same kind. Have also made a survey of the lands in the vicinity of the Bath and Alsop Lakes in the Little Laramie Valley May 18, 1914, finding not to exceed 80 acres of seepage or waste land, exclusive
4208 of the Big Basin.

4208 Cross-examination by Mr. Delph E. Carpenter:

I made one examination of seepage from ditches in Cache la Poudre River. This examination extended over a period of four days. In other words I acquired this knowledge of possible seeping of Greeley-Poudre System through some observation made of that canal during four days of time that I spent in Cache la Poudre Valley. I never had any previous experience with seepage of water from canals in Cache la Poudre Valley.

There are portions of inlet canal into Lake Hattie Reservoir that will seep as much as portions of Poudre Valley Canal. It is hard to make comparison between the inlet to Lake Hattie Canal and the extension of the Poudre Valley Canal commonly known as the Larimer-Poudre Canal. The country is considerably dif-
4209 ferent in each case. There — very different conditions in every way.

We did not follow all along the Larimer-Poudre Canal in order to give this opinion, we just observed it in places. We followed Poudre Valley Canal easterly about 20 miles. Did not follow along the course of it, just crossed back and forth. I followed for same distance Mr. Meeker did. We stopped at point about 2 miles east of range line between ranges 67 and 68. That is as far as we followed canal itself. That is about west line of Greeley-Poudre Irrigation District lands. We made trip through district itself and over north boundary where canal would probably be constructed.

We simply followed canal down a little south to east of Cobb lake.

We didn't pay any particular attention to Larimer County Canal except at places where we crossed it. We didn't follow it any way.

Made careful study of amount of seepage from Larimer
4210 County Canal from river to Cobb Lake. There is less seepage from Larimer County Canal between these two places than from Poudre Valley Canal. Don't know how much. Don't know how Larimer County Canal looked when first constructed. Do not know how that country appeared when canal was first constructed. Do not know how much that canal seeped after its construction.

Do not know how much Larimer and Weld Canal seeped after its construction. Only comparison I can make is at present time.

Don't think that I take these canals as comparison after they have been operating 25 to 35 years, when comparing with new canal. Poudre Valley Canal undoubtedly seeps as much now when it is old as the other canals. I think it is a safe statement to make.

Have been making a study of seepage of canals as an engineer
. since June. Have been engaged in that work in Wyoming,
4211 Colorado and Montana. In district between Denver and Greeley in Colorado. Engaged in that work about one year there on Community Canals and Canals of Farmers Canal and Reservoir Company. Community Canal is not a new canal but there are older canals along South Platte River. My duties were that of construction engineer and seepage was not my specialty. I was construction engineer for the Arnold people. Part of my duties were to see to excavation of dirt and to give estimates to contractors.

Principal spot where Poudre Valley Canal seeps is where it goes around sharp mountain or hogback Do not know name of hill. It is place where canal turns sharply around mountain. I hardly
think that this canal is in condition it will be when district
4212 starts to use it. If that ditch when completed were lined with concrete it would make considerable difference.

Made no measurements of canal to ascertain actual loss by seepage between head of canal and Douglas reservoir. A large percentage of the loss in that canal occurs at Shipp's Hill.

Did not investigate seepage or loss of water from Larimer and Weld Canal east of county line between Weld and Larimer Counties. That canal penetrates the section of country very similar to that irrigated and which will be irrigated by Greeley-Poudre System. Do not know loss of water in that canal between head and lower end. Do not know loss of water in Larimer County Ditch which crosses railroad track immediately south of Pierce and penetrates a similar area. Do not know loss of water in Pierce lateral which crosses railroad track immediately above Pierce.

What little I know about loss of water by seepage in ditches
4213 of Poudre Valley simply by comparing ditches.

And that comparison was one of the things we did in the hasty four day trip that we made during which we took pictures of all of the headgates on the Poudre River, among other things. I grant that the engineers who laid out the Greeley-Poudre System had reasonable degree of information on their subject. It would be reasonable to presume that engineers who have spent years in the Poudre Valley in close contact with ditches of the valley would probably know a little more about loss from seepage from canals than one who ran hastily over it in four days. That would not necessarily affect way in which they laid out their canals or planned system. The first 16 miles of the Poudre Valley Canal from Douglas Reservoir to the river is completed so as to carry about 200 cubic feet of water per second of time and is now carrying water and apparently has been for several years. Do not know how much money

has been spent on that canal. It was some of it very difficult construction.

4214 Do not know plans of Greeley-Poudre Irrigation District with relation to betterments on Poudre Valley Canal, except from hearsay. Did not hear Engineer Wortham's testimony. Did not hear or read Mr. Hedke's testimony. Do not know grade of canal. The areas of seeped land which we found in Poudre Valley cover territory seven miles wide and extending ten miles due north of Fort Collins and a territory five by six miles southeast of Fort Collins. Latter territory is on south side of the river. North boundary of this territory is about 2 miles north of township line between Townships 8 and 9 and south mile is 2 miles north of township line between Townships 6 and 7.

Territory north of Fort Collins is marked by large numbers of reservoirs, both large and small, which occupy this territory. It is very rolling. Southeast of Fort Collins the territory which is seeped is along some draws and creeks and other areas close to river. They are four miles east of Warren Lake. Am not aware of fact

4215 that tile drains have been laid through most of territory east of Warren Lake and pear Poudre River during past five or six years. There are places where tile has been laid and tile on the north side of the river also. Some sections that are drained right considerable north of alkalied land south of river. Area east of Warren Lake south of Poudre is about 140 acres. There is one bunch of 80 acres altogether and the other is a narrow strip extending northwesterly. That is where return from table lands above outcrops on side hill. Area is bottom river land. All of this land mentioned is in Larimer County.

In Weld County we found 450 acres of seeped land. That was in a territory northeast of Greeley principally. It occurred in

4216 small spots only.

We found numerous seepage ditches carrying return waters. It is a fact that in a great many places in the depressions through the country within the Poudre area seepage ditches occur in the depressions and a great many of depressions are drained.

Their waters are used for irrigation in the valley. If any additional seepage water were added to the seepage water already appearing, it would simply mean additional water for irrigation in the valley. Not all of seepage water is available for irrigation. Believe about fifty per cent is not. I refer to losses principally by evaporation. I mean that about fifty per cent of the water which is originally conserved is lost by evaporation and there is some seepage you cannot make use of.

If any accidental seepage appears from carrying water

4217 through Poudre Valley Canal it would simply add to that already existing below canal.

After Poudre Valley Canal reaches the northerly boundary of the Greeley Poudre District, water which happened to escape by seepage would not all of it moisten lands in district. Probably fifty percent of it would. The other would be entirely lost and you would get no benefit from it what ever. It would go into seepage and evaporation which would not be available.

We saw quite a number of irrigation pumps in readiness to use water from seeped areas and lakes formed by seepage. Irrigation of lands was not in full progress at time we were in valley.

Out of 35,000 acres of land in Weld County, we found only 450 acres seeped. We found only about 1½% of lands we examined were in that condition. At least that is what I examined. Do not have any information relative to accumulation of water in the Larimer Poudre Canal constructed and lying northeasterly of land in the district. Did not know that land will stand in that ditch for days without seeping away. Do not know comparative grades upon
4218 which various canals of Poudre Valley are constructed. Did not investigate more than 3 or 4 places along the Larimer Poudre Canal below Cobb Lake. We looked at the canal 3 or 4 places in about 50 miles of its course. We ran onto so many places not constructed or completed and ceased trying to follow canal. There were stretches where canal was not constructed at all for half a mile or so. Could easily see beyond that and could follow canal. Did not have time to travel last 50 miles of canal. Took trip over district to north boundary where canal runs. There were indications of considerable gravel on Lone Tree Flat and right near Nunn and also on Wildhorse Creek a tributary of Coal Creek. Found
4219 little gravel on ridges. Struck the canal in three or four places. Am testifying not so much from examination of canal as from examination of land straight through district. Don't think there is great variation in soil at places I examined. I did not dig myself. Made purely superficial examination.

Larimer and Weld Canal and Larimer County Canal must have crossed same gravelly area on the Lone Tree and Owl Creek drainage and along Coal Bank Draw throughout their courses. They deliver water clear to Crow Creek. And if one ditch is run on more of a grade to a mile than another the first has less chance of silting up than the latter. Now if these older ditches were run on grade 2½ feet per mile and new ditch on little over 1 foot per mile whether or not the latter would silt better than old ones would depend on what velocity two ditches were designed for, which depends of
4220 course also on comparative sizes. Assuming two ditches were practically same size and velocity it would mean that one having greater grade would have greater velocity. One having greater grade and correspondingly greater velocity would not silt as well as one having lesser grade and slower velocity.

If Cache la Poudre Canal, or Larimer and Weld Canal, for example, happened to have grade of about 2½ feet to mile they would not silt as well as Larimer-Poudre Canal would if it only had a grade of 1 foot per mile.

Cross-examination by Mr. Fred Farrar:

We spent three and one-half days in whole Poudre Valley. We started from Laramie at noon and reached Fort Collins in afternoon. Actual time in valley itself was probably 3¼ days.

4221 In examining works from Poudre River south from upper portion downward. Visited 14 diversions in that distance.

We saw 14 principal diversions. Took us three days to go along river. Were not along river all the time. Did not pass directly up and down river. Don't think there were a good many diversions we did not see. Every time we crossed ditch we followed it to its head if we had not already found diversion, that is below head of Poudre Valley Canal.

In this time we examined 64,000 acres land closely for seepage. We found 933 acres of alkalied land which was worthless. We estimated acreage.

During time we were examining these 64,000 acres of land we were also making examination of headgates. 64,000 acres of land is exactly 100 square miles. We also examined approximately 35,000 acres more or less casually upon which we found 450 acres seeped land. That would be approximately 50 square miles territory.

On this 64,000 acres of land we passed along at least two sides of every section. Some cases went into section. During this 3½ days we traveled 360 miles in Poudre Valley alone.

This is the extent of my knowledge of valley.

There are 24,000 acres included in plat Exhibit R which I filed here tonight. It took 5½ days to make examination or survey. Surveys were made with transit and stadium. I actually made survey of superficial areas of all lake surfaces in 5½ days. Had
4223 three men besides myself.

Had transit in Poudre Valley but did not use it.

Year 1913 was rather below normal in amount of precipitation. Seepage should be less. Effect on waste land would be very small I think. Do not think there would have been much difference had I made these surveys of seeped lands in Laramie Plains at end of summer rather than at end of winter. Application of water for irrigation during summer would not increase size of class of lands I have in mind. There would be no material change. That is class shown on Plat Exhibit R. Effect of greater precipitation would be to make more ponds but I do not think area of waste land would change.

Cross-examination by Mr. Delph E. Carpenter:

On James Lake outlet on Laramie Plains and ditches did not do any concreting to prevent seepage. We expect certain amount
4224 of natural and incidental seepage in every ditch system.

Z. E. SEVISON.

Redirect examination by Mr. N. E. Corthell:

4224 The 1914 precipitation in the Laramie Plains region was very much greater than in 1913. There was a most unusual snowfall early in the winter, saturating the ground to a greater extent than usual and there were more ponds and lakes than usual this spring.

J. A. ELLIOTT.

Direct examination by Mr. John D. Clark:

4225 I am the present superintendent of the system of the Wyoming Development Company near Wheatland. We have never experienced a great deal of seepage from the laterals. What we have had practically all comes from No. 1 Canal No. 1 Lateral, our largest lateral which has the heaviest grade on the system, fills up very little except in a very few places. It keeps scoured. All the smaller laterals fill up and require cleaning each year. We gauge No. 1 Lateral from time to time and while it is on a ridge, we have not experienced a great deal of seepage because the bottom is not through the subsoil which is of clay. It has the same effect in preventing seepage as silt in the canal would have. Two
4226 years ago, by shutting the gates and measuring the water at our large distributing laterals on No. 1 we found about 18% loss in 30 miles. Similar gaugings on No. 2 Canal showed about 6%. The diversion dam at the head of No. 1 Canal is built on piling with sluice boards to throw the water into the canal when running, and at other times the sluice boards are taken out to allow the water to go down the stream. At the head of No. 2 Canal, we have a concrete overflow dam, an effective modern dam capable of diverting all the water in the stream at that point. In run-
4227 ning water in Canal No. 1 we at all times have to allow a certain amount to go down to Canal No. 2. If it leaks through No. 1 dam, we don't consider the water lost because it is picked up again at No. 2. This is why we have never attempted to prevent loss at that point, the final distribution being from No. 2 Canal, where the dam is effective and kept in repair. Water will leak through at various points, but not to any great extent, the leaks being repaired as often as they occur. The dam at the head of No. 3 Canal is similar to that of No. 1, only it is on mud sills instead of piling, an effective dam used to divert water into No. 1 Reservoir whenever the ditches are not filled with snow and ice between irrigating seasons. This dam is sufficient to divert all water
4228 available in the stream during that period up to the capacity of the ditch. It is located on Sybille Creek between No. 1 and No. 2.

4228 Cross-examination by Mr. Delph E. Carpenter:

Modern structure was put in at head of No. 2 Canal 2 or 3 years ago I have forgotten which. Prior to that time I don't really remember much about No. 1 Dam or No. 2, but I think all gates were in working order. At any rate it was replaced by modern structure during last two or three years. I have forgotten whether it was 1910 or 1911.

JAMES M. HOGE, a witness in behalf of the Complainant.

Direct examination by Mr. N. E. Corthell:

4229 Have lived near Platteville, Weld County, Colorado, for five years, engaged in farming. Lived in Wyoming for eighteen or nineteen years prior to that time, engaged in ranching and a little farming on Sand Creek southwest of Laramie, and also on the west side of the river. Was farming in Sections 20 and 19, Township 14, Range 74; also in Section 35, Tp. 15, R. 75. The first place lies in the Sand Creek valley and the second north and
4230 west of the river under the Pioneer Canal. On the south side I got water from Sand Creek through an individual ditch. Raised wheat, oats, potatoes and alfalfa for ten or twelve years under irrigation. Had good results, raised fine potatoes and alfalfa, and I never raised better oats and wheat than up there. The crops fully matured. After hauling three loads out of eight, I threshed 109 bushels of wheat off 3 1/3 acres out of the
4231 five loads left. Had good yields of oats, threshing about 668 bushels of wheat and oats. I had ten or twelve acres. Had the best potatoes one year I ever raised. The yields were pretty generally good in quantity and quality. Had very good alfalfa for a few years, but only had 6 or 8 acres. The yields in quantity and quality of these crops in Wyoming compare very favorably
4232 with the yields in Colorado and the net results on the hardier grains and vegetables were about the same in Wyoming as at Platteville, the markets being a little better than in Colorado, so that the net financial results were better. In Colorado I have been raising wheat, oats, sugar beets and alfalfa, a few potatoes and some cabbage. My farm is situated about twenty miles from Greeley on the South Platte River valley west of Platteville. Lived
4233 thirty-five years in southwestern Pennsylvania before coming to Wyoming. Crops raised and results obtained from farming in Wyoming were just as good as in Pennsylvania, except they raised winter wheat in the latter state. I raised spring wheat here. Don't know what winter wheat might do.

4233 Cross-examination by Mr. Fred Farrar:

Have not had occasion to observe farming conditions in Pennsylvania since leaving there. My comparison is based on conditions as they existed 25 years ago.

We feel that we are in one of best farming sections of Weld County. As matter of fact, we have not shown development in that section of country that they have in others. They are more backward than around Greeley. I have water in Lupton Bottom Meadow Island No. 1 and Meadow Island No. 2 Ditches. Am one mile from Platteville. One place is immediately on Platte River bottom. There is one place just half mile back from first. Immediately west of me there is high mesa. Some of the land southwest of me is under ditch from Platte River. On west side the water is from the St. Vrain, and Boulder Creek. It is only one mile from edge of bluffs

from our place. Bluffs come in almost immediately to river at Platteville. Irrigated area is confined almost entirely to intermediate country between these bluffs. Think Stanley Lake system brings whole country in. That is not yet developed. That is project which contemplates storage of water up toward Denver. This
4235 storage is outside of valley of Platte and really in valley of Box Elder. As matter of fact, highest ditch irrigating in my section is on east side of river and is what is known as English Ditch and passes along bluff about half mile from town of Platteville.

Have been familiar with Platteville five years. Did not know it before that. Passed through it. Know that town is of rather early settlement. Town is no larger today than it was 30 years ago. Eight miles below Platteville there is new town called Gilcrest. Town of probably 250 people. It has grown up in last 8 years.
4236 Six miles below there is town of La Salle which has been town only within last 10 years and previous to that was railway station. It has quite good growth. Nine miles south of us is town of Lupton, which has grown to be quite a town within last 15 years.

Platteville has not been able to show any such development. Would not say that it is due to fact that there is practically no body of irrigated land in that vicinity. Think it is because the town has always been a cow town, until sugar beets came up. That was real industry until last few years. It has always been handled as cattle country up to that time. Wintered their cattle on Platte and grazed them out on country east and southwest until beet industry began to be interesting.

Sugar beet industry commenced when Greeley factory started. Did not know that first factory in Colorado was at Loveland and constructed in 1901. Am not familiar with history of sugar
4237 beet development. Ditches I am under have no reservoir water. They depend entirely upon direct flow of stream. At that point in summer water in river is very low. I am not short of water. Some of people in vicinity are short of water.

Redirect examination by Mr. N. E. Corthell:

Think we got better than average acreage of sugar beets last fall. Better yield per acre. It is pretty good from year to year.

Recross-examination by Mr. Fred Farrar:

Could not say that my crops of wheat raised on my Sand Creek Ranch in Wyoming were uniform from year to year. The yields I have given were based on my experience for a few years. Have some pretty good crops of oats. Other yields which I have given in Wyoming were based upon extraordinary experiences rather
4238 than upon the general experience.

Z. E. SEVISON.

Direct examination by Mr. John D. Clark:

4239 From April 26th to May 18th I made surveys of sections on the Laramie Plains, and prepared maps marked Plaintiff's Exhibits S-1, S-2, S-3 and S-4. These blue prints show correctly certain specified features in each section but not all
4240 the physical or cultural features. The Murphy Ditch shown in map S-1, with headgate on the north bank of the Laramie River in the S. E. ¼ of the S. W. ¼ of Sec. 36, paralleling the Sodergreen High Line Ditch and running below it for about half or three-quarters of a mile is an entirely separate and distinct ditch from the Sodergreen Ditch. Both are in actual operation. I found alfalfa on Sec. 36 in the S. ½ of the N. E. ¼ between the Murphy Ditch, and the Pioneer Canal and two laterals of the Murphy Ditch, all irrigated from the Murphy Ditch, approximately eighteen acres. This field is perfectly plain and the alfalfa is in good condi-
4241 tion. A plane table survey is usually considered the most accurate way of making a survey of this kind, and if properly done, should show all features of this nature.

From the same map, the dotted lines in Sec. 36 indicate the road leading from the Pioneer headgate in a westerly direction from the county road, known as the Woods Landing road across the Murphy Ditch and lateral and the Sodergreen High Line Ditch, all in the S. W. ¼ of the N. E. ¼, Sec. 36; then runs about 400 feet northwesterly; then turns and runs southwesterly across Sec. 36; thence due West to the county road. I am acquainted with the area shown on Sheet No. 1 of Defendants' Exhibit 114, purporting to be a plane table survey map of the same section, designated as "meadow." A portion of this is alfalfa, about eighteen acres in the S ½ of the N. E. ¼. The rest is meadow and the plane table map is in-
4242 correct in this particular. The road shown on this map running from the headgate of the Pioneer Canal, marked "Laramie Canal" in a northwesterly direction is incorrect above the Sodergreen High Line Canal. Beyond that point it runs as shown in the blue print, S-1.

Map S-2 shows Sec. 16, Tp. 15, R. 74 with an oats field as indicated, 43.6 acres in area, determined from accurate survey. The acreage (53.3) shown on Sheep 14 of Defendant's Exhibit 114 is the same field but is incorrect as to acreage. The oats field
4243 does not extend to the east line of the section. The nearest point is about 400 feet.

Map S-3 shows Sec. 22, Tp. 14, R. 76 with the Parker Ditch and the Popp and Pahlow Ditch correctly located. Under the Parker ditch there is irrigated pasture and meadow land watered from the Bloom lateral of the Pioneer Canal. If a plane table survey were made of this section, I don't think it would be possible to overlook the Bloom lateral or the irrigation from it. About 16.3
4244 acres in the S. E. ¼ of the N. E. ¼ is irrigated from the Popp and Pahlow Ditch. The total area of irrigated land in this section is divided as follows:

An oats field	32.7	acres
Alfalfa	10.4	"
Meadow	69.9	"
Irrigated pasture	45.3	"
Total	158.3	"

Sheet 2 of Defendants' Exhibit 114 is incorrect as to the shape and area of the meadow; also in omitting the alfalfa field of 10.4 acres east of the Parker Ditch, but not irrigated from it.
4245 It is also incorrect in showing no irrigated land above the Parker Ditch, where 66.1 acres are irrigated. The Popp and Pahlow Ditch is incorrectly shown, in fact, it re-enters Section 22 and irrigates lands there. The Parker Ditch is incorrectly shown. If a plane table survey were made of that section with any degree of care, it would not be possible to overlook the existence of the Bloom lateral and irrigation for a considerable tract from it on the alfalfa field below the Parker Ditch.

Exhibit S-4 shows Section 14, Tp. 15, R. 74, containing 379.6 acres of irrigated land, divided as follows:

4246

Alfalfa	73.2	acres
Old plowed ground	36.2	"
Meadow	207.2	"
Irrigated pasture	63.	"

Sheet 20 of Defendant's Exhibit 114, showing this section, is incorrect in showing an alfalfa field of 16.8 acres instead of 61.2 acres, and also in showing two separate fields of alfalfa in
4247 different locations. There is no such fence as that shown running east and west on the center line of Sec. 14 in the Defendants' survey. The fence at the southern boundary of the pasture is about 1000 feet further south than shown. The northern alfalfa field shown to extend to the north line of the section does not extend within 600 feet of it, and is bounded by a fence. A waste ditch from the Pioneer Canal comes into this section in the northwest corner for a short distance and enters the section again in the N. W. ¼ of the S. W. ¼ and runs in an easterly direction to a point where it crosses the old Wolcott Ditch, which is on the north and south center line of the section, and about 1400 feet from the southern line of the section, where it empties on to the low land and the water spreads over the land between the Wolcott Ditch and the river, where it is ordinarily used for meadow land. The
4248 defendants' map of this section is incorrect in that it fails to show an area of 14.6 acres of plowed ground in the N. E. ¼, plowed in 1913 or previously. All the features discussed existed in 1913, the alfalfa fields having been in existence for one year or longer. The errors shown in the plane table survey are not permissible and it should not omit the features I have shown. The lake and county road as shown on plane table survey are approxi-

mately correct. The section corners were all found by me
4249 except the southeast corner, so that there would be no difficulty in ascertaining the boundary of the section. There is a waste ditch at the lower end of the Pioneer Canal, which has been in existence, to my knowledge, for six years, and is easily found. The notation: "Total area of all lake surfaces 743 acres; total area of all seeped waste land 325 acres" on Exhibit R, indicates that this is all of the areas of that kind that lie within the area shown on this map.

42449 Cross-examination by Mr. Fred Farrar:

Referring to my Exhibit S-3 which shows Section 22, Tp. 14, N., R. 76 W., discrepancies which I found between my survey and plane table survey are in lands north of county road. Parker Ditch is inaccurately shown on plane table sheet south of county road. Also Popp and Pahlow Ditch. Parker Ditch is very much out of alignment on plane table sheet. Plane table sheet shows this
4250 ditch running about three quarters of a mile outside of section south of county road. In other words, if I am correct, route of ditch is to east of point where they found it. There is no loop in ditch like is shown on plane table sheet.

I used transit in making my survey. I ran lines of ditch with transit. Had two men assisting me in survey.

When I mentioned finding laterals I referred to Bloom Lateral which is northern lateral. It is ditch practically as large as Parker Ditch. I did not know that the surveyors in making the plane table survey did not attempt to show laterals. Do not think in this case there would be less ground to criticise than if they had attempted to show lateral ditches. If they don't show them
4251 on plane table sheet it gives wrong impression of conditions in that section.

Waste ditch at lower end of Pioneer Canal is simply ditch which evidently was started from plow furrow or something of that sort and now looks as if it had cut its own channel to river. It crosses railroad in a culvert. After it passes railroad right of way there is not much appearance of ditch.

Referring to Exhibit S-4, there is no fence along north line of Section 14-15-74. There is a fence, however, running east and west immediately north of area which I found in alfalfa. This is about 600 feet south of section line. Alfalfa field on plane table
4252 sheet runs to fence. If plane table survey mistook fence for section line, thinking fence was on section line, there would be discrepancy of general size of alfalfa tract between my survey and one shown on plane table survey. Fence on east side is entirely different. There is material difference in two areas. Both in shape and size. Principal difference in shape is on east side of tract. Fence on east side runs due north and south according to my survey. According to plane table sheet, it runs northwest and makes entirely different appearing field. There is no fence running northwest in my survey along alfalfa. I am looking at my survey. There is one running northeast but not northwest.

Do not know when land in northeast corner of section was
4253 plowed. It was plowed previous to 1913. Was working on this section last season and built Grave Ditch which drains Alkali Lake and crosses this plowed land in northeast corner. Do not think this piece was referred to in direct examination.

There is practical discrepancy between plane table survey and my survey of oat field on my Exhibit S-2 and sheet 14 of plane table. That error, if error, was not in favor of Colorado. Outline of tract is just same on plane table survey as I found it except in making allowance for difference in size of two sheets.

Z. E. SEVISON.

Redirect examination by Mr. John D. Clark:

4253 The Popp and Pahlow ("Barlow") Ditch, designated on Sheet 2 of the Defendants' plane table survey was simply
4254 located at the bridge on the county road and probably on the north line of the section and sketched in between, apparently without any view of the ditch between those points. The land below the Popp and Pahlow Ditch in Sec. 22 marked on my map as irrigated pasture, 16.3 acres, is irrigated from that ditch. I had never seen the plane table survey map prior to my examination this afternoon, and was directed to make a survey to ascertain the location of certain definite objects and did not have in mind any location made by the Colorado engineers.

Recross-examination by Mr. Fred Farrar:

I did not know that lands lying north of county road were not covered by actual survey but were simply sketched in from a very superficial survey.

JAMES M. HOGE.

Direct examination by Mr. N. E. Corthell:

4255 On my farm and the neighboring farms in the South Platte Valley in Colorado, some native hay is raised; also some native grass land is irrigated and used for pasturage purposes. The methods of handling water for such irrigation are very similar to the methods on the Laramie Plains in Wyoming, where I irrigated quite a large extent of similar lands; and was also familiar with the methods used by other ranchmen in similar work. In giving the production of crops on my Wyoming farms, I did not give those in
4256 Township 15, where the results were generally good. I sold forty tons of oats one fall at $1.80 a hundred, which was about half of the crop produced. It was very heavy grain; very good oats; equally good, I think, with crops grown or seen by me in Colorado and other places.

4256 Cross-examination by Mr. Fred Farrar:

Land both north and south of farm I now occupy is irrigated for pasture in Colorado. It is river bottom land. This river bottom

land is natural hay land. Unless ground is rough the hay can be cut.

E. D. TITUS.

Direct examination by Mr. John D. Clark:

4257 I am familiar with Sec. 36, Tp. 14, R. 77, near the headgate of the Pioneer Canal (in Wyoming). Referring to the map, Exhibit S-1, the location of the ditches, fields and roads shown is correct. There is an alfalfa field as shown on this section between the Murphy Ditch and the Pioneer Canal. It has been there ten or eleven years, and last year stood more than two feet in height and is easily observable by anybody making any sort of an examination of the land. People have remarked to me about the large growth. The Murphy Ditch as shown on this map has been
4258 there beyond my memory, and is entirely separate from the Sodergreen High Line. The road shown is also correctly shown.

I farmed Sec. 14, Tp. 15, R. 74 for quite a number of years, and built the fences that cross the interior. Exhibit S-4 correctly shows the location and shapes of the fields and the location of the fences and ditches. I ran the lines around the different tracts to find out the exact acreage as required by a contract I had with the people owning the land. I built the waste ditch crossing the northwest corner and again entering the section in the south half about eight or nine years ago to carry waste water in time of storm to the river from the Pioneer Canal. It has been in constant use and
4259 can be easily seen by anybody making an examination of the land and will carry 35 to 40 second feet of water. It is about six feet wide on the bottom. This ditch is an artificial ditch extending across the Wolcott ditch to an old river channel. The fence on the south boundary of the meadow is about 1000 feet south of the center line of the section. There is no fence located near the center of the section as shown on the plane table
4260 survey. The alfalfa field shown on the Sevison map in the north half of the section is not entirely in the N. E. ¼ of the section as shown on the Colorado plane table survey map, but extends into the N. W. ¼ 300 or 400 feet, maybe more. The nearest east and west fence is about 600 feet south of the north line of the section. I measured from the quarter rock down to the land I plowed, and afterwards put into alfalfa. The fence lying west of the north and south center line of the section does not reach to the north line as shown on the plane table survey. It lacks about 600 feet. The north and south fence in the east half of the northeast quarter runs due north and south as shown on Sevison's map. That is the only fence that has been there to my certain knowledge in the last twenty-five years, and there is no fence corresponding to that shown by the plane table survey. I built the fences in that
4261 section myself. Have measured with a chain the oat field on Sec. 16, Tp. 15, R. 74 and found a trifle over 40 acres. The same field shown on Sevison's map S-2 as 43.6 acres. The Sevison

map, Exhibit S-3, correctly shows the ditches, fences and fields on Sec. 22, Tp. 14, R. 76, including the sizes and irrigated areas. There is an alfalfa patch lying immediately below the Parker Ditch and east of the oat field, not shown at all on the plane table survey map of this section, where it is marked meadow land, the location also being different. The plane table survey map does not re-
4262 semble the tract of land at all. The Bloom lateral of the Pioneer Canal crosses this section as shown on the Sevison map. It is about four feet wide on bottom and about sixteen inches in depth, and irrigates land above the Parker Ditch as shown on the Sevison map. The ditch is not shown on the plane table map, which is also incorrect in its symbols designating this land as unirrigated pasture land. The Popp and Pahlow Ditch enters this section but is not correctly shown on the plane table map. The Parker Ditch is also incorrectly shown, having no reverse curve as indicated on the plane table map. The meadow extends to the Popp
4263 and Pahlow Ditch beyond the boundary indicated on the plane table map and into the E. ½ of the E. ½ of the section, containing about 15 or 20 acres which was cut over in 1912, and I think in 1913. There is a waste ditch extending from the end of the Pioneer Canal to a slough about 1000 feet from the river. It is more than a mile and half in length in a direct line but winds around. After it passes the railroad track and strikes the flatter ground, it is eight feet on the bottom and two feet in depth, that portion being built about five years ago. The slough runs into the river.

4264 Cross-examination by Mr. Fred Farrar:

Alfalfa on Section 36 as shown on my Exhibit S-1 is about 3 or 4 inches high at this time. I was up there on the 12th of present month and it was showing up nicely then.

Referring to Exhibit S-4, I constructed fence about 600 feet south of section line and north of alfalfa. I knew I was not constructing it on section line. So constructed it because it was adjoining other land I had put into cultivation and I didn't want to separate them from other lands. Section is not fenced on north. The land is open up to county road. It is fenced in quite a large field. There are about 2000 acres that I leased.

4265 Referring to Section 14 shown on Exhibit S-4, the waste ditch which I have described after it passes Wolcott Ditch is in an old riverbed from 20 to 30 feet wide. Channel is cut. This map does not show it.

My statement exhibits are correct is from general knowledge of areas and from measurements I made myself. I made measurements of land that was irrigated under Bloom Lateral which is owned by other parties. Mr. Watson owns land at present time. I made no measurements on Exhibit S-1. On Exhibit S-3 I measured land irrigated several years ago by a man by the name of Heffron who owned certer of Section 22 this represents. I don't believe I measured all of areas shown on sheet. Did not run
4266 out ditch lines.

R. I. MEEKER.

Direct examination by Mr. John D. Clark:

4266 I assisted Sevison on some of the surveys during the past three weeks upon certain sections to ascertain the location of fields and ditches on the Laramie Plains, including the Watson Ranch and adjacent lands in Sec. 22, Tp. 14, R. 76; Sec. 36, Tp. 14, R. 77 and the survey of the Carroll Lake and Alsop Lake and inspection of seeped waste lands in the vicinity of the Bath and Alsop Ranches, and am familiar with his maps of these surveys, which correctly represent conditions as we found them. Have not checked his areas. Have been familiar with the alfalfa field in Sec. 36, Tp. 14, R. 77 shown on Exhibit S-1 for two seasons and saw alfalfa cut from it in 1912 and 1913. The Murphy Ditch is one of the
4267 oldest ditches on the Laramie River and I have seen it diverting water which was applied on the underlying land in 1912, 1913 and 1914.

Exhibit S-3 correctly designates and shows the irrigated area in Sec. 22, Tp. 14, R. 76, known as the Watson place. The Bloom lateral extends across that section. The source of the water supply on that section is the Bloom lateral of the Pioneer Canal. Some lands under the Parker Ditch are irrigated by seepage from the latter ditch. Water from the Bloom lateral is carried over the Parker Ditch by flumes which would be observed if they
4268 followed the laterals. The Colorado plane table survey is in error in classifying lands in Sec. 29, Tp. 14, R. 76, lying South of the county road as pasture land, unirrigated, since, practically all of that land lying under the Popp and Pahlow ("Barlow") Ditch is irrigated. I saw water applied there in 1912, 1913 and 1914; approximately 130 acres which is not credited as irrigated land. The Sodergreen Lake is incorrectly shown, being really located in Sections 21 and 28 instead of wholly in Section 28. The Pioneer Canal and Pioneer Canal Enlargement and Lake Hattie Supply Canal No. 1 are incorrectly shown since the Enlargement discharges water directly into the Sodergreen Lake, and the Pioneer Canal and Lake Hattie Supply Canal No. 1 draw their water from the bifurcation structure at the lower end of the lake. There is a waste ditch from the Pioneer Canal known as No. 1, located several miles above Laramie and another known as No. 2 at the end of the Pioneer Canal, both of which discharge directly into the
4269 river. I have known these since and including 1912, having visited them every year. A drain ditch was constructed in the summer of 1913 by Mr. Buntin in Sec. 14, Tp. 15, R. 74. I believe before the Colorado plane table survey of that section. I have also observed a number of other small drainage ditches and recall one on the Sodergreen Ranch along the base of the bluff directly south of the Sodergreen Lake under the Parker and Popp and Pahlow Ditches.

Cross-examination by Mr. Fred Farrar:

Drain ditch constructed by Mr. Buntin was not a completed ditch at the time I made survey of that area. Think I heard greater portion of Mr. Woodhall's testimony for Colorado.

Referring to Exhibit S-1, I recall fact that Mr. McAnelly and Mr. Woodhall testified that it was impossible to make plane table survey of all of area, and that everything north of county road was
4270 sketched in from superficial survey. Do not recall exact commencement of plane table survey. It was my understanding that some work had been done on Section 36 and I recall having seen plane table party out at work in adjacent section, Section 31-14-76. I did not understand Mr. McAnelly when he testified that when he first began survey he did not make classification which he termed irrigated pasturage. I understood that testimony was introduced to effect that he did not make classification called irrigated pasturage.

The 130 acres in section 29 designated pasturage, as I understand from testimony introduced heretofore, is represented as dry non-irrigated land. According to legend shown on sheet one and other sheets that land is classified by Colorado as non-irrigated
4271 Sodergreen Lake and bifurcation works of Lake Hattie inlet lie north of county road.

Waste Ditch No. 1 of Pioneer Canal is used to regulate flow of water at times of rainfall when excess water came into canal. There is excess water occasionally from heavy rains. There are times when canal has to be regulated by closing headgates and that would tend to throw surplus down canal and in order to keep it from overflowing at lower end, it is advisable to waste some water through waste ditch No. 1. It is not quite midway along canal.

R. I. MEEKER:

Redirect examination by Mr. N. E. Corthell:

4271 Waste Ditch No. 1 of the Pioneer Canal carries the water to the Laramie River but the term of "waste" is not used to indicate that the water is lost. I am familiar with the testimony of John E. Field relating to the flow of the water in the
4272 Laramie River and with the defendants' Exhibits 125-129; 143-145 in connection with the same. Those tables do not represent Mr. Field's own measurements or observations, but are existing hydrographic records secured in past years by the U. S. Geological Survey, the State of Wyoming, and the State of Colorado. I assembled all the hydrographic records on the Laramie River prior to the commencement of the court work and spent a large amount of time on them at intervals during several months. Since the giving of Mr. Field's testimony, I have reviewed the data, assembled it, compared it, and noted the relation of results at the stations and analyzed a large portion of the records, re-
4273 plotting the discharge curves and making new rating curves, and working out daily means and monthly totals and annual

runoff, continuing the records down to this time, May 15th inclusive, 1914. I am familiar with the general practice and methods used in measuring streams and recording flow, and have had about fourteen years' experience in measuring streams and in computing data and in analyzing data secured by others, and I am familiar with the methods of measurement and sources of records in the State Engineer office of Wyoming and Colorado and the U. S. Geological Survey, having spent several years with the survey in Colorado and adjoining states, measuring streams and canals and in that work and related work, since which time I have had occasion to go into the records both in Wyoming and Colorado. The accuracy of stream records depends first on the natural conditions at the gauging station, and secondly, the methods and care used in securing those data. The greatest and most common errors that occur in stream measurement are usually caused by incorrect soundings, which invariably give too great a cross section, especially in high water measurements. The reasons are that in making soundings the weight in streams which have rock beds sinks into holes between the rocks or the weight and lines are carried down stream to a point not perpendicular to the cross section, giving soundings which are too great. Errors also occur from lack of keeping the meter
4274 point clean and sharp to avoid increased friction. If not well oiled and in good condition, the velocities secured are below their true values and the measurement is less than the actual volume of water. At times on mountain streams the velocities of swift currents can only be secured on the surface when a co-efficient is required for the reduction to a mean velocity. Such co-efficients are based on experience and judgment is needed in their application. The tendency of all high water measurements both from sounding and velocity factor is to secure too high results, as disclosed by an examination of the older and earlier records, which being from high water measurements, are usually in error and give results far too great. Errors also occur from the settlement of the gauge, and unless frequent checkings of bench marks are resorted to, these errors may cover a considerable length of time, giving a gauge reading which is too high and therefore showing more water than actually passes. Errors frequently occur from careless readings of the gauge or from neglect and faking of the records. The time of day at which gauge height observations are taken may not give a true mean for that day, especially on mountain streams, where the daily tide is pronounced. In case automatic stage registers are used, it is very important that the pen be checked with the staff gauge each time the chart is changed, and proper notations be noted on the sheet in order that corrections may be made. Errors also occur in measurements at time of high water from rising and falling stages. Back water from dams, drift or other things frequently vitiate the results for short periods. Ice conditions
4275 are an important factor and the direct application of discharge measurements based on open channel conditions and applied to gauge heights secured when ice conditions obtain, give result too large. This is also true of obstructions of channels by

driftwood or otherwise. Numerous instances have come to my notice of stream measurements in the west where the winter records are practically of no value, being grossly in excess of the actual run-off. This has been confirmed by the more efficient methods of today and greater care used that a sufficient notation as to conditions during the time observations were secured. The errors in the field in making stream measurements are not the only ones. Errors frequently occur in computation, and especially so in the extension of the discharge curve beyond known points of measurement to cover high water. In such case the error is usually positive. In summation then, the accurate measurement of stream flow with current meters is not a mechanical operation which can be performed by indiscriminate and inexperienced persons but requires experience and judgment, not only in the field, but for the proper application and computation of the data secured. Errors in stream measurement preponderate in the positive direction. Most of the records of stream flow secured in the Laramie River basin are based on daily gauge heights of staff gauges made morning and evening.
4276 However, within the last three or four years, automatic water-stage registers have, in a measure, replaced the staff gauges and the later data should be of much more value than the older data which is based on two readings per day of staff gauges. Practically all the stream flow data used by Mr. Field outside the Glendevey and Colorado-Wyoming line stations for 1912 and 1913, and data secured by the Laramie Water Company in the latter part of 1912 and in 1913 and 1914, are from staff gauge readings, while practically all the Laramie Water Company's data are based on automatic water stage register records, the exceptions being the records of 1912 at the Pioneer Dam and the Lake Hattie Supply Canal No. 2 Dam, based on staff gauge readings up to about the middle of August. Since that date automatic water stage registers have been used continuously winter and summer. This is also true at the McGill and Lookout stations on the Laramie River. The data secured at Two Rivers Station was based on staff gauge readings prior to April, 1914. At the present time the gauging stations on the Laramie River and Little Laramie River, with the exception of the May's Ranch Station on the Little Laramie and the Wheatland Station on the main stream are equipped with automatic stage registers, some of them
4277 owned by the State of Colorado, others by the Laramie Water Company, others by the State of Wyoming, and others by the Wyoming Development Company. The Glendevey and State Line Registers were installed late in the season of 1911 by hydrographers from the Colorado State Engineer's office, who supervised the operation of them but local people at times have been used to change the charts. They were installed prior to Mr. Field's administration. There is nothing in the record to indicate that he personally had anything to do with maintaining them, or that Prof. Carpenter had anything personally to do with the installation or reading of the measurements. From an examination of the records, no measurements have been made by Mr. Field and in only a few instances was Mr. Carpenter present during measurements and at no time as

I recall, did he manipulate the meter in person, although he supervised it in a few instances at the Colorado-Wyoming Station
4278 and two or three other stations. I refer to the records of State Engineer's office of Colorado and the hydrographic records secured by Prof. Carpenter in 1912 and 1913 on the Laramie River. He permitted me access to his records and I made copies of those that were needed for computation and notes of others. Mr. Field used those records with other records obtained by the State and also by the U. S. Geological Survey, and the State of Wyoming. I found some large errors in the old records on the Laramie River at the Woods Landing Station. In years where records were secured during the winter, the flow is grossly exaggerated, due to observations when there was ice interference, no discharge measurements being made under those conditions. The application of the discharge measurements made in open channel conditions or during the
4279 summer therefore gives volumes of water enormously greater than actually passing. Generally the months of December, January, February, March and part of April would be affected by these conditions, as the ice does not pass out of the river at Woods Landing until about April 5th to 15th. There are, of course, exceptions in years of earlier springs. The resulting record showed too large a discharge during the winter months. I also found some errors in the high water records, in one instance where they were under-estimated and in another instance over-estimated. These errors were so great that the data cannot be accepted without a careful analysis and re-working. In some instances I was unable to secure the basic data of the earlier years at the Woods Landing Station, either discharge measurements, cross section, notes, or other data, and could not re-compute with any certainty the volumes of water during those years. In my opinion the modifications and final estimates of Mr. Field in dealing with these previous records contain some large errors which vitiate them. I could not modify the records which I have myself secured, because they have been made under known conditions with hydrographic methods of much greater efficiency and accuracy than those secured in the early days, and
4280 the uncertainties due to ice conditions and other factors are eliminated. I have taken all the measurements made at the Colorado-Wyoming line by the State of Colorado, the U. S. G. S. and Prof. Carpenter during the years 1911, 1912 and 1913, and analyzed them by area and velocity curve methods, and thence deduced a discharge curve of area and velocity curves, which are factors of that discharge curve which show his high water measurements have areas greater than the standard cross section and mean velocities in excess of the mean velocity curve for that station. The result is that the application of his discharge measurements with such analysis gives too great a discharge by a good many thousand acre feet during the high water period of the Laramie River, the elemental errors of his measurements being too great a cross section area and too high mean velocities. The cross section areas are accounted for by the fact that soundings were made during high water measurements, and the standard area curve was not used for this station,

and the excess mean velocities were evidently the result of not using a stay line or wire to suspend the meter and decrease the force of the current, and insufficient weights. Prof. Carpenter found three culvert channels other than the main channel, which were carrying
4281 water at extreme high water stages. I do not know just how he applied the water passing through those culverts, but I assume that he made a rating curve for the channel and then for those gauge heights where water passed through the culverts he added values to the rating table securing a total to represent the entire flow. I prepared a discharge curve as I indicated, taking all the measurements mentioned and those made by myself, and from this curve, deduced a rating table applicable for the high water discharges of the year 1912. A discharge curve is a graphic method of interpreting discharges for all gauge heights at a record station. To plat a discharge curve it is necessary to assemble the measurements which have been made, and plot these on a cross section paper using gauge heights as ordinates and discharges in second feet as abscissa. The curve is then thrown through the known points meeting that condition which represents the mean curve of all the measurements. Mathematical equivalents are then taken from this discharge curve for the various gauge heights. This is the rating table and its application to the daily mean gauge heights gives the daily mean discharges of that particular station. The sheet offered (exhibit T-1) represents a record in the manner indicated of all the
4282 water measurements and velocities recorded at the Wyoming-Colorado line and the curve has been extended to conform to the area and velocity measurements. The curve so established is the curve which is applicable for the years for which these measurements were made and established for the high water discharges of 1912. Other curves could be constructed, based on a standard cross section, and the area and velocity factors. That curve represents the best practice in hydrographic engineering. A standard area curve for a discharge station which has a permanent cross section is secured by taking careful soundings during low water periods or level observations and extending these level observations up to and above the high water mark. From these data the areas are computed each half foot on the gauge. These points are then platted and the standard curve is drawn in. This curve is usually less than the area curve deduced from measurements made by soundings at high water and other stages for the reasons indicated. The table
4283 produced (Exhibit T-2) is the mathematical equivalent of the graphic. The table (Exhibit T-3) shows the discharge of the Laramie River at Boswell's Ranch on the Wyoming-Colorado state line for the year 1912 as determined by the curve and rating table just introduced, using the gauge heights of the State Engineer's office of Colorado published and on file in that office, being the same data used by Messrs. Field and Carpenter in the tables prepared for Colorado.

(Copy of Complainant's Exhibit T-3.)

Laramie Water Company, Laramie, Wyoming.

Daily Mean Discharge of Laramie River at Bowell's Ranch (Revised by Mecker), Near Jelm, Wyoming, for the Year 1912.

Drainage Area, 312 Square Miles.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	....	....	....	....	115	1,395	1,175	290	92	92	82	
2.....	....	....	....	....	128	1,490	934	214	82	92	82	
3.....	....	....	....	....	141	1,890	813	198	82	103	72	
4.....	....	....	....	....	115	2,200	775	183	72	115	72	
5.....	....	....	....	....	103	2,200	853	154	62	115	72	
6.....	....	....	....	....	82	2,200	701	154	72	103	72	
7.....	....	....	....	....	103	2,080	596	141	62	103	72	
8.....	....	....	....	....	141	1,890	534	198	62	103	52	
9.....	....	....	....	....	168	1,890	564	168	62	92	72	
10.....	....	....	....	....	168	1,890	534	141	72	103	82	
11.....	....	....	....	....	168	1,600	534	128	82	92	62	
12.....	....	....	....	141	183	1,395	630	115	72	82	43	
13.....	....	....	....	115	198	1,395	665	115	72	72	43	
14.....	....	....	....	82	214	1,310	701	103	82	72	62	
15.....	....	....	....	62	232	1,075	596	115	92	72	62	
16.....	....	....	....	52	270	893	534	141	103	82	43	
17.....	....	....	....	62	330	775	478	128	103	92	36	
18.....	....	....	....	72	376	701	451	115	103	92	52	
19.....	....	....	....	92	478	665	425	103	115	103	72	
20.....	....	....	....	82	564	665	478	103	141	92	72	
21.....	....	....	....	62	596	701	400	92	103	62	43	

Copy of Complainant's Exhibit T-3—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
22.....	....	....	....	43	665	775	352	82	92	72	52		
23.....	....	....	....	36	738	893	330	92	103	82	52		
24.....	....	....	....	72	813	1,025	330	82	92	72	52		
25.....	....	....	....	72	893	1,075	290	82	82	82	52		
26.....	....	....	....	72	1,075	1,025	290	72	92	92	43		
27.....	....	....	....	72	978	1,175	310	62	103	103	36		
28.....	....	....	....	72	813	1,235	270	72	92	82	36		
29.....	....	....	....	92	934	1,175	232	82	92	82	36		
30.....	....	....	....	103	1,490	1,125	232	92	92	82	36		
31.....	....	....	....	....	1,735	....	290	103	....	82	....		
Total...	....	....	....	1,456	15,007	39,803	16,397	3,930	2 628	2,765	1,715		Year period.
Mean...	....	....	....	76	484	1,327	526	127	888	89	57		
Run-off Acre feet.....				2,864	29,760	78,962	32,342	7,809	5,236	5,472	3,392		165,837

Discharges applied by H. W. C., 4/18/14.
Checked by R. I. M., 4/20/14.

(COPY OF COMPLAINANT'S EXHIBIT T-4.)

Comparative Table.

1912 *Run-off of Laramie River at Colo.-Wyo. Line, Boswell's Ranch.*

Values in Acre Feet.

	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Total.
Published 16th Biennial Report, Colo.....	2,713	30,034	74,097	33,388	7,367	4,863	5,121	3,290	169,873
Revised by Engineer Field.....	2,830	32,783	92,912	34,087	7,545	5,078	5,343	3,405	183,983
Revised by R. I. Meeker.....	2,864	29,760	78,692	32,342	7,809	5,236	5,472	3,392	165,837

NOTE.—The published data of Colorado did not include water which passed around the gauging station through three culverts during high water.

The revised data by Engineer Field includes water passing through culverts measured by L. G. Carpenter. The Colorado revised data are not based on area velocity curve analyses. For this reason the upper portion of the discharge curve for extreme high water gives too great a discharge.

The revised data by R. I. Meeker are based on area and velocity curve analysis, using a standard area curve and measurements for years 1911, 1912, and 1913.

R. I. MEEKER.

May 19, 1914.

Exhibit T-4 is a table showing a summary of the flow in acre feet at the state line as determined from the same data, and given in three different series that are indicated in the table itself; first, the published data in the 16th Biennial report of the State Engineer of Colorado; second, the same data as revised by State Engineer Field in his testimony in this case; and third, the same data as revised by the witness at the present hearing using the discharge curve and rating table, and discharge table just put in evidence; and these are simply different methods of arriving at the same result and using the same gauge heights and records. From
4284 this it appears that the published report of the State Engineer of Colorado gives the flow of the Laramie River at the state line in 1912 in round numbers: 160,000 acre feet; Mr. Field's testimony, 183,000 acre feet; the calculation of witness, 165,000 acre feet, covering the months of April to November inclusive. The explanation of the higher figures computed by Mr. Field
4285 from the measurements and calculations of Prof. Carpenter is that the discharge measurements were not analyzed by area and mean velocity curves and proper weights given to the more dependable measurements as in my method. On April 11, 1914, I took the cross section at the Colorado-Wyoming line from the existing water surface, and also above and below high water line with a level and rod, and then took this data and plotted the actual cross section and determined a standard area curve which can be used at this station for the reason that conditions are permanent with reference to the stream bed in the main channel. The difference between the measurements and computations of area arises from the fact that I made a measurement with level and rod above the water surface, while Prof. Carpenter made his measurements with
4286 a line and weight beneath the water surface and during high water stages. As I recall he also testified in one instance a pipe was used to secure soundings. A cross section of a river channel can be taken with greater accuracy by level and rod than by soundings with leaden weights or through pipe or other means when the water is four to six feet deep. On the curve which I have put in evidence, the areas of each discharge measurement have been plotted to show the general location of the area curve, but no line has been drawn to them. The only line drawn on Exhibit T-1 is the Standard area curve based upon the cross section determined by level and rod, but the location of the line drawn through the areas of the respective measurements is very apparent on account of their closeness. The standard area curve on this Exhibit is determined by my measurements, while the measurements of Prof. Carpenter fall to the right of this curve, giving areas in excess of the standard curve thus showing too great a discharge. (Witness projects an area curve on Exhibit T-1 in a dotted line corresponding to the measurements made by Prof. Carpenter.) The mean velocity curve is shown further to
4287 the right on this sheet, the curve being determined by plotting through the individual mean velocities and taking the curve which would balance with the various measurements made with the

exception of the mean velocities secured by Mr. Carpenter, which are in excess and beyond any of the velocities secured by other hydrographers. I am not clear what measurements were taken as the basis for the location of the curve used by Prof. Carpenter. As I understand, neither he nor Mr. Field analyzed their discharge curve, their areas and mean velocities. Their curve (the dotted line) at high water stages would give too great a discharge, very much
4288 greater than the existing curve in Exhibit T-1. The small triangles in red ink on this chart indicate measurements of Prof. Carpenter in 1912; and my own measurements made in 1913 are indicated by a small green square; and the measurements made in 1911 are designated by a small circle with a black dot in the center; in 1912 additional measurements by other hydrographers are marked by a triangle and dot in black. Measurements in 1913 by other hydrographers, are plotted with a small black square.

Exhibit T-2, column 3, (the 5th column from the left) gives the discharge in second feet for the respective gauge heights for the main channel under the bridge at the gauge station. The next column gives the discharges for the various gauge heights through the culverts at high water stages. The last column (also under figure 3) is a summation of the water passing through the main channel and the water through the culverts, and gives the total discharge at the Boswell Station at high water stages according to Exhibit T-1, the discharge curve and the related data.

Defendants' Exhibit 157 is the graphic equivalent of the hydrographic record secured in 1912, at the station at Filmore
4289 just above the Bellamy Canal on the Little Laramie River. On April 24th, I examined these records in Prof. Carpenter's office. They correspond to the hydrograph and indicate a flow in 1912 of 128,955 acre feet from May 20th to Oct. 19th inclusive; from June to September, inclusive, 117,185 acre feet. The records secured in 1912 by the State of Wyoming at May's Ranch 1½ miles above, also the records secured by the Laramie Water Company at Lake Hattie Supply Canal No. 2 Dam about one mile below the Filmore Station of Prof. Carpenter are comparable with the Carpenter records when corrected by adding the amount of water diverted by Lake Hattie Supply Canal No. 2, and the amount of water diverted by the Bellamy Canal, records of which were secured in both instances, though there are several small ditches which take out a small volume of water between the Carpenter Station and the Lake Hattie Supply Canal No. 2 dam not sufficient to
4290 vitiate the comparison. In extreme high water these small ditches might divert as much as 45 second feet or a flow for the season of approximately 4,000 to 5,000 acre feet. Fair results can be secured at the station at May's Ranch, although the river is in two channels at this station during high water, but there are bridges in there where the measurements can be made directly at the station. The Carpenter station is not an advantageous station for securing dependable results for the reason that it is located at a point above the Bellamy dam where there is no bridge and where high water discharge measurements can not be made. To make

discharge measurements at this station, it is necessary, at low stages, to wade in the vicinity of the station and at high stage it is necessary to go down to the bridges across the several channels at Wright's Ranch and make measurements of each channel, also measurements of the Bellamy Canal, and another small ditch, or measurements could be made at May's Ranch. The station at Lake Hattie Supply Canal No. 2 Dam is the best station for measurements of water on the Little Laramie River in the vicinity of Filmore for the reason that conditions at the dam are permanent, the dam having a weir across and there is a bridge on the Dougherty Ranch about a half mile below where discharge measurements can be made at high water and where they were so made in 1912, and an excellent discharge curve secured based on area and mean velocity analysis. Of course, it is necessary to add any diversions between Bellamy Canal and Lake Hattie Supply Canal No. 2 to be comparable.

4291 The comparative table produced (Exhibit T-5) showing the 1912 run-off at Filmore in acre feet is the result of analysis of the data available at all three stations. I prepared the data at the Lake Hattie Supply Canal No. 2 dam, examining the basic data secured by Carpenter and the basic data secured at May's Ranch, but did not make new computations, taking the computations of the State Engineer of Wyoming at Filmore, the computation derived from Prof. Carpenter's measurements and my own figures at the Lake Hattie No. 2 dam.

(COPY OF COMPLAINANT'S EXHIBIT T-5.)

Comparative Table.

1912 *Run-off Little Laramie at Filmore, Wyoming.*

Values in Acre Feet.

	June.	July.	August.	Sept.	Oct.	Total.
(a) May's Ranch (Wyoming).....	54,300	23,200	7,750	4,440	4,750	94,440
(b) Filmore (L. G. Carpenter).....	76,632	27,676	8,514	4,363	Record incomp.	117,185
(c) Hattie No. 2 Dam (Lar. Water Co.).....	51,073	20,875	5,829	3,761	4,175	85,713
Excess by L. G. Carpenter over State of Wyoming, Period of June to Sep., incl.....	22,332	4,476	764	—77	....	27,495

(a) 1½ miles above Filmore. See 11th Biennial Report, State Engineer of Wyoming, p. 94.
(b) At Filmore, just above Bellamy Canal Dam. See Exhibit No. 157, by Colorado.
(c) Approximately one mile below Filmore; includes water diverted by Bellamy Canal; includes water diverted by Hattie No. 2 Canal.

Several small ditches divert water between the Bellamy Dam and No. 2 Dam. No correction made for these diversions. The results secured by the Laramie Water Company should, therefore, be slightly less than the values secured either at May's Ranch or Filmore, since there is no inflow between the two stations.

May 19, 1914.

R. I. MEEKER.

(COPY OF COMPLAINANT'S EXHIBIT T-6.)

Comparative Table.

1913 *Run-off Little Laramie River at Filmore, Wyoming.*

Values in Acre Feet.

	May.	June.	July.	Aug.	Sept.	Oct.	Total.
(*a*) May's Ranch (Wyoming).....	21,880	23,164	6,366	2,566	1,325	1,848	57,149
(*b*) Filmore (Colorado)	15,987	17,851	2,890	1,217	815	No record.	38,760
(*c*) Hattie #2 Dam (Lar. Water Co.)...	18,600	20,844	4,851	1,870	1,167	1,622	48,954
Deficiency between Colorado and Wyoming, May to Sept., inclusive.....	5,893	5,313	3,476	1,349	510	....	16,541

(*a*) At May's Ranch, 1½ miles above Filmore.
(*b*) At Filmore, just above Bellamy Canal Dam.
(*c*) Approximately one mile below Filmore; includes water diverted by Bellamy Canal; includes water diverted by Hattie No. 2 Canal.

Several small ditches divert water between the Bellamy Dam and No. 2 Dam. No correction made for these diversions. The results secured by the Laramie Water Company should, therefore, be slightly less than the values secured either at Mays Ranch or Filmore, since there is no inflow between the two stations.

R. I. MEEKER.

May 19, 1914.

Exhibit T-6 gives the flow derived in like manner at these three stations for 1913. The records at Filmore in 1913 were secured by the State of Colorado, which had a hydrographer in the field to cover the Little Laramie River last summer.

Defendants' Exhibit 157 was based on the Filmore records for 1912. The Filmore record for 1913 was not put in evidence
4292 by Colorado. The 1912 records secured by Prof. Carpenter are in excess of those secured at May's Ranch for the State of Wyoming for the period from June to September, 27,495 acre feet, probably due to the fact of poorer gauging station, and the difficulty in securing correct high water measurements of the numerous channels passing through Wright's Ranch where they were made. As I recall in some of these high water measurements, the water was passing over the meadow. As there is but one small ditch diverting water between May's Ranch and Filmore Station and no inflow, and the 1912 records at May's Ranch are also substantiated by discharge measurements made in other years, the conclusion is that the volume of water secured at the Filmore Station by Mr. Carpenter is in error 20,000 or 25,000 acre feet. This is also affirmed by the corrected data secured at Hattie No. 2 dam, which agrees in a general way with the data secured at May's Ranch when an allowance is made for the small ditch diversions and the Bellamy dam and Lake Hattie No. 2 dam.

Referring to the 1913 records secured at Filmore by the State of Colorado, I am unable to give a definite explanation of the deficiency of 16,541 acre feet for the period of May to September, inclusive, which occurs between the May's Ranch or Wyoming station and the Colorado station, other than that the data that were secured are based on insufficient discharge measurements or incorrect discharge measurements and a comparison with the data secured at Hattie No. 2 dam shown as the aggregate for the Bellamy Canal, no correction being made for Hattie No. 2 Canal through which no water was diverted in 1913, that the Filmore record is in error ap-
4293 proximately 15,000 acre feet too low. These data secured by Colorado at Filmore Station were not used by Mr. Field in his testimony or discussion of the Little Laramie River run-off, and the fact that Exhibit 131 bears the following notation: "Record for 1913 at Lake Hattie Inlet plus flow in Bellamy Canal by R. I. Meeker" indicates the uncertainties and lack of confidence in the records secured by the State of Colorado. It might be that Mr. Field disregarded this low flow secured by his hydrographer for the reason that it did not show as large water supply available from the Little Laramie River as he could secure by using the Lake Hattie Dam records. The tendency throughout his hydrographic record is to consistently accept the records which give the greatest flow at stations where there were conflicts and to destroy those records which would show a less discharge thereby showing a larger amount of water in the Laramie River basin available for irrigation on the Laramie Plains. A specific instance where he has used my records when they were higher than the Colorado records is at Woods Landing where one of the year's records was too low and he had those

records re-computed and revised, but he ignored another year of those records which, if revised according to the data available, would show a much less discharge than the face value of the rec-
4294 ords. I find no consistent reason why he should have adopted the method of taking the high years and destroying the low years, other than he had decided upon what volume of water was available in the Laramie River basin and made his computations fit the answer. A consistent and careful analysis of these records from a hydrographic standpoint does not permit of any such deductions, and it was because of the uncertainties and errors and unknown conditions under which the old records were secured that after an extended and careful re-computation of the old records at Woods Landing and at other stations, I came to the conclusion that only in a general way could they be taken and not used concretely. They do, in a broad way, mark the yearly run-off if the winter flow records are disregarded and the two or three years which are grossly in error are disregarded. As a result of my analysis of these records and the continuation of my own measurements and records down to May 15, 1914, I have revised and brought down to date the tables of the flow of the Laramie and Little Laramie Rivers used in my former testimony.

(COPY OF COMPLAINANT'S EXHIBIT T-7.)

Laramie River Run-off, 1912, 1913, 1914.

Run-off, 1912.	Acre feet.	Distribution.	Acre feet.
Laramie River at Pioneer Dam, near Woods, Wyo. Run-off Jan. 1 to Dec. 31.	207,000	Pioneer Canal	17,703
		Lake Hattie Reservoir....	69,855
		All other ditches between Pioneer Dam and Two Rivers	29,892
NOTE.—Jan., Feb., and March run-off estimated as 8,300 acre feet.		Wheatland Res. No. 2 and intermediate ditches below Two Rivers.....	89,550
	207,000		207,000

Run-off, 1913.	Acre feet.	Distribution	Acre feet.
Laramie River at Pioneer Dam, near Woods, Wyo. Run-off Jan. 1 to Nov. 30.	109,593	Pioneer Canal	13,504
		Lake Hattie Reservoir....	28,470
		All other ditches between Pioneer Dam and Two Rivers	18,917
		Wheatland Res. No. 2 and intermediate ditches below Two Rivers.....	48,702
	109,593		109,593

Monthly Discharge of Laramie River at Pioneer Dam, Near Woods, Wyoming, in Acre Feet.

	1912.	1913.	1914.	Means for 12 months.
January	.....	2,650	3,283	2,966
February	.....	2,355	3,088	2,722
March	.....	3,296	4,003	3,650
April	5,534	12,674	8,807	10,740
May	40,643	38,307	°13,383	39,475
June	91,874	26,598	.....	59.236
July	34,863	6,825	.....	20,844
August	7,809	3,130	.....	5,470
September	4,641	3,023	.....	3,832
October	6,456	3,812	.....	5,134
November	4.403	3,677	.....	4,040
December	2,644	3,246	.....	2,945
Total	198,867	109,533	32,564	161,054

° 1 to 15, inclusive.

These records secured by the Laramie Water Company.

R. I. MEEKER,
Hydrographer.

May 21, 1914.

(COPY OF COMPLAINANT'S EXHIBIT T-8.)

Little Laramie River Run-off, 1912, 1913, 1914.

Run-off, 1912.	Acre feet.	Distribution.	Acre feet.
Little Laramie River at Hattie Supply Canal No. 2 Dam, near Filmore, Wyo., plus volume diverted by Bellamy Canal. June 1 to Dec. 31	68,874 24,793	Bellamy Canal and James Lake Reservoir	24,793
		Hattie Supply Canal No. 2.	14,053
		Ditches between No. 2 Dam and Two Rivers	17,245
		Wheatland Reservoir and intermediate ditches below Two Rivers	37,556
	93,667		
	93,667		93,667

Run-off, 1913.	Acre feet.	Distribution.	Acre feet.
Little Laramie River at Hattie Supply Canal No. 2 Dam, near Filmore, Wyo., plus volume diverted by Bellamy Canal. Jan. 1 to Dec. 31	47,327 12,310	Bellamy Canal and Lake James Reservoir	12,310
		Hattie Supply Canal No. 2 Ditches between No. 2 Dam and Two Rivers	222,254
		Wheatland Reservoirs and intermediate ditches below Two Rivers	25,073
	59,637		
	59,637		59,637

Monthly Discharge of Little Laramie River at Hattic Supply Canal No. 2 Dam, Near Filmore, Wyoming, in Acre Feet.

	1912.	1913.	1914.	Means for 12 months.
January	.....	1,045	1,230	1,138
February	.....	1,000	1,277	1,138
March	.....	1,476	1,439	1,458
April	.....	3,909	3,451	3,680
May	.....	14,142	°3,033	14,142
June	42,147	15,590	.....	28,868
July	13,558	3,431	.....	8,494
August	3,911	1,353	.....	2,632
September	3,701	1,107	.....	2,404
October	1,697	1,562	.....	1,630
November	2,702	1,642	.....	2,172
December	1,058	1,070	.....	1,064
Total	68,774	47,327	10,430	68,820

° May 1 to 15, inclusive.

NOTE.—Run-off of Little Laramie River included and accounted for in storage tables of Laramie River Basin for 1912 and 1913.

R. I. MEEKER.

May 21, 1914.

The table (Exhibit T-7) is intended to supersede Exhibit I in my former testimony and the table Exhibit T-8 is intended to supersede Exhibit J in my former testimony. These two tables now
4295 introduced include a summary of all the data I have of the flow of these two streams obtained from my personal measurements and observation, secured under the most advanced hydrographic methods and under known conditions, and brought down to date. The Laramie River record extends from April, 1912, to May 15, 1914, inclusive, and the Little Laramie table from June, 1912 to May 15, 1914, inclusive. The total run-off of the Laramie River at the Pioneer dam in 1912 was 207,000 acre feet; in 1913, 109,593 feet; the mean of these two years was 161,054 acre feet. The Little Laramie run-off for 1912 is 93,667 acre feet; and for 1913, 59,637 acre feet; the mean, 68,820 acre feet. The means are
4296 based on two years' records on the Big Laramie for all months, and on the Little Laramie the mean for the month of May is based solely on the run-off for May, 1913, since the May, 1914 records were not used in determining the mean, as they cover but fifteen days. The mean annual run-off is the summation of the monthly mean run-off for twelve months in each year. Based on review of the flow records taken in a general way, and other hydrographic information, I have concluded that the year 1912 was slightly above normal in the Laramie River basin, and that, roughly, the normal at the Woods Landing station or Pioneer dam is approximately 200,000 acre feet, the year 1913 being a trifle above 50% of normal.

I have prepared a table from the U. S. G. Survey records taken at Saratoga, Wyoming, covering the run-off of the North Platte

River, covering the years from 1903 to 1906, inclusive, 1909, 1912, 1913, inclusive, for the months of April to October, being all the records available. I am familiar in a general way with the
4297 conditions affecting the flow of that stream. The drainage area above the Saratoga station is very similar to that of the Laramie River basin, being mountainous and being adjacent to like forestization and similar climatic conditions. Both basins are rimmed by high mountains, a portion of which lies between the two basins and is common to them. Both streams flow in a northerly direction, in general parallel with each other, and about 80 miles apart—in the upper portions approximately 20 miles apart.
4298 Both drainage basins have a northerly exposure and I consider the physical and climate conditions similar, more so than the similarity between the Laramie River and the Poudre River. The Laramie and North Platte, based on the physical features of the drainage basins, would be more likely to correspond in the fluctuations of their annual flow than the Laramie and the Poudre. The records on the North Platte and the Laramie River are hardly simultaneous enough to draw an absolute deduction, but only permit general conclusions. I think the table prepared would be valuable as an indication of what was the probable relative flow on the Laramie River for 1912 and 1913 as compared with other years shown on the North Platte.

(COPY OF COMPLAINANT'S EXHIBIT T-9.)

Daily Mean Discharge of North Platte River, Near Saratoga.

Records of U. S. G. S.

Year.	April.	May.	June.	July.	August.	Sept.	Oct.	Total.	Per cent.
1903.....	a91,792	a269,999	a411,111	77,905	27,423	35,225	40,705	954,161	96.1
1904.....	88,070	295,900	320,400	82,390	30,680	19,760	23,060	860,260	86.6
1905.....	56,650	204,700	417,700	86,330	26,440	13,450	18,380	823,650	82.8
1906.....	99,400	291,000	337,000	123,000	33,400	29,900	28,300	942,000	94.8
1909.....	78,000	360,000	768,000	319,000	87,300	60,100	31,400	1,703,800	172.0
1911.....	a91,792	234,000	320,000	78,100	18,600	12,400	31,200	786,092	79.4
1912.....	69,000	250,000	497,000	196,000	54,200	36,100	42,100	1,144,400	115.5
1913.....	159,632	254,392	217,677	40,089	17,323	15,521	26,976	731,610	73.7
Total...	734,336	2,159,991	698,888	1,002,814	295,366	222,457	242,121	.....	.....
Mean...	91,792	269,999	411,111	125,352	36,921	27,807	30,265	993,247	.....

a Mean of actual records used for missing months to complete April to October record.

H. W. CAREY.

April 18, 1914.

4299 Table Exhibit T-9 (Table offered in evidence for the purpose of establishing the relative percentage of the run-off for the normal year and primarily to offset the introduction of the Poudre table and the deductions of Mr. Field.)

According to this table, the flow of the North Platte for 1912 was 115.5% of the average flow for the eight years shown by the record, and for 1913, 73.7% of the average for the eight years. I do not know of any better basis from which to determine the percentage of the average flow of the Laramie river for these eight years.

4300 From an examination of Prof. Carpenter's field notes, records and data relating to the measurements made by him or under his direction on the Laramie River, and its tributaries, practically all measurements were made by A. P. Maury and Louis Carpenter. Occasionally the Professor was present, but only in a few instances, judging from the notations in the field books. The notes on the various discharge measurements were insufficient to determine definitely just how they were made. The statement was made to me that they were all secured by the vertical integration method, but the field notes contain no notations as to how they were secured. I would say they were insufficient notes whereby one could probably valuate them. As a whole, I believe them to be fair hydrographic records, but there is an absence of notes in places whereby I could not tell how much confidence to put in them. Of course, there are exceptions, for example, as to the measurements which I did analyze carefully at the Colorado-Wyoming line and found them to give too great discharges, and also on the Little Laramie River at Filmore, which were obviously in error, showing

4301 too great discharges. I took all measurements made at stations on the Laramie River and plotted them on discharge curves derived from my own measurements and found variations in places and especially the tendency was for the high water discharge measurements to give results too high. The low water measurements checked reasonably close, but the discharge measurements on the Little Laramie did not check during high water stages with the flows determined by either the State of Wyoming or the Laramie Water Company. I examined the Bristol Register Charts of the Colorado-Wyoming station for 1912 and 1913 on file in the State Engineer's office with especial reference to the charts covering the high water records of 1912, and also with reference to the condition of the pen, and its variance with the staff gauge during high water stages, and the correction made by Prof. Carpenter. The 1912 Bristol chart records are the poorest that I have had occasion to review. The 1913 records are in much better shape. In 1912 the pen was only corrected upon visits by the hydrographer, the observer simply changing the chart and perhaps with one or two exceptions, making no notation of what the staff gauge registered when the chart was removed. For this reason the records were open to grave suspicion since during 1912 the pen was in error frequently, and especially so during May and June. At one time there was a variation of one foot between the pen and staff gauge. From the record the pen appears to have been very sluggish and distinct daily waves

are not marked on the chart, such as I have observed at the
4302 station at the Pioneer dam in 1913 and 1914. In 1913 the State Engineer's office secured two sets of records, one from the Bristol Register charts and one with morning and evening observations on the staff gauge. This may have been for the reason that the 1912 data were in such poor shape. This register uses chart No. 817 which is only graduated to the nearest two-tenths of a foot interval and in taking gauge heights from the chart it is ultra-refinement to determine them closer than the nearest ½ tenth of a foot. The daily mean gauge heights as determined from the charts are entered on the chart on the respective date, but there is no note indicating who made the computations or who checked them. Some of the charts have no entry as to who changed them, but from information secured at the State Engineer's office and also from conversation with Mr. C. D. Oviatt, who has at times changed charts at this station, the charts have been changed both by Mr. Oviatt and Mrs. Oviatt. In conversation with Mr. Oviatt I found that he had no written instructions to make entries of the staff gauge reading when the chart was removed, and since they were not made whenever the pen was in error, no record is available for correction. He did have verbal instructions not to adjust the pen. The record for May 11th to 17th is missing. On May 16th the gauge rod registered 1.85 feet according to notation, and the pen .095 feet. On May 20th, the gauge rod registered 2.5 feet and the pen 1.5 feet, a very poor record. On May 26th the gauge rod registered 3.2 feet, the pen 2.1 feet; May 29th, the rod registered 3 feet, and the pen 2 feet. A notation occurs of a correction of one foot by L. G. Carpenter at 7:30 P. M. June 1st the gauge height registered 3.3 feet, and the pen 3 feet; on the chart of May 24th to 31st
4303 occurs the following notation: "Records on gauge got moved by crumpling of chart on May 11th until corrected on May 29th. Recorder is working properly but is too low by about one foot. Turner." June 1st the gauge rod registered 3.3 feet, and the pen 3 feet. The chart was removed June 10th, but there was no reference to the staff gauge reading. June 11th, the pen was corrected. .3, but no note showing who corrected it. On the chart of June 17th to 24th no note appears with reference to the staff gauge reading. The chart of June 24th to July 1st shows no notation of staff gauge reading. The 1913 Bristol Register charts are in much better shape and show frequent notation of correction by T. R. Grieve, the hydrographer who covered that portion of the river The 16th Biennial Report of the State Engineer of Colorado contains the following statement relative to gauge station near Boswell, Wyoming:

"This station established August 20, 1911, the equipment consists of a vertical staff gauge and automatic gauge. The automatic gauge was installed July 14, 1913." An examination of this Biennial Report and the 15th Biennial Report disclosed that there are no published records for 1910. T. R. Grieve, chief hydrographer of Colorado, states that the reason for this was that C. D. Oviatt was employed to read the staff gauge in 1910 but that he only read

it about once a week and his usual report was that the river was stationary. These data were so poor that no attempt was made to work them up. In conclusion, the data have been secured in a very careless maner and they contain errors, I believe these data for
1912 are the same referred to by Prof. Carpenter in his testimony and the same used by Mr. Field in his testimony. Refer-
4304 ring to Mr. Field's estimate of 12,800 acre feet probable run-off from mountain territory out of Four Mile, Seven Mile, Cooper and other small streams, heading in the mountains north of the Little Laramie River on the west side of the valley, the only run-off from that area is a very small inflow at times from Mill Creek to the Little Laramie. The most of this water is diverted before reaching the river, and applied on lands in that vicinity along the creek. Except Four Mile, I should say no water enters the Laramie River from those streams other than perhaps a small volume from Four Mile after very heavy torrential rains. The meadows along Four Mile require what little natural flow
4305 there is in the foothills, so practically no water reaches the Laramie River from that Creek, as I have observed in crossing it. King's survey of the 40th parallel made in the 70's shows Cooper, Dutton, Four Mile and Seven Mile Creek as not extending to the Laramie River. Cooper, Dutton and Seven Mile enter depressions, but the other tributaries are not shown as continuous to the Laramie River, showing that at that date there was no inflow. Seven Mile flows into James Lake, to which there was no outlet prior to the construction of the James Lake Irrigation System. Cooper and Dutton Creeks flow into Cooper Lake, having no connection with the river. There is practically no inflow from the source whence Mr. Field estimates 12,800 acre feet.

4306 Referring further to his testimony estimating an inflow of 12,800 acre feet from the mountain area on the east side of the Laramie Plains lying south of a point opposite Two Rivers, and a point opposite the Wheatland Reservoir, being an area of about sixty miles in length by five miles in width, very little water is contributed to the river from this area and that flows in from shall tributaries south of Laramie such as Soldier, Willow and Five Mile Creeks, and then only in times immediately following heavy rainfall or perhaps a very small flow may reach the river during the melting of the snows in March. From that area lying North of Laramie, there is practically no inflow to the Laramie River from the area extending along the slopes of the Black Hills to the Wheatland Reservoir. On April 25th I made a special inspection trip of those channels or draws between the steel bridge at the Two-Bar shearing pens and Laramie and outside of a few small draws which may carry a little water after very heavy rains, and which enter the Laramie river a short distance above the steel bridge or immediately north of Laramie practically no water enters the Laramie River from the Black Hills. The slight flow or run-off from this area is intercepted by lakes and ponds and is also intercepted by the Oasis and Boughton Ditches, and in turn carried to the lakes and ponds.

The run-off in the Black Hills is very meagre, occurring only after torrential rains or the melting of snow in the early spring. In frequent trips to the Wheatland Reservoir during 1912, 1913 and 1914, I have never seen in the aggregate over a few second feet in any of the ordinarily dry channels crossing the road to McGill, and then only after heavy rains or in March or the first few days of April. Some of the water originating on the slopes of the
4307 Black Hills is absorbed in transit by the sedimentary formations at its base. Reference to the Laramie Quadrangle topographic map of the U. S. G. S. shows the intermittent nature of the drainage from the Black Hills of these channels and the termination of the flow near the base of the hills. Mr. Field's estimate of this inflow is much too great.

Referring to Mr. Field's testimony as to the estimated discharge of 18,300 feet in Chugwater, reported by the State Engineer of Wyoming for 1911 and 1912, the gauging station is located on the C. & S. railroad, about thirty miles above the mouth of the creek about the point where it leaves the foothills proper. There is some irrigated land both above and below, but mostly below on both sides. I do not know of any gauging station at the mouth of Chugwater, but at one time after three days' rain on the Wheatland area I saw perhaps 75 or 100 second feet running into the Laramie River from that stream. Otherwise never more than a few second feet. The flow of this creek is practically absorbed by irri-
4308 gated lands lying along the stream, the record referred to being the record at the gauging station at Chugwater.

Referring to Mr. Field's testimony in connection with Defendants' Exhibits 136-141, and especially the chart dealing with the diversion of water through the Pioneer Canal Enlargement to Lake Hattie and to the Pioneer Canal proper, Mr. Field has taken the amount of water diverted by the Pioneer Canal enlargement which includes the water diverted to Lake Hattie and the water which is used on lands under the old Pioneer Canal, and then, in addition, made an allowance for the Pioneer Canal, thus duplicating the volumes of water used by that canal, an error which is perpetuated throughout the table, amounting to 17,700 acre feet in 1912 and approximately 12,000 acre feet in 1913 in both charts. As to
4309 the storage capacity of the Wheatland Reservoir No. 2, based on a survey of the high water mark in October 1912, and levels taken at the outlet and using the contour map filed in the State Engineer's office for that reservoir, I determined the active capacity to be 83,400 acre feet.

The last two years' record of the inflow ond outflow without refined computations, indicate that the capacity is even less. On May 15th, 1914, according to the capacity of the reservoir, there were 58,000 acre feet of water impounded. On the same date in
4310 James Lake reservoir there were stored 21,400 acre feet, and in Lake Hattie reservoir, 26,500 acre feet storage active on all occasions. This would leave on May 15th, 1914, an unused storage capacity of 25,500 acre feet in Wheatland Reservoir No. 2; 15,600 acre feet in James Lake Reservoir; and 42,000 acre feet in

Lake Hattie Reservoir, a total of 83,100 acre feet of unoccupied active capacity.

Referring to the testimony of Messrs. Hedke and Duvall relating to the filing maps or blue prints of the several irrigation works finally merged in the Greeley-Poudre or Laramie-Poudre project, I have had typewritten copies of the statement prepared and bound, together with all the filings, which I produce. (Plaintiff's
4311 Exhibit U-1.)

Mr. Carpenter: Objection as not the best evidence or any evidence of what original filings show, and as immaterial and irrelevant in that all matters pertaining to said water rights are merged in the decree of the District Court of Larimer County, Colorado, Exhibit 179.

I have also blue prints of the maps obtained from the State Engineer's office and identified by Mr. Hedke in this case, which are on many different scales and of different sizes. I have
4312 prepared a map upon which these blue prints have been transferred and combined in a single map upon a uniform scale, which I produce (Plaintiff's Exhibit U-2), and which is a correct transcript of the drawings in the blue prints. Featured in three different colors are shown the outline in vermillion, indicating the location of the lines of the Link Lake Ditch and Reservoirs since referred to as the Upper Rawah Ditch, which was originally and early planned for the diversion of water from the headwaters of the Laramie River by the Sky Line Canal to the Poudre River for the irrigation of lands in the vicinity of Fort Collins. The black line bordered on each side with vermillion extending from the west fork of the Laramie River to Chambers Lake represents the constructed Sky Line Ditch, and the vermilion dotted and solid lines lying to the north and west of the west fork of the Laramie River represent the projected ditch shown by these filings, the continuous line indicating the portion that is practically constructed. The filing dates, viz: Filing Nos. 1722, October 6, 1904; 3049, February 24, 1906; 5448, January 8th, 1909" indicate the dates and filings in the State Engineer's office as shown by the dotted lines. The dotted and solid lines in green represent
4313 the various plans for collection ditches and tunnel, which are now merged into one scheme for the diversion of the headwaters of the Laramie River to the Poudre River. The brown dotted line indicates the reservoir and canal detour system around Boulder Ridge from the headwaters of the Laramie River to the Poudre River. The same filing is shown in the small key map at the lower lefthand corner of the sheet, on a smaller scale so as to include the entire project in one sheet. The waters of the Upper Rawah Project could be carried to and through the tunnel by discharge into the West Fork of the Laramie, and if these waters were turned into the West Fork instead of being carried across that stream into the Sky Line Ditch, they would go on down to the tunnel. These waters can be carried either way. The solid green lines

indicate constructed work and the dotted lines projected
4314 work according to the filing. The brown dotted lines indicate a distinct alternative route from the green solid or dotted lines, and the Upper Rawah system shown in vermilion being also a distinct system which can be made supplemental to the tunnel system and used either way. The solid colors indicating constructed work were made from personal examination in 1913.

Mr. Carpenter: Objection to introduction of Exhibit U-2 as not best or any evidence of true location of lines; for improper conclusions of witness noted on map and not supported by record; incomplete through omission of data appearing in original records, and to conclusions of witness on matters of intent of original appropriators as settled by court decree, Exhibit 179.

4315 I think I heard most of the testimony of the Colorado witnesses in regard to the surveying and construction work done from time to time on these various projects; also the testimony of witnesses for Wyoming as to the surveying and construction work done from time to time on the Lake Hattie and Laramie Water Company's work, and have since read the transcript of the testimony from which I have constructed a chart showing graphically the progress of surveying and construction work on the different projects which I produce (Plaintiff's Exhibit U-3).

Mr. Carpenter: Objection as not best evidence because of incorrect statements noted as facts, conclusion of witness, omission to note work shown by testimony to have been done, improper segregations of portion of Laramie River works from remainder, contrary to the evidence in this case and the decree of District Court, Exhibit 179.

This chart is scaled so as to show approximately the rate of construction as measured by the amount of expenditure from time to time as best could be deduced from the testimony, the captions and the legends showing the significance of the different colors. The work designated in red indicates the time when money was expended on construction and the relative proportion of the same on
4316 the Pioneer High Line system and the related parts. The yellow, the time and proportionate expenditures or construction of the Link Lake or Upper Rawah Ditch. The green (Plaintiff's Exhibit U-3) shows similar data on the Laramie River system of the Greeley-Poudre Irrigation District; the blue, the data on the Poudre Valley system, on which last mentioned system I was unable to secure from the testimony the entire amounts expended and the exact time, so that it is necessarily incomplete.

4317 From my records and experience, the duty of water diverted from the Laramie River between the Pioneer Dam and Two Rivers Stations is approximately one acre foot per acre. This includes copious flooding of the meadow lands and irrigation of the pasture land adjacent to the river. If all the lands irrigated between these stations were included, the duty of water would be higher. I am familiar with the method of diverting, carrying and applying

water in the Laramie Plains and also in Colorado. The irri-
4318 gation on the bench lands of the Laramie Plains is very similar to the irrigation generally in Colorado, notably on the Gunnison, the South Platte and the North Platte Rivers, and the Arkansas, and other streams where native hay is raised in large quantities. I am familiar with the character of the diversion dams, head-gates and other similar irrigation works in the Poudre Valley in Colorado, and those on the Laramie Plains, with the exception of some very small dams. The works on the Laramie Plains compare very favorably with those in the Poudre Valley in efficiency and with respect to the waste of water, and those ditches which have temporary dams usually only require those for the late meadow
irrigation or otherwise the dams would be more permanent
4319 in character. The temporary character of the dams does not result in a waste of water because there are large numbers of ditches below that have prior requirements to which water must be passed. Taking into consideration the entire system of ditches and reservoirs on the Laramie Plains and especially the location and character of the Wheatland Reservoir No. 2, the net loss or waste of water resulting is no greater than in other irrigated areas generally and for the reason that the Wheatland Reservoir No. 2, which is a channel reservoir and has a large priority over many of the ditches above receives all the return flow of the river and its tributaries above that point and uses it, making it available for use on the Wheatland lands below, there being no corresponding condition in Poudre Valley, where water is more likely to be lost than in the Laramie Valley. The return flow from the irrigated lands along the Laramie River is very rapid.

Referring to Mr. Field's testimony about the number of natural channels of the Little Laramie River into which the flow of the stream is divided, this does not indicate an unnecessary or unusual waste of water, as it would be necessary to construct an extensive system of ditches and laterals at greater cost if these natural channels did not exist, and the artificial ditches would give a greater waste
and loss.

4322 (On resuming his testimony.) Referring to Exhibit T-7, I desire to ask for the following corrections:

Change opposite "Lake Hattie Reservoir" 69,855 to 52,152; change opposite "Two Rivers" 89,550 to 107,253. In the table I duplicated the 17,703 acre feet used by the Pioneer Canal including it the second time in the Lake Hattie Reservoir diversion. This error misled Mr. Field in his Exhibit No. 136, the error in which is based on the error in Plaintiff's Exhibit T-7 which is the table replacing Plaintiff's Exhibits B and I. The error referred to does not occur in Exhibit 141.

At page 220, Volume 1 of the Plaintiff's evidence, the dates of
measurement and record of the flow of the Laramie River
4323 should be 1912 and 1913.

On page 226 the reference to the flow of the Wheatland Reservoir No. 2 from May 1st to August 17th, 1913, should read

"Covering the period of May 1st to August 17th, 33,870 acre feet" in place of 90,053 acre feet as shown in the transcript.

In the third answer, same page, the inflow into the reservoir from January 1st to August 18th, 1913, is 63,463 acre feet.

The correction of the errors as to the flow and distribution of water in the Laramie River in 1912 does not affect the flow, but simply shows a redistribution of the water.

4323 Cross-examination by Mr. Fred Farrar:

Effect of change which I have just made in table shown on my Exhibit T-7, wherein I have changed inflow into Lake Hattie Reservoir for year 1912 from 69,853 to 52,152, decreases volume of water charged to Lake Hattie Reservoir by 17,703 acre feet and credits same volume to Wheatland Reservoir No. 2 and intermediate
4324 ditches below Two Rivers. When I say "credits" I mean that that much addition- water above my original figures was taken into Wheatland Reservoir No. 2 or intermediate ditches.

The same error occurs in Table, Plaintiff's Exhibit "B" which was introduced in evidence August 22, 1913.

I was in error at outset of taking of testimony in this case.

Later on I revised this table shown on Exhibit "B" and superseded it by table shown on Exhibit "I," which was introduced some time later in case.

I made same error in my revised table shown by Exhibit "I."

I again continued the error in my table Exhibit T-7, which was introduced yesterday.

My mistake was not discovered by myself until my criticism of Mr. Field's diagram shown on Defendant's Exhibit 136 and it was challenged by him.

In my direct testimony, I have assumed to term as unreliable in some cases and questionable in other cases, records of stream flow or discharges made by other engineers and other hydro-
4325 graphers. I am willing to admit that even I am not infallible.

I have delineated factors to which I attributed inaccuracy in measurements of flow of water in streams. These same factors were pointed out by witnesses for defendants, more particularly Professor Carpenter and Mr. Field. These inaccuracies which I mentioned may occur wherever stream measurements are made.

They are not matters of criticism directed specifically toward earlier records of Laramie River but include other measurements.

If same errors are apt to occur in any set of measurements, same things may be said of other measurements taken at other places and by other persons.

In all measurements there is certain human factor that may contribute either to accuracy or inaccuracy.

Assuming some of these factors may have been present in measurements taken, for illustration at Boswell Station on Laramie River, it is reasonable to suppose that same errors may have occurred in measurements which were taken above Boswell Station on that stream and also *that* those which may have been taken at other places on

Laramie River and on its tributaries, but those are determined by analysis of specific data of any station.

If same errors prevail at different places on stream these errors would in a measure be compensating, but it must be remembered that at upper stations on Laramie River there is less volume of water and less opportunity for gross errors. Velocity of
4326 water at Glendevey Station, one of upper stations, at high water, is probably greater than it is at the interstate line station, there being greater grade in river at upper station.

Experience is not only requisite necessary to proper accomplishment of measurement by current meter, that must be supplemented by care and judgment in work. There is certain judgment required which is supplied by experience. It is the outgrowth of ex-
4327 perience. It is not a question of adaptability. It is my experience in engineering work and especially in the measurement of water, that many men take up this field of work who demonstrate by the quality of work and methods they use that they are not adapted to it primarily from viewpoint of accuracy and care. This is true of men in all professions.

My conclusions as to stream flow are based almost entirely on my measurements made during period commencing April 12, 1912, supplemented by analysis of older data. I did not use my figures as basis for critical analysis. I used hydrographic methods with which I am familiar and have acquired through good many years' experience in rating older data.

I made part of this analysis since evidence on behalf of defendants has been given. Large part of it was made prior to that time. Everything I have done relative to analysis of basic data governing other records has not been with idea of sustaining my original statement shown on Exhibit "B" and Exhibit "I," introduced during testimony of examination in chief by me, wherein I committed myself to runoff for 1912 at Woods Landing of 207,000 acre feet. I have made my analysis and determination since that time with view of arriving at actual volume of water that is available.

My original statement of 207,000 acre feet as made in my Exhibit "B" was based entirely upon my own measurements where I had them, supplying them by estimates for few months for year 1912 from data secured under known conditions. After critical examination of all other records taken by other observers I have not modified my estimate made for year 1912, because those data were secured under known conditions and worked up carefully and rigidly.

I have not in any way materially modified any other conclusion at which I arrived relative to total or mean annual flow of Laramie River. My decision or conclusion as to annual flow at vicinity of Woods Landing Station or Pioneer Dam, I have had to refer to in a way and to use old records, because I would be unable to determine runoff of Laramie River in average year from one year's measurements. My analysis and digest of these late data leads me
4329 to believe it is less than their face value shows. I do not desire to be understood as testifying in the case in chief only to flow for years 1912 and 1913. I believe I testified yesterday that

mean annual runoff of Laramie River in vicinity of Woods Landing station was approximately 200,000 acre feet. I did not arrive at that conclusion some months ago. I do not arrive at conclusion that these old records are all excessive I cited one specific instance where re-working of those had increased flow greatly.

I think there are quite a number of gross instances. If old records are taken at their face value annual flow of Laramie River at Woods Landing is grossly in error. It is excessive.

These records which I have revised, have not discarded entirely, include records made by state engineers of Wyoming, United States Geological Survey, state engineer of Colorado and by Professor L. G. Carpenter and others. In my particular case it was a revision downward, because everything contributed to that point. There is no uncertainty as to gross error in winter flow of Laramie River at Woods Landing as secured by State Engineer of Wyoming and by United State Geological Survey in early years and this matter can easily be affirmed by careful investigation by any hydrographer of experience.

4330 If gauge rod were raised in any manner it would not show true volume of water and would give values less than the actual. Ice in stream may have tendency to raise gauge rod, but I do not recall more than one or two instances where rods were actually raised above their true position by such causes. Invariably the error is settlement. Effect of ice forming around gauge rod and object to which it is attached would depend upon stability of piers or abutments to which attached. If pier or abutment to which it is attached was not solid and substantial usual tendency would of course, be to raise it. The true winter flow is very small in comparison with spring and summer flow, on Laramie River, but acceptance of old winter records such as those at Woods Landing, which are greatly in error and show in some of low water months January and February, as high as 50,000 acre feet, when actually a runoff of in the neighborhood of 5,000 or 10,000 acre feet, could not be accepted.

4331 I heard Mr. Field's testimony that he had discarded winter records of which I speak in arriving at his determination. There were 2 or 3 years in which the errors occurred. There was one specific error that was obvious.

Exhibit T-2 is based upon my discharge curve Exhibit T-1. The Sixth vertical column on Exhibit T-2, reading from left, indicates flow of water at respective gauge heights through culverts at different stages. This particular column is located at upper left hand corner of Exhibit T-1 and is designated as curve for culverts west of road.

4332 According to table Exhibit T-2 discharge through these culverts west of road at gauge height of 3.65 feet is 480 cubic feet per second. Curve shown on Exhibit T-1 shows discharge at that particular gauge height of 580 cubic feet per second.

I am evidently again in error in one of these tables. 580 is correct.

I desire to have a correction noted on my table Exhibit T-2.

Change in table as shown in next column to right should be corrected to 2,300 and an increase of 100 second feet.

At a gauge height of 3.6 feet the total flow through channel and culverts would be 2,080 second feet.

I recall that Professor Carpenter found that on June 4, 1912, at gauge height of 3.62 feet, there was a total discharge of 2,512 cubic feet of water per second of time.

I find that at the gauge height of 3.4 feet there was passing through culverts and outside channel 100 cubic feet of water per second of time. In absence of other data I used Professor Carpenter's discharge measurements as basic data.

I departed from his discharge measurement at higher
4333 gauge heights for culverts only.

According to my table I find 10 cubic feet of water going through culvert outside of channel at gauge height of 3.25 feet.

Figures shown in this column six are based on discharge measurements of culverts by Professor L. G. Carpenter. Overflow according to my determination, occurs just above 3.2 on gauge.

On April 2, 1914, I directed an inquiry to Robert Follansbee, District Engineer for United States Geological Survey at Denver, relative to certain measurements made by Geological Survey at this station. The answer is as follows:

4334 "300-304 CHAMBER OF COMMERCE BLDG.,
DENVER, COLORADO, April 3, 1914.

Mr. R. I. Meeker, c/o Laramie Water Company, Laramie, Wyoming.

DEAR SIR: I have your letter of April 2d relative to the highwater measurements made by Mr. Fletcher on the Laramie River at Boswell's Ranch in 1911.

The original notes for these measurements are in the Washington office, and therefore, I am unable to give you definite information in regard to them at this time. In discussing the matter with Mr. Fletcher, however, he states that, to the best of his belief, he used one 15 pound and one 6 pound torpedo weight on the meter which was suspended by a single wire, reducing the obstruction to the current to a minimum. In the swiftest part of the current a stay line was used in addition, which insured accuracy of soundings and accuracy in holding the center of the meter at the .2 and .8 depth for determining the velocity. He is not certain in regard to correction for angle, but believes that this was not serious in any event. While he did not actually see the overflow channels, he instructed his assistant to examine them to determine whether there way any flow. As the latter reported that there was no flow, Mr. Fletcher did not visit them for the purpose of making measurements.

As the accuracy of these measurements was questioned last summer, I made a special trip to the gauging station September 1st and 2nd, and ran lines of levels myself to determine the approximate gauge reading at which the overflow would begin. In addition to running a line of levels across the valley to determine the cross

section of the several small overflow channels, I ran levels up the river as far as the beginning of the main overflow channel to determine the fall between the two points. From these levels I have compiled the following notes:

The main overflow begins approximately 1,050 feet upstream from the gauge (located at the bridge). Between this point and the gauge there was a fall of 2.5 feet at a gauge reading of 1 foot. The lowest point in the main overflow channel at the river bank was 1.4 feet higher than the water surface. But while the river would overflow this point at a rise of 1.4 feet (or a reading of 2.4 feet on the gauge), it could not flow through the main overflow channel until it rose .6 feet higher (or a gauge height of 3 feet), as the overflow channel rises that amount within a short distance of the river bank. Therefore, on the assumption that the slope of the river does change materially between the two points within a range of stage of a few feet, it is not possible for water to flow through this main channel until the gauge reads 3 feet or higher. Although there are two or three much smaller overflow channels which might possibly carry water at a somewhat lower stake than 3 feet, the culvert openings under the road are so small, that until water passes down the main overflow channel, the total amount of overflow would be very small.

I am writing the Washington office to send me the original meter notes in order that your question may be answered more fully.

Very truly yours,

(Signed) ROBERT FOLLANSBEE,
District Engineer.

4335 (In accordance with Survey regulations, I am enclosing a copy of this letter to the State Engineer of Colorado.)"

4336 (Witness continuing:) I have not allowed any overflow whatever at gauge height of less than 3.25, notwithstanding that Mr. Follansbee states that two or three of the small overflow channels might carry water at gauge height of less than 3 feet, but I have used Professor Carpenter's data which is more direct in fact than others in showing actual water conditions at that stage. I do not know that Professor Carpenter was more conservative than the United States Geological Survey, on point of overflow, from Colorado standpoint. Measurements of Geological Survey are based on levels when no water was running and do not show actual conditions when water was running, although they show topography and in a way confirm Professor Carpenter.

Standard area curve of which I have spoken in my tables and my area curve, I obtained by taking the same with a level and rod and then checked sounding at low water stages and used a few of soundings at low water stages in making determination. The standard cross section is the actual area curve at that point. I made those measurements April 11, 1914. Professor Carpenter's measurements were made in May and June, 1912.

Upon measurements made two years subsequently, I have

assumed to criticise cross section area used by Professor
4337 Carpenter in determining his discharges. I have affirmed that standard by conditions that existed there early in 1913, showing that cross section is practically permanent. I am practically sure that conditions obtained in 1914, when I made my measurements, are same as actual cross section area existing at time when Professor Carpenter made his measurements two years earlier because measurements in middle of stages, at middle and low stages in 1911, '12 and '13, all check.

Effect of presence of debris and silt which river might carry during high water, upon overflow channels after water began to subside, would be to decrease amount of water passing through culverts. A considerable amount of debris might and probably would be left in channels as water subsided.

I did not make any measurements of overflow channels. I accepted Professor Carpenter's.

If there was any silt in cross section of main channel at low water stages, it would be scoured out during high water, but examination of cross section late in fall of 1913 and again in spring of 1914 and also early in 1913, when I made measurements and visited station do not indicate deposition of any silt at that station.
4338 Rock bottom is exposed at all stages.

Relation between volume of water and velocity of flow is to show increase with stage. The higher the water the greater the velocity under open channel conditions.

Examination of river channel at Colorado-Wyoming line station for several hundred feet below and down to the ripple, the controlling point for that station, shows that no condition of sedimentary deposit affects the flow at that point. That was on April 25, 1914 and also in 1913, I waded down there and examined it when I made measurements. In fact I made measurements even low- and I have been up and down channel, and it is clean cobblestone and boulder bottom.

At point where cross section measurement was made, bed consists of some jagged fragments of rock, some cobblestones, a few boulders in main channel and in auxiliary channel there is a little sediment. Main channel is comparatively smooth and regular at that point. There are some holes among these cobblestones and boulders which give occasion for securing too high soundings. I would say that moderate conditions for mountain stream exist at that station. I recall that in taking soundings there, if I didn't use care, I could secure soundings in holes which would give depths of 6 to 8 tenths of a foot deeper than what the true bottom surface would
4339 be. This did not involve an exercise of judgment, by making numerous surroundings and feeling around to determine average bottom surface, measurement was obtained. No particular judgment and experience was necessary except judgment and experience in measuring stream to avoid securing too great a cross section area. My conclusions as to mean annual or normal flow of Laramie River did not involve use of records of North Platte. Records of that stream were introduced to offset some conclusions by State

Engineer Field, who used percentages for Poudre River and applied them to Laramie River. I stated there was great similarity between North Platte River above Saratoga Station at which records were taken and Laramie River above Woods Landing. Saratoga station is approximately 40 miles north of Colorado-Wyoming line. There is irrigation by water diverted from North Platte River between Colorado line and Saratoga. There is copious irrigation of meadow land from North Platte River above Colorado line in Colorado.

4340 North Park may, from topographical viewpoint, be compared with Laramie Plains, in that it is a wide mountain plateau surrounded by hills.

North Platte River and tributaries head in mountains to east, south and west of North Park. North Park is a little over 30 miles east and west from rim to rim of boundary mountain ranges. Tributaries of North Platte River which head to south and west of North Park flow from Park Range on west and Continental Divide on south of Park. Park Range to west is portion of Continental Divide. North Park is about 30 miles from north to south and has an area somewhat less than Laramie Plains. In arriving at comparison between Laramie River and North Platte River, it would not be proper to compare North Platte River at Saratoga as to percentage of flow in any one year to normal with records obtained at Laramie River at Lookout, that would be too far down drainage basin in my opinion. That is practically below all irrigation outside of Wheatland Project.

Nevertheless very similar topographic conditions exist above these two stations, that is, above the Saratoga Station on the North Platte River and the Lookout Station on the Laramie River. It

4341 was necessary to use existing records. There are no records above Saratoga except right at Park.

I have stated that Mr. Field took high records at arriving at his conclusions. Where conflicts or uncertainties existed, that would of necessity mean that he took high records for all discharges of river and its tributaries in Colorado as well as in Wyoming. I would say that that would work against Wyoming. The taking of high records would indicate more water than actually existed at Glendevey and demand or drawing of Greeley-Poudre System would more greatly deplete actual runoff than it would the overestimated runoff, giving Wyoming less water.

At Pioneer Dam staff gauge and automatic are maintained. Automatic registers two feet higher than staff gauge for reason that automatic is operated the year around and in order to keep pressure bulb free from ice conditions it is placed two feet below crest and at high water stages, if range of chart is insufficient, pressure of bulb is then raised a foot or two feet during those times, in order

4342 to get full range of chart and get record of all water passing over dam.

There is no data, it is simply marked on chart by crossing out printed figures and ma-king in a red zero 2 feet above zero shown on chart. Since installation of that Bristol Register, there has been no change in pressure bulb. It has remained constantly two feet below

crest, but on account of higher water stages, it will probably be necessary to arrange it this summer during high water. In operating a Bristol Register it is necessary to keep pressure bulb two feet below highest surface.

At Lockout Station, where I have reversed condition and staff is approximately one foot below automatic, I had also adapted chart to meet range of river and changed printed figures to indicate datum of pressure bulb. Automatic is above staff because it is not possible to put pressure bulb, without considerable expenditure and digging well and conduit, to very bottom of river. Chain gauge is set. Datum is established so there will never be any negative readings. In other words pressure bulb is placed in lowest portion of channel adjacent to right bank and below all low water. Chain gauge registers a foot greater in depth each time.

4343 All readings at Lookout Station are based on chain gauge. Changing of datum point on chart simply being tabulated to secure flow at proper range.

Chain gauge is read every time chart is changed and a notation made on chart, so that if pen is in error, there can be proper correction, but there have been very few corrections on any of my Bristol Registers, because I have operated them personally and pens are in excellent shape.

Chain gauge which I have at that point does not maintain constant register. It only registers elevation of water surface when it is lowered. Upon each occasion when I visited it once a week I lowered my gauge into river and took my reading. Chain gauge is basic gauge for keeping Bristol Register adjusted just the same as staff gauge is. In operation of any sort of automatic water register, Bristol or flood type, it is necessary to have staff or chain gauge, which is permanent and data found on that are used for setting pen on charts.

4344 Staff gauge was installed by Wyoming Development Company at Lookout Bridge in April, 1914. This staff gauge is set, as I checked by reading to compare it with reading on chain gauge at same time at same datum.

I do not have the gauges at these two stations, Pioneer Dam and Lookout, so adjusted that a person who did not understand adjustment would not be able to determine which is correct. Datum is indicated on charts, so that it is a mere matter of referring to chain gauge to compare with chart. Datum is noted sometimes after and sometimes before chart is taken off. Notations are made on chart of chain gauge readings so there is no doubt as to what pen is reading and there can be no confusion in matter.

April 11, 1914, when I made my measurements at Boswell Station, I did not make measurement of river.

Am unable to give exact figure of amount of water passing Laramie at this time (May 23, 1914) because I have no staff here. There is an old gauge here that was established by Professor Greenway or someone. It was there in 1913. I could just give a rough figure in this way, by stating that yesterday there was approximately 1400 cubic feet per second passing over Pioneer Dam.

There is no water being taken into Lake Hattie inlet. The
4345 reason for not taking any water could best be answered by Mr. Schrontz, General Manager of Laramie Water Company. I know the reason. Think Mr. Schrontz's plans have changed some in last 2 or 3 weeks. He has planned to finish some drainage work at lower toe of dam that was unfinished in 1913, and to make an inspection of concrete facing at point where it is broken on inner toe at and on water surface this summer, and for that reason he does not wish to run any water at this time into Lake Hattie Reservoir, there being sufficient water for this year's needs of North Canal.

There are 26,500 acre feet of water now in Lake Hattie, as I yesterday testified. That is sufficient for this year's needs under North Canal.

Water is storing at this time in Wheatland No. 2 Reservoir. On May 14 I visited that station and entire flow of river was being stored. I did not see Mr. Elliott when he was here day before yesterday. I am not aware of fact that storage has been discontinued in the reservoir for this year. I based my statement on my visit on May 14th, when no water was discharging from reservoir.

4346 Comparing flow of Laramie River at this time this year with the same time last year: May 22, 1913, flow of river at Pioneer Dam including water diverted by canal enlargement, that is the flow just above dam, was 500 cubic feet per second in round numbers. On May 22, 1914, it was approximately 1400 cubic feet per second.

Flood waters did not commence earlier this year than last. They have culminated later. On May 1, 1913, flow at Pioneer Dam including flow of Pioneer enlargement was 500 cubic feet per second. On May 1, 1914, flow was 221 cubic feet per second. That indicates that high water commenced earlier in 1913. It might be said to have commenced the last two days of April.

In my judgment highest flow of Laramie River for 1914 has not yet occurred.

While, as matter of fact, we have almost three times amount of water, according to my measurements at Pioneer Dam, on May 22 of this year, as compared with the measurements for same time last year, it is my judgment that the river has not yet reached its highest point for this year. True comparison between runoff for this time of year cannot be made between days but must cover period of ten or twenty days or a month.

Comparison- of relative amounts of water which have passed down river this year in month of May as compared with last year (1913) are: Taking gross flows from May 1 to May 15 of both years, during period of 1914, runoff of Laramie River at Pioneer dam
4347 was approximately 4000 or 5000 acre feet more than it was in 1913. This occurred notwithstanding fact that high water in 1914, commenced later than it did in 1913.

We have this condition, that Lake Hattie has at this date all necessary storage for this year and vast quantities of available water are passing the dam. Water is passing dam and will be used by Wyoming Development Company at this time since there remains

considerable storage capacity in Wheatland No. 2 Reservoir. Water is not being wasted.

We have in prospect highest water yet to come for year 1914.

Assuming, for sake of question, that Wheatland Reservoir has sufficient water, water must pass down the Laramie River during 1914 into the North Platte River.

Since I gave relative flows for year- 1913 and 1914, from May 1 to May 15, I have discovered an error. Flow in 1914 was 13,400 acre feet and in 1913 was 1,600 acre feet for same period.

I still however desire to maintain statement I made that on May 22, 1913 there was approximately 500 cubic feet per second flowing in river at Pioneer Dam and in 1914 approximately 1400 cubic feet per second. Based on snow reports and all information
4348 I can secure in reference to water conditions on stream, it is my judgment that 1914 runoff will be very close to 1912. It will be probably 200,000 acre feet. I predict a much heavier flow in 1914 than there was in 1913. That is not mere speculation, it is from my present knowledge, and is a positive fact. We know from condition of snowfall that runoff will be larger than it was in 1913.

Practically no water reaches river from drainage area from mountains east of Laramie Plains, at least as to that portion lying north of Laramie. It is intercepted by ditches or ponds and lakes between river at base of mountains. There would be slight runoff after heavy rains from area to east. Do not know whether the heavy rain that occurred in Laramie an hour or so before I testified on that point caused any runoff to reach the stream. I believe the runoff of the streets of Laramie reaches the river through sewers but the sewer capacity is not very large. On the open country, topography
4349 is such that large portion of it would be collected in ponds, in depressions and draws. From there it evaporates and seeps away. A greater portion of water would be absorbed in transit in passing down drainage channels. I also stated that considerable portion of water which flows from hills is absorbed in formation at base of hills. It passes into underground strata. Based on what information I have from geological standpoint, it would not reach the river. Strata is permeating and porous. We have unpermeating strata on the other side. This formation is peculiar to the base of the foothills where the edges of the various strata outcrop and can't intercept water. Further out on plains strata are more nearly horizontal and also shale occurs which would intercept water from sinking
4350 deep into strata beneath.

Oasis and Boughton Ditches might take up very small volume of water from hills to the east. In the past two years that I have been in this vicinity have made trips to McGill and at one time there was continuous rain for three days and it was on third day that I made trip, there was practically no concentration of that runoff in drainage channels across road to McGill. In making trips from Laramie City to Wheatland Reservair I have had occasion to observe a num-er of channels which indicate that water passes into river. I have been in torrential rains of short duration down there many a time.

There is irrigation from Soldier Creek, Willow Creek and Five Mile Creek. Water for this irrigation is taken from these creeks. I know personally that there is irrigation on Seven and Four Mile Creeks but I have not examined Dutton or Cooper Creeks.

4352 LARAMIE, Wyoming, May 23, 1914.

R. I. MEEKER.

Cross-examination continued by Mr. Fred Farrar:

Gauging station at Chugwater Creek is approximately 30 miles above mouth of that stream, that is, about its confluence with Laramie River. There is irrigation along Chugwater Creek both above and below the station, by which water is diverted from creek. Creek joins Laramie River near town of Wheatland. It flows along eastern boundary of Wheatland District.

I understand there is reservoir that was built by Swan Land and Cattle Company in vicinity of Chugwater, which went out and they have plans for use of considerable volume of water there. I believe gauging station at Chugwater was established by U. S. Geological Survey to secure data at their request. At times I have
4353 been in there and talked with them, they have spoken of an irrigation system that was projected by company. There may have been proposed channel reservoir in vicinity of Iron Mountain, don't know exact location. Observed possibility of reservoir in traveling through country where creek breaks through range. Any such reservoir would be dependent on water in Chugwater Creek and tributaries for supply.

I recall no reservoir on Poudre River, channel reservoir, at lower end of irrigated area which would intercept water which passed from dams above, similar to Wheatland No. 2 Reservoir. I know of no possible reservoir of that nature which would be constructed on Poudre River.

As matter of fact topographical condition of Poudre River is such that no such reservoir as Wheatland No. 2 Reservoir could be constructed.

I am aware of fact that there are certain demands on Poudre River from appropriations made from South Platte River below junction of Poudre with Platte.

Dead or unavailable capacity of Wheatland Reservoir No.
4354 2 is roughly about 35,000 acre feet. A channel between the two basins constituting the bottom of this reservoir might make a small volume of water available from the north basin. Controlling feature of active and dead capacity is present outlet of reservoir. Do not think it practicable to modify present outlet on account of low grade of river at that point.

Am familiar with map of Wheatland Reservoir No. 2 filed in office of State Engineer of Wyoming November 28, 1901, showing area of 6,690 acres and a capacity of 120,420 acre feet in the completed reservoir. I know that such a filing was made. It was made

by Clarence T. Johnson, former State Engineer of Wyoming. Map shows contour lines at every five feet in depth.

Was not informed why records taken at Wright's Ranch in 1913 on Little Laramie River were not used by Mr. Field. I knew he had not used the records in his tables. Did not know reason.

4355 Referring to Exhibit U-2, in main body of map outlined in brown, I indicate reservoir site called Laramie River Reservoir Filing- Nos. 4912 to 5448, and in small key map in lower lefthand corner of map I show this reservoir on smaller scale and also ditch leading around Boulder Ridge from it. It is a detour canal, an alternative route. It was surveyed by Mr. Hedke. I recall that he testified that Colorado people decided not to use that route. The ditch is over 100 miles long. I believe the statement was made that water could not be gotten through the canal, after Mr. George G. Anderson had reported on it. Do not remember whether Anderson report corroborated Mr. Hedke. I can, however, identify this line of ditch and reservoir site with one that Mr. Hedke described as having been surveyed preliminarily by him. I know Laramie Water Company made a reservoir filing on this same reservoir site. That is the site which they describe as Glendevey

4356 Reservoir of Laramie Water Company's system. It is one of proposed reservoirs, another one being the one at the interstate line which is called the Roberts and McConnell Reservoir. This latter reservoir is also proposed by Laramie Water Company.

Laramie Water Company did not contemplate use of ditch shown by line on map U-2. Their plan is to utilize channel of river to convey water down to Laramie Plains and to use water within its own basin.

Cross-examination by Mr. Delph E. Carpenter:

On Exhibit U-2 I make various notations of dates of filing on various lines of ditches and tunnels indicated. Those dates refer to dates of filing in State Engineer's office.

In referring to the two lines indicated, as attempting to show location of Upper Rawah Ditch or Rawah Ditch of Greeley-Poudre System, I show two distinct lines. The more westerly of these two lines is that of the 1902 survey known as the Link Lakes Ditch.

I am aware of fact that that was a preliminary survey. I

4357 was not aware of fact that section corners had not been all of them ascertained at that time.

Heard the greater part of Mr. Zac. T. Duvall's testimony with reference to survey made on this and other ditches in 1904. Now recall that he stated that he was compelled to trace correction line from township corner to find corners along line of Upper Rawah Ditch and also re-trace township lines along Deadman and Nunn Creeks location to find corners. As I understand it, Lower and subsequent line of Upper Rawah Ditch was modified on account of material encountered and also on account of better line found thereby and not primarily from any section corner uncertainties.

I am aware of fact that along lower portion of line and what is known as Grassy Pass to end of ditch, location is practically the same. Also that detour as shown as appearing on section 34 in part was caused by Mr. Duvall deciding to go around Grassy Pass mountain instead of through a 35 foot cut.

The solid color- noted on certain portion of these ditches
4358 on this map refer to portions practically completed. There are flumes that have not been installed, waste ways and headgates, and so forth and perhaps a few short sections of prism that might be unfinished.

Beyond this portion marked "Completed" and clear up to this lake marked "Camp Lake" right of way has all been cleared through very heavy timber. I found small pits or openings where construction had been opened up. Did not indicate partial work on map because could not do it on the scale of the map with distinctness. Amount of construction would appear so small that it would not be practicable. Did not note fact that the way was cleared through very heavy timber. Have not indicated clearing on any of them. Clearing of timber was in that case a necessary and expensive portion of the construction. It cost, as I understand, about $1,000 per mile.

On this same Exhibit U-2 I indicate by solid green line marked "Constructed Lar.-Poudre Tunnel" as of filing No. 1722, October 6, 1904.

On another dotted line, being second dotted line from this solid to north, I put additional line of "Right of way map U. S. L. O., filing No. 3049." That refers to filing map in U. S. Land office at Denver, Colorado, for right of way application. Did not
4359 indicate right of way filing in United States Land Office on map along solid green line because was unable to find any such. Could find no government right of way for that line. It has been my experience that it is a customary procedure to secure rights of way as nearly as possible immediately prior to construction, but I have known cases where rights of way were applied for after construction commenced.

If right of way for this tunnel line was secured April 9, 1907, by government filing, I did not happen to observe it on government records.

Two ditch lines indicated on map in green, portion in solid color and portion in dotted line, known as two lower collection ditches of the Greeley-Poudre System, I only noted those portions in solid color which were practically completed. Rights of way for
4360 these ditches were cleared throughout. Very little excavation work had been done in any of dotted portion. There may have been very short sections which could not be shown properly on map of this scale. There are large portions of the ditch line commonly known as Deadman and Nunn Creek Ditch in vicinity of Brinker Creek crossing which is actually completed. This map is not intended to be absolutely complete in the portion of completed ditch. It is intended to give approximate status of construction. It is difficult to show every little piece of prism which has been ex-

cavated. Some of these portions are uncompleted prism. It is apparent to observer that on these two ditch lines, work was begun at various points along line and apparently by separate workmen or contractors. Subcontractors had been let various sections.

For all practical purposes, construction of the three lines of collection ditch, that is, Deadman and Nunn Creek Ditch, Rawah and Lower Supply Ditch, and Rawah Ditch, sometimes known as Upper Rawah Ditch, practically accomplish same object as would have been accomplished by construction of ditch noted on my key map as taking water from Glendevey Reservoir, around Boulder Ridge into Cache la Poudre River.

I have heard the testimony relative to several tunnel lines that were run by Engineers Tenney, Duvall and Hedke.

4361 In indicating line of Sky Line Ditch of Water Supply and Storage Company, as a completed canal, I did not intend to infer that this work had any of it been done by the Greeley-Poudre System or their predecessors in title. That, as I have noted on map is the separate and individual property of the Water Supply and Storage Company. It is shown in a distinct manner by double lines. I should not have noted at the same time by double lines, for same purpose, two ditches taking water from Laramie Lake and Lost Lake from viewpoint I was working.

Referring to Exhibit U-3, lead pencil lines denote beginning and end of years, small brown lines on map indicate monthly spaces. The larger brown lines are to be disregarded.

On this graph I have attempted to segregate the Greeley-Poudre System into three portions. The first two portions, going to make up that part of Greeley-Poudre System or work connected with the tunnel. The one in brown known as the Link Lake or Upper Rawah Ditch, being a trans-mountain canal, whereas Laramie River system, is indicated in green as collection system of canals and trans-mountain tunnel.

4362 The green merely includes the two or lower collection ditches.

That portion on Cache la Poudre River I have indicated by the line Poudre Valley System. That is wholly incomplete. I am unable to secure sufficient data from testimony to plat values properly and also periods of time.

Taking all three portions of graph referring to Greeley-Poudre System prior to 1909, I would not say that graph would show anywhere near expenditure of $800,000 to $1,000,000 on all three together.

If such were case my graph would be wholly incompetent to convey to the eye an impression of expenditure of money prior to 1909. It would be in error in that way. As you know graph is intended to show construction expenditures and as I recall I have not attempted to show any expenditures for *for* acquirements of rights, etc. No acquirement of already constructed ditches or anything of that kind.

Taking Upper Rawah Ditch unit of Greeley-Poudre System I do not show any expenditure of money in construction or toward that

end in 1905, 1906, 1908 or 1909. I do not recall any such testimony. Where I found expenditures had been made for surveying which were made for construction I incorporated those with construction.

4363 It is not intended to be shown by this graph that construction did not go on on some portion of the system, either on the Poudre Valley or on the Laramie River during any or all of the years just indicated.

Referring to year 1906 and that portion of graph representing Upper Rawah Ditch, I understand there were repairs made during some of those years but I made no attempt to include those. There was possibly a small amount of work done during year 1905. I do not wish to convey to the eye by this graph, the idea that no men were engaged in any kind of work on those ditches in those years. I could not do that.

In 1908 I indicate by graph that no work was done on Upper Rawah Ditch. If, as matter of fact, there were 282,000 feet of timber paid for on right of way of that ditch to Government of United States by owners in 1908, that would constitute an expenditure of money. Am also aware of fact that testimony of Mr. Akin shows that during years 1908 and 1909, more or less repair work was done by men upon this ditch, as I indicated previously I did not

4364 attempt to include repair work on the Upper Rawah Ditch. As matter of fact these several years which appear blank, are not intended to convey to the mind that there was absolutely no activity during those years.

Referring to section of graph marked "Laramie River System" which I intended to include tunnel and lower collection ditches, I indicate some surveying and construction in 1904. I fail to indicate any surveying or construction in 1905, 1906 and 1907. I do not recall the testimony of Mr. Duvall as to surveying done in 1905 in connection with tunnel.

(Testimony of Mr. Duvall appearing at page 1898 of Defendants' testimony relative to tunnel survey in 1905, read to witness.)

I remember that he made another tunnel survey but I failed to recall the year.

It is a fact that in all engineering undertakings, especially of the magnitude of this one, several lines are frequently run to determine which is the final and best line and all of the work has the same common end after all.

I understand that repairs were made on the Upper Rawah Ditch in 1913 by Mr. Wortham and party, but as I indicated heretofore, I have not attempted to show repair work on the graph. I have attempted to show primary construction work only.

I do not think it proper to defendants in this case to have omitted any notation of work done on the Cache la Poudre portion of Greeley-Poudre Irrigation District system of work owing to fact that I have so little data at my command relative to that portion of the system. Think it proper to show there was a Poudre Valley System and indicate what little information I had and put on the notation "In-

complete" and furthermore the testimony has brought out that feature. In attempting to illustrate on a graph, matters of that kind, such illustrations should be as complete as possible and I have made these as complete as I could with the information at hand.

Have already stated that the graph does not show upwards of $800,000 of expenditure on the entire system prior to 1909. All I have shown or attempted to show on this graph, and considerably more, will be found throughout the testimony in this case.

A few days since I testified concerning the Poudre Valley Canal of the Greeley-Poudre Irrigation District System. I testi-
4366 fied that the sum total seepage from the canal would be large on account of its length and formations through which it passes. I would think a loss of 46% would be excessive.

In that testimony, in a general way, I attempted to compare the Poudre Valley Canal with the Laramie Plains work.

Am familiar with the fact that in the year 1903, after a critical and careful examination of seepage of water from the Pioneer Canal of the Laramie Plains system of irrigation works had been made by Professor W. P. Fleming of the Wyoming Experiment Station, it was determined that over 46% of the water entering the headgate of that canal is lost by seepage.

R. I. MEEKER.

Redirect examination by Mr. N. E. Corthell:

4367 The photograph (Plaintiff's Exhibit W-1) was made in 1912 (not by myself). It shows the concrete diversion dam of the Pioneer Canal Enlargement, which is used as a measuring station for water. The view is taken looking up the river, showing the Jelm Mountain in the distance and showing also the weir across the river described in my testimony. The measuring station has been maintained there in this condition since early in 1912. All the water in the river, except the diversion of the Pioneer Canal Enlarge-
4368 ment passes over the dam. I made another photograph (Plaintiff's Exhibit W-2) of the same dam, showing the conditions during the winter, when ice prevails, and how it was cut back from the crest of the dam in order that we might have a free flow to secure accurate records, which conditions have been maintained throughout the winter season of 1912-13 and in 1913-14.

The picture (Exhibit W-3) shows the concrete bifurcation structure across the Pioneer Canal Enlargement in the lower end of Sodergren Lake, and one gate shown in the abutment to the right regulates the water in the old Pioneer Canal, and the other gate to Lake Hattie Supply Canal No. 1 and Lake Hattie Reservoir.

The picture (Exhibit W-4) made by me shows the concrete diversion dam of the Bellamy Canal in the Little Laramie River 800 feet above Wright's Ranch or Filmore post office.

The picture (Exhibit W-5) shows the concrete outlet gate of the James Lake Reservoir.

4369 The picture (Exhibit W-6) shows the earth dam with concrete facing at the Carroll Lake Reservoir and also the outlet gate, which is of concrete with a steel gate.

The picture (Exhibit W-7) shows the old log crib and rock diversion dam of the Wheatland Canal on the Laramie River now abandoned.

The picture (Exhibit W-8) shows the log crib and rock fill section of the Wheatland Tunnel Diversion Dam, now used.

The picture (Exhibit W-9) is concrete diversion dam and head works of Wheatland No. 2 Canal from Sybille Creek.

4370 I visited the Upper Rawah Ditch on July 24th, 1913, making measurements of the capacity of the constructed portion and several sections of the prism at the lower end and at other places, from which data and the grade given in the statement of the Rawah Ditch, State Engineer's No. 5448, 15.84 feet per mile, I have made two computations of two sections in the last 2,000 feet above the point where it drops down the mountain side to the west fork of the Laramie River. This capacity I determined at 2,000 feet above the end to be theoretically 115 second feet with an allowance of 1½ feet for free board, which is a little less than would be used in practice. At 1,000 feet above the end, 96 second feet. In actual operation of mountain ditches they rarely ever carry their theoretical capacity so I would say the present lower end of the ditch would carry less than 100 feet in practice. From my inspection of part of the irrigated lands in the Poudre Valley made April 20-23, I determined over an area of 100,000 acres the extent of the area of exposed water surface, which is 7,500 acres in reservoirs and ponds.

4371 Cross-examination by Mr. Fred Farrar:

This examination is same one made in same manner described in my testimony relative to headworks of ditches on Poudre River (pages 4144 to 4192 inc.).

No additional time was given to examination for purpose of determining exposed water surface. It was another of the items which entered into purpose for which I entered Poudre Valley.

I do not know how much of the 7,500 acres of exposed water surface represented water which was in active storage.

The dead or inactive water surface constituted but a small portion of the total.

Carroll Lake Reservoir is located in sections 31 and 32-17-74, just above rim of Big Basin and derives its water supply from Little Laramie River through Carroll Ditch. Ditch may have another name, am not positive. Cannot tell when reservoir was constructed.

4372 It covers by estimate about 70 acres and has capacity of less than 500 acre feet. This reservoir has been utilized for irrigation within past few years. Did not visit it in 1913. Picture shown in exhibit was taken May 18, 1914. It was not filled at that time. Water was below concrete and steel outlet shown in picture of dam. Water was probably a foot below outlet ditch. Only evidence I have of filling in prior years is high water marks shown on reservoir. Reservoir is of comparatively recent construction. Should judge it was constructed in last four or five years from nature of concrete and everything.

Referring to my Exhibit T-1, same being discharge curve, distance to right indicates greater capacity or greater flow. Curves indicating capacity or flow progress to right. Since introducing this in evidence, I have platted on area curve a second curve indicated by dotted or dash lines. That curve was drawn in order to show approximate location of area and mean velocity curves which would be based on high water measurements of Professor Carpenter, without taking into consideration the standard cross section of other measurements.

Some of Professor Carpenter's measurements as indicated
4373 by points on this plat, are on one side and some on the other of the curve which I have indicated by the dotted line.

A line drawn to indicate measurements shown by other records would approximate curve which I have platted and indicated by dotted line, without consideration of standard area curve. In case of mean velocity curve it would show mean velocity in excess of general trend of mean velocities or other discharge measurements.

A curve could be drawn covering general trend of all older measurements, except my own, but it would break at a gauge height of about three feet and in that distance two of measurements made by Professor Carpenter would show mean velocities in excess of five mean velocities determined from other measurements, the preponderance being in favor of the standard mean velocity curve as located by myself and used in computing the flow.

I base high area extension of velocity curve on group of mean velocities appearing from a gauge height of about 2.35 feet and covering or extending to 3 feet, measurements being made
4374 by others than Professor Carpenter.

A mean velocity curve could be platted based upon measurements other than my own and other than Professor Carpenter's, up to gauge height of approximately 2.75 and from that point on upward to highest point determined by Professor Carpenter. In other words to make a curve which would be to left of mine in vicinity of 2 feet gauge height crossing mine at about 2.75 and progressing to right of mine up to 3 or his height of 3.75 feet, but it would not be giving proper weight to other measurements. In fact, numerous mean velocity curves could be drawn in if a careful analysis of the mean velocities and areas were not made.

The area and mean velocity curves which I have adopted pass through measurements made by myself and are affirmed by measurements made by the U. S. Geological Survey and a number of other measurements.

My standard area curve lies to left of every point made by other persons than myself, but it should because as I have indicated, in other testimony, tendency of securing too high soundings during high water stages invariably results too great. I did not know that other hydrographers did not make proper computation of that, for reason I was unable to find any notes or data showing that other hydrographers had used standard area curves and areas
4375 which are secured from other measurements.

I have discarded all areas of discharge measurements for

the reason that they give values in excess of standard area curve, which is most accurate method of determining cross section. I have used these methods in working up data for a number of years and it was not resorted to in this case for a special purpose.

Whenever I have used the words "Standard Area Curve" I refer to area of velocity determined by myself and to curve derived from true cross section and not based on soundings at high water, which contain errors from factors entering discharge measurements as heretofore indicated. I am not assuming that other hydrographers have in each case either lacked the same skill that I have or were negligent in taking their soundings. I have made careful and rigid examination of data secured by other hydrographers and supplemented that by going into field and making special investigations. I have made no assumptions in the standard area curve. I have taken actual area curve.

Referring to Exhibit W-1, structure at end of Pioneer Canal was completed in winter of 1911-12.

Outlet of Lake James shown on Exhibit W-5, I am unable to give date of construction. I think it was prior to Pioneer con-
4376 struction just mentioned.

Structure on Sybille Creek at head of Wheatland No. 2 Canal was built in spring of 1913.

Dam in Little Laramie River at head of Bellamy Canal shown by Exhibit W-4 was constructed October 1912.

Bifurcation works of Pioneer Canal Enlargement shown by Exhibit W-3 was constructed prior to 1912.

In making record of stream flow where staff gauge is used, it is customary to read the gauge twice each day. For a rational expenditure of time and money this method gives sufficient data. Practice is to read it in morning and evening. Readings are ten or twelve hours apart. I was not aware of fact that Mr. Oviatt transmitted his staff gauge readings at Boswell Station to the State Engineer of Wyoming.

4377 Cross-examination by Mr. Delph E. Carpenter:

Capacity of Rawah Ditch would be greater by allowing one foot free board instead of one and one-half foot free board. Parties owning ditch might decide to attempt to run water using freeboard of six inches or a foot but they would have disastrous breaks and would have to come down to freeboard of one and one-half feet. Experience will tell in each case. As matter of fact a number of mountain ditches that I have examined, actual carrying capacity is approximately 50% to 60% of their theoretical carrying capacity.

R. I. MEEKER:

Redirect examination by Mr. John D. Clark:

4378 The errors in Plaintiff's Exhibits B, I and T-7, corrected above, did not occur in the measurements, but in the computations of the distribution, and in adding the amount to make

correction as to the use of water below Two Rivers. It alters the amounts of water charged to ditches below Two Rivers, the Wheatland No. 2 Reservoir, but it does not alter the volume of water distributed, or affect or change the deductions and measurements secured at Lookout Bridge. My testimony as to inflow into the reservoir was based on independent measurements taken at that bridge. Chugwater Creek passes along the eastern boundaries of the Wheatland tract through a depression at a considerable distance below the mesa land included in that tract, roughly, at least 200
4379 feet. It is also a considerable distance below the lands embraced in the Bordeaux tract, and the run-off from Chugwater at a point where it would be possible to divert it to those tracts is very small, being chiefly used for bordering meadow lands.

4379 Recross-examination by Mr. Fred Farrar:

Water from Chugwater Creek, while possibly not available for lands actually included within territorial limits of Wheatland tract, nevertheless is available for irrigation of land within state of Wyoming and adjacent to or in the general neighborhood of Wheatland.

R. D. STEWART, a witness in behalf of Complainant.

4380 Direct examination by Mr. N. E. Corthell:

Chief engineer and superintendent of the Laramie and Hahns Peak Railway Company since 1902, and acted in that capacity during the construction of the railroad across the mountains between Centennial and Walden in 1909, 1910 and 1911. The railroad extends 110 miles from Laramie, Wyoming, to Coalmont, Colorado, crossing the Medicine Bow Range of mountains at Fox Park, altitude 9,200 feet. The railroad enters the mountains from the north side at Spring Creek station at mile post 35 from Laramie and winds through the mountainous region to Northgate at mile post 80; the mountains extend along the Laramie River to its
4381 headwaters. The construction work on the railroad was prosecuted during the winter seasons of 1909-10 and 1910-11, and some work was done at Lake station about mile post 47 during the winter of 1908-09. This work consisted of rock excavation and cost the same as work prosecuted in the summer. The winter work was voluntary on the part of the contractors. I have been up to the Laramie-Poudre Tunnel on the Laramie River and know the nature of the country between Laramie and that section, and think that the Skyline Canal was pointed out to me from the tunnel site. In my opinion it would be entirely practicable to carry on rock work in the construction of ditches during winter seasons without
4382 adding to the cost more than what snow shoveling might occasion, which is not a burden.

4382 Cross-examination by Mr. Fred Farrar:

Snows encountered in going over mountains with the Laramie-Hahns Peak Railroad in 1909-10-11 during winter months were

from approximately three to four feet on level. Road was built from Laramie out. At time we were working on hill, road was constructed to within 15 miles behind at times. At other times it would reach the end and would be close to us. In one instance the winter work was done approximately and another about five miles ahead of the railroad. I should judge we had about forty men working in winter all in one camp. That was true of each winter we
4383 were working there. They were doing rock work entirely. Snow was shoveled out of way of embankments and of course in cuts very little attention was paid to it.

I was in vicinity of Greeley-Poudre tunnel once. It was during summer months of 1910. I went up in automobile from Laramie.

Cross-examination by Mr. Delph E. Carpenter:

Engineers who have had charge of construction work in vicinity of Greeley-Poudre Tunnel and Sky Line Ditch of Water Supply and Storage Company would probably know more about conditions there than I would, as to winter work. Would not say that work in vicinity of Greeley-Poudre Tunnel would vary very ma-
4384 terially from other mountain work at similar altitude. I am judging from my knowledge of mountain work.

Those who have been engaged in construction of that work in that immediate vicinity and who have encountered the difficulties there, would know more about the conditions at that particular point than I would.

Redirect examination by Mr. N. E. Corthell:

The railroad company hauled up a car or two, carrying an outfit in latter part of January, 1914. They said they were going to the Greeley-Poudre Tunnel.

(Mr. Carpenter: We object to testimony of witness along lines indicated by question for reason that it is not proper rebuttal and is not best evidence of what happened in connection with transportation of party to tunnel.)

Weather and snow conditions were somewhat more severe than usual.

4385 Recross-examination by Mr. Fred Farrar:

We unloaded this outfit at station called Wycola at milepost 67 out of Laramie. Do not know whether or not that particular outfit ever got to tunnel. Would consider it unreasonable that they killed two horses and consumed five days in going five miles in getting to tunnel. Nevertheless I was not in there. I was on Hahns Peak Railroad at various and sundry times. I was probably 25 miles from tunnel. Wycola is 25 or 30 miles from tunnel. Wycola reached Laramie River by Boswell's Ranch. It is about 8 miles from Boswell's. That is nearest point to railroad station.

Laramie, Hahns Peak and Pacific Railroad was open for busi-

ness across mountains October, 1911. It operated all winter 1911-12. In keeping road open we have to run rotaries in front of trains always. There is a rotary in front of every train. We run trains every alternate day during winter. There have been times when we have had accidents and got on ground in which case we were tied up for 2 or 3 days. We have been blocked for considerable time on account of accidents, getting on ground by rails spreading or something happening. We were never blocked by snow on account of fact rotary plow was able to keep road open.

4387 Recross-examination by Mr. Delph E. Carpenter:

I do not know anything about the hardships this party endured which unloaded to go to tunnel in winter of 1914. Do not know anything about enormous expense in getting there. Have no idea of amount contractors lost by being forced to go in there in winter time. I know that snow conditions were not the same in 1911 in winter as they were in winter of 1913-14. I do not know anything about Upper Laramie River Valley above Boswell's Ranch.

R. D. STEWART:

Redirect examination by Mr. N. E. Corthell:

4387 For years prior to the building of the railroad over the mountains, freight was commonly hauled over the mountains every winter.

GEORGE TRABING, a witness on behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

4388 Have lived at Laramie, Wyoming, 35 years. The stage line from Laramie to Walden, Colorado, crosses the mountains between Boswell's on the State line between Wyoming and Colorado and Pinkhampton, Colorado. I was contractor on the line about eight years ago for three years until the railroad got into that country. The stage line ran daily each way and I went over the line once a month to do the collecting. It ran regularly each winter and I don't think they missed a trip the last twelve
4389 years until we had it, and then we had two or three failures of single trips. The road was generally traveled and freight hauled over it through the winter. There was also a stage line running up the Laramie River valley from Jelm to Gleneyre, and a Post Office beyond at Glendevey, to which mail was served from our line connecting with line at Boswell's. This stage line ran up the river and I took charge of it. I had a contract running from Laramie to Gleneyre until we were cut off at Walden four years ago. The line above Gleneyre ran three times a week. I do not think we missed a trip to Gleneyre and the mail was taken
4390 from there by contractor named Thompson to Glendevey. I have been to Chambers Lake twice, the last time about twelve years ago. We traveled through Sand Creek Pass and up the Lara-

mie River and over the divide at the headwaters. There was at that time a good road running up the river to Chambers Lake. I was there about August on a camping trip. I think it would be practicable to travel on a sled in and out of that country generally in the winter season, the same as they do in North Park and to carry on work there. We have had experience at different kinds of team work carrying the mail to Keystone and Holmes and to mountain camps fully as high as it is up there. Our road is a winter road over the same range of mountains farther north.

4391 Redirect examination by Mr. N. E. Corthell:

When I was over at Chambers Lake there were ranchmen living above Glendevey.

4391 Cross-examination by Mr. Fred Farrar:

Don't know pass over which I went from Boswell's to Pinkhampton, we go through what they call Mountain Home Park. It is at a low depression in the main mountain range. I think it undoubtedly possible to go up Laramie River on sleds in winter time.

Cross-examination by Mr. Delph E. Carpenter:

They work all winter long in vicinity of Keystone, Wyoming. It would be perfectly practicable and feasible to work all winter long on ditches taking water from Douglass Creek over into Little Laramie River.

Redirect examination by Mr. N. E. Corthell:

At time I went over to Chambers Lake there were ranchmen living above Glendevey. That was about 12 years ago.

Recross-examination by Mr. Delph E. Carpenter:

Keystone, Wyoming, is on Douglass Creek. I do not know whether or not that is where Laramie Water Company are constructing ditch from Douglass Creek over into Little Laramie River. Keystone is almost west from Centennial Valley, just over range of mountains. Keystone is located on Section 22-14-79. It is very close to top of range west of Laramie Plains, because it is on river that flows other way, kind of on headwaters of Douglass Creek which flows other way, so you virtually cross range to get to it.

GEORGE A. CAMPBELL, a witness in behalf of Complainant.

Direct examination by Mr. N. E. Corthell:

4393 Have lived at Laramie, Wyoming, about 32 years and I am secretary of the Laramie River Association, an organization composed of people in the Laramie Valley formed for the purpose of resisting diversion of water from the Laramie River in Colorado out of the water-shed.

I wrote a letter dated March 25th, 1910, to the United States Investor, Boston, Mass., a copy of which, aside from the address, is incorporated in the record in connection with the testimony of William Iliff (Page 232, Vol. 5, Defendants' transcript). I have the clipping referred to in the letter which was published in the
4394 Pierce Record, Pierce, Colorado (in the Greeley-Poudre Irrigation District) March 24, 1910. This clipping is as follows:

"Financial Inquiry.

The following from the United States Investor, Boston, shows the esteem in which Greeley-Poudre Irrigation District bonds are held in the New England metropolis:

Municipal 6% Bonds.

20559.—(Concord, N. H.) Kindly advise me as to the value and reliability as an investment of the municipal 6% irrigation water bonds of Weld County, Colorado, Greeley and Poudre district. What is your opinion of this class of bonds in general?

Ans.—We consider this issue of irrigation bonds one of the best which we have had occasion to investigate. The Greeley-Poudre irrigation district is a municipal corporation, organized under the laws of Colorado, and embracing 125,000 acres, immediately adjacent to the famous old irrigated Greeley district, one of the richest agricultural districts in America.

Land values under irrigation in this district are advancing steadily; crop failures are unknown, and climatic and soil conditions are particularly favorable for the raising of potatoes, sugar beets, alfalfa, etc.

Long before there was any irrigation undertaken in this district, the Union Pacific railroad built through it, and since then has built branches with the sole intention of serving the district. The land is being rapidly taken up, and there is no point in the district more than four miles distant from the railroad on which the Union Pacific has already spent more than $2,000,000. The Chicago, Burling- and Quincy Railroad has surveyed and contemplates building directly through this district next year.

These bonds are municipal bonds, and are a prior lien over any subsequent issue by the District. Without exception, there has never been a default in the interest or principal payments on Colorado municipal district bond issues. We have no hesitancy in recommending these bonds.

As a general rule, this class of bonds are a good investment, but in each particular issue of irrigation bonds careful investigation should be made before purchase."

4395 I produce copies of two circulars (Plaintiff's Exhibits V-1 and V-2) then in circulation by Farson Sons & Company, advertising these bonds.

4396 On Tuesday of this week (May, 1914), I visited the site of the Greeley-Poudre Tunnel at the Laramie River, where I saw eight men working, cleaning out the cut, removing the earth and rocks from the portal of the tunnel. No water had been diverted. About 100 feet to the north of the entrance to the cut leading to the tunnel there was a crib made of logs that had been placed across the channel of the stream, four logs high, but nothing put into the crib to prevent the water flowing through so it checked the flow of the stream very little. When filled this crib would have the effect of diverting water from the river into the tunnel. The crib was quite a long distance above the permanent dam. I don't
4397 know the exact distance but it is near the opening of the cut from the river to the tunnel, something like half a mile above the permanent dam. Nothing has been done on the latter work since the fall of 1910 that I could discover, and it is incomplete, some of the work put in having been washed out.

N. K. Boswell, a witness in behalf of Complainant.

4398 Direct examination by Mr. N. E. Corthell:

Have lived in the Laramie Valley since '68, having owned since '69 a ranch at the Wyoming-Colorado line. I have been familiar with the conditions in the valley at that ranch and above since I have been living there. There is a well-traveled road running up the river to the Chambers Lake district, which has been traveled a great many years. In fact since they trailed through there in '69 logging up there and cutting timber on the Laramie River in '67 and '68. Poles and timbers have been cut up along the river to Glendevey since that time, and a tie camp was maintained
4399 in that neighborhood since '67. The river valley above my place is pretty well settled for about twenty miles up to not far from the tunnel. There has always been travel about twenty miles above my place to Glendevey and thereabouts through the winter season, people haul in supplies, the mail is carried to Glendevey almost every day, and there is nothing to prevent communication to the tunnel in the winter season. There is considerable snow there but nothing to prevent work. In the logging camps and tie camps work was carried on in the winter season. This
4400 includes the region where the ditches lie.

Cross-examination by Mr. Fred Farrar:

Ties are run down from there. They are floated down river. Mail goes in above Boswell's on sleds most of time during winter. It goes as far as Glendevey. Could not say how many people live between Glendevey and tunnel during winter months, have not been up there for quite a number of years. People generally take in their supplies for winter in the fall. They take them in the fall because they can get them in better in fall than in winter. Snow is pretty deep there but there has been no time in a great many years but what they could get up to Glendevey.

4401 *Stipulation.*

It is stipulated in open court between counsel for the parties litigant, that photographic reproductions of any of the maps and similar exhibits offered by the parties to this proceeding may be substituted and used in lieu of the originals as offered and introduced during the taking of the testimony and shall be labeled and marked by the respective commissioners as are the originals; except in cases where the substance of the exhibit cannot be shown by photograph.

Stipulation.

It is hereby stipulated and agreed by and between the parties hereto that all evidence in this action was offered at times mutually agreed upon between the parties hereto, and that the said parties mutually agreed and assented to the periods of time occupied by the Defendants and by the Plaintiff in the presentation of the evidence on behalf of the Defendants and on behalf of the Plaintiff in rebuttal respectively, and that any and all objections to the time when such evidence was presented are hereby waived.

And this was all of the testimony offered on behalf of the complainant.

(End of Transcript, vol. 9, Complainant's Rebuttal.

[Endorsed:] Supreme Court U. S. October term, 1915. Term No. 7, Original. The State of Wyoming, Complainant, vs. The State of Colorado et al. Abstract of Evidence. Filed June 5, 1916.

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Supreme Court of the United States

OCTOBER TERM, 1916

No. [redacted]

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARIMER-POUDRE RESERVOIR AND IRRIGATION COMPANY, DEFENDANTS.

IN EQUITY

Brief on Behalf of the Plaintiff

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[illegible] Co., Printers, Washington, D. C.

Supreme Court of the United States

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Brief on Behalf of the Plaintiff

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SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1916

NUMBER 7 — ORIGINAL

THE STATE OF WYOMING, *Complainant*,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, *Defendants*.

IN EQUITY

BRIEF ON BEHALF OF THE PLAINTIFF

I.

STATEMENT OF THE CASE

This is a suit by the State of Wyoming against the State of Colorado and two individual defendants incorporated under the laws of that State, growing out of questions of the use of water from the Laramie River, which has its source in Colorado and flows into Wyoming.

The Bill alleges that in 1865 the settlement of the valley of the Laramie in Wyoming began, and

from that time on to the time of the commencement of the wrongs complained of the settlers in the valley of the Laramie in Wyoming had improved and by the practice of irrigation had rendered highly productive the lands in that valley in Wyoming, and had built up there a community of twenty thousand people, irrigating three hundred and twenty-five thousand acres of land.

It is alleged that these lands without the artificial irrigation are so arid in character that they are unproductive; that the citizens of the plaintiff had built the City of Laramie within the valley of the stream, and the plaintiff had established there its State University; and the community, the City, the University, the real values of the lands, are all dependent upon the use of the waters in controversy; that by the practice of irrigation the lands within the valley have become worth a large amount, to-wit, more than ten millions of dollars.

The Bill alleges that it has become established by the customs, laws and decisions of both Colorado and Wyoming that the waters of all streams, subject to any prior rights that may exist, are open for appropriation and use for irrigation purposes; that priority of appropriation gives priority of right.

The Bill further alleges that the mountains at the head of the Laramie River where very heavy

banks of snow fall in winter are within the State of Colorado, and that it is these heavy banks of snow in Colorado which supply the waters of the stream, the valley of the Laramie in Wyoming being arid and furnishing little water.

It is further alleged that notwithstanding the prior appropriation of the water by citizens of Wyoming, the defendants are threatening to pierce the walls of the water-shed by a tunnel through the mountains, and to carry away the waters of the stream to the amount of more than one hundred thousand acre feet per annum, (an acre foot being such amount of water as will cover one acre of ground to a depth of one foot), to a point more than one hundred miles away from the Laramie Valley and from which no part of the waters can return.

It is further alleged that if this threat is carried out, it will destroy the value of the lands within the water-shed of the Laramie River in the State of Wyoming, and will destroy the community which has been built up there.

The answer of the State of Colorado denies that the run-off from the heavily timbered mountainous area in Colorado at the head of the Laramie River supplies all of the waters of that stream.

Alleges that not more than 100,000 acres of the

drainage area of that river in Wyoming are productive under irrigation of which 50,000 acres lying between the Colorado line and the Wheatland reservoir are of inferior quality, unproductive, adapted to raising only limited crops. That the lands comprising the other 50,000 acres have some productivity, but that the greater part of the irrigation rights for these are junior to the rights of defendants.

Denies that the doctrine of the right to the continuous flow of the river ever obtained in Wyoming.

Admits that prior to the commencement of defendants' irrigation system, some of the lands along the Laramie River and its tributaries had been settled on, improved and rendered more productive by irrigation therefrom, but avers that the run-off was abundant to supply plaintiff and defendants.

Denies that plaintiff's lands would be rendered valueless without the water, or that more than 2,000 people are supported by their irrigation or that more than $500,000.00 had been expended in Wyoming in the development or use of the waters prior to the initiation of the defendants' rights.

Admits that certain of the waters are used by towns and villages in Wyoming, but avers that the run-off is sufficient for such needs and the needs of the defendants.

Admits certain appropriations from the stream

prior to the commencement of defendants' irrigation system, but avers that the run-off is sufficient for both.

Avers that the rights of defendants were initiated August 25, 1902, when there was abundant water to supply prior appropriations.

Denies that plaintiff and its citizens had appropriated all the waters prior to the threatened diversion.

Avers that at no time had more than 50,000 acre feet annually been taken from the stream for use in Wyoming prior to the initiation of defendants' rights, and that the annual run-off from Wyoming lands is more than 500,000 acre feet and the total annual run-off of the stream is more than 800,000 acre feet.

Denies that defendants are threatening to divert from the stream more than 100,000 acre feet, but avers entire diversion cannot exceed 70,000 acre feet annually.

"Defendant avers that the State of Colorado is the owner of all waters within said State of Colorado with the full right to dispose of them as it may choose and denies that such rights are subject to the rights acquired by the complainant and its citizens as alleged in the bill of complaint; avers that it is the right of the defendant commonwealth to dispose of the waters of that portion of said stream lying within the State of Colorado without let or hindrance by

the complainant or its citizens; and defendant avers that the defendant commonwealth can so dispose of the waters of said stream regardless of the prejudice that it may work to the complainant or its citizens within the State of Wyoming, and need give no reason for its will."

SECOND. The second division of the answer, apparently intending to constitute a second defense, alleges the sovereignty of Colorado as a State; that the Laramie River arises in that State; that the region within the boundaries of the State of Colorado is the apex of the Continental Divide, and therefore that streams flow from Colorado in every direction; that Colorado has the plenary and exclusive right and power to control and regulate its non-navigable waters; that the streams arising in the State "after leaving the mountains in which they originate, flow across lands of a nature usually described as plains, and from which, owing to the lack of rainfall, these streams receive no additional supply of water, but, on the contrary, the water in said streams is very rapidly diminished by evaporation and by absorption by the soil through which they pass;" that these lands are unusually fertile and when irrigated produce unequaled crops; that the Laramie River is a stream having its source in Colorado, from which it flows

into Wyoming; that said stream is not navigable; that the use of the waters of the stream by irrigation within Colorado is essential to the life and well-being of the inhabitants of a large area within Colorado, and the right of continued use of the waters is as vital as is the land itself; that Wyoming has no jurisdiction over the lands or water in Colorado; that under the laws and principles of international and interstate law the sovereign rights of Colorado over the waters of the river are not subservient to the sovereignty or rights of the State of Wyoming; that the State of Colorado cannot be subjected to the burden of arresting its development, or of denying to its inhabitants the use of an element which nature had supplied entirely within its own territory, and that without the free use of the water the lands to which said water is sought to be applied would be uninhabitable.

THIRD. The third division or defense of the answer alleges that the annual run-off of that portion of the drainage area in Colorado is 300,000 acre feet, and of that portion within Wyoming is 500,000 acre feet; that the diversion system sought to be enjoined could not divert more than 70,000 acre feet annually, nor could more than 90,000 acre feet annually be diverted from the stream in Colorado; that the predecessors of the defendants conceived and began the construction

of a large irrigation system on August 25, 1902, for the purpose of conveying 70,000 acre feet of the water of said stream to a body of 125,000 acres of land in Weld County, Colorado, and since have constructed a collection system for gathering the waters, a reservoir for impounding it and a tunnel of 12,000 feet in length for carrying it through the mountain range, all at an expense of about $1,200,000.00; that the Greeley-Poudre Irrigation District was formed under the laws of Colorado for the purpose of irrigating said 125,000 acres of land; that bonds of the District for that purpose have been voted and issued to the amount of $5,000,000.00 par value, of which $2,700,000.00 have been used and $2,300,000.00 are still available in the treasury of the District; that citizens of Colorado have filed upon large bodies of public lands of the United States, relying upon the use of the water, and have made valuable improvements upon said lands; that the use of the water would enhance the value of the land about $50,000,000.00, and if denied that the value of the lands would be largely destroyed and the acquisition of title from the Government defeated; that at the time of the initiation of the defendants' rights there was an abundance of water in the river to supply all rights to water existing in the State of Wyoming which had their origin prior to the inception of the defendants' rights; that the lands in

Wyoming to be irrigated are inferior in productiveness to the lands in Colorado, and also require a greatly increased quantity of water over the necessities of the lands in Colorado, and that irrigation of the Wyoming lands will produce less returns than of the Colorado lands.

The corporation defendants joined in an answer, the first defense of which is in all material respects identical with the first defense of the answer of the defendant The State of Colorado.

The second defense likewise in the answer by the corporations, while stated in different language, bases the defense on the sovereign right of the State of Colorado to the use of the water within the State regardless of the rights of neighboring states and their citizens. It seeks to buttress this claim by quotations from the Constitution of Colorado.

The third defense is the same as the third defense in the answer by the State, with the addition of averments supposed to set up an estoppel. These additional averments are as follows:

> "Defendants aver that the plaintiff and its citizens, long prior to the institution of this suit and at all times, were fully advised of the said diversions and proposed diversion of these defendants and their predecessors in title, and have been advised of the formation of said district, of the voting of the bonds thereof, of the

sale of said bonds to innocent purchasers for value, of the said construction for the purpose of effecting said diversion, and of the steps taken by citizens in said district in reliance thereon.

"Defendants aver that plaintiff and its citizens are equitably estopped from questioning the diversion sought to be enjoined herein."

Answer of the corporations, page 17, line 28, to page 18, line 6.

The fourth defense of the answer by the corporations sets up matters which seem to us in effect the same as those stated in the third defense, excepting that the matters in estoppel are not contained in the fourth defense.

The plaintiff filed the general replication.

Inasmuch as the evidence will be discussed somewhat at length in another portion of this brief, we deem it sufficient here to confine ourselves to a brief general statement of some of its salient features.

The Poudre Valley in Colorado is very fertile. Irrigation began there quite early in the history of the Rocky Mountain region and has been carried on with such success as to make out of that valley a wonderful garden spot. In this work of irrigation they have constructed many reservoirs and ditches and have used more nearly the total flow of the Poudre River than has been accomplished in the case of any other river in the region. Besides they have dug

through the walls of two near-by watersheds and have brought into their valley the strange and unaccustomed waters of two other streams, Grand River and Michigan River, which do not by nature mingle their waters with those of the Poudre. All of these things they have been able to accomplish at great expense because the lands of that valley are highly productive and of great value, and therefore have furnished them the necessary means and will abundantly repay the expenditure.

On the other side of the mountains from the Poudre is a mountainous area at the very crest of the continent. It is an area of heavy winter snows which constitute the real source of the Laramie River. This river, gathering its waters from numerous confluent streams in these mountains, naturally carries its water out of the mountains and upon the Laramie Plains. These plains are arid, with very light rainfall and porous, gravelly soil, and through evaporation and seepage into the thirsty soil the volume of water in the river naturally decreases mile by mile along the one hundred and fifty miles of the river's length in Wyoming.

Beginning in 1865 and continuing through the years since, the citizens of Wyoming have diverted waters from the river for the irrigation of lands on these plains.

These lands without the use of the water are unproductive. Indeed with irrigation they are far less productive than the lands in the Poudre Valley in Colorado, and therefore will not in anything like as large measure repay the husbandman for his expenditures and his toil in diverting the water from the stream and applying it upon the land.

Nevertheless the people of the Laramie Plains have been able to increase largely the yield of their lands through the use of the waters of the Laramie River and have built within the watershed of the river prosperous communities.

The inhabitants of the Poudre Valley in Colorado, finding they could not irrigate all the lands which they desired to irrigate even though using so much of the flow of the Poudre as it was found practicable to utilize, plus the waters of the Grand River diverted from its own watershed into the Poudre, plus the waters of the Michigan River diverted from its watershed into the Poudre, plus waters already diverted from the Laramie River and carried into the Poudre, sought additional waters that they might further extend their beautiful and lucrative garden. They found that by the use of a long tunnel through the mountains and certain intercepting ditches it would be physically possible to intercept and carry from the Laramie River into the Poudre a large volume of

additional waters, and they began their preparations to take this water. Thus far all the evidence agrees.

The defendant contends that the amount of water possible to be taken will not exceed 70,000 acre feet per annum, the plaintiff contends that the amount will exceed 100,000 acre feet per annum.

We believe a clear preponderance of the evidence establishes that the citizens of Wyoming, long before the commencement of any proceedings by defendants to take the waters in controversy, appropriated the entire available waters of the Laramie River, and that the threatened diversion of these waters by the defendants will be disastrous to the plaintiff.

II.
BRIEF OF THE ARGUMENT

A. DISCUSSION OF THE EVIDENCE.

The Laramie River rises in the high mountains of the Continental Divide, about thirty miles south of the Wyoming-Colorado line, and flows northerly into Wyoming and thence in a general northeasterly direction about 150 miles to its confluence with the North Platte River, about thirty miles west of the point at which the North Platte River enters the State of Nebraska. The Cache la Poudre River starts at Chambers Lake upon the Continental Divide, the headwaters of the river being interlaced with those of the Laramie River, but it flows in a northeasterly direction on the east side of the Green Mountains, whereas the Laramie River flows on the west side of that range. A few miles north of its source the Poudre turns to the east and enters the South Platte River near Greeley, Colorado; the South Platte flows easterly to its junction with the North Platte near the town of North Platte, Nebraska, the two rivers forming the Platte, a tributary of the Missouri. About five miles north of their headwaters the Laramie

and the Poudre are divided by a narrow ridge of the Green Mountains, and through this ridge the defendant Laramie-Poudre Reservoirs and Irrigation Company, under a contract with the Greeley-Poudre Irrigation District, has driven a tunnel about 11,000 feet long for the purpose of diverting water from the Laramie River into the Poudre for use upon the lands lying within the boundary of the defendant the Greeley-Poudre Irrigation District, a municipal corporation. This district lies within the valley of the Poudre and the South Platte, from fifty to eighty-five miles east of the Green Mountains and north of the town of Greeley.

The Laramie Valley in Colorado is very narrow, being from one-half to perhaps two miles in width, and contains only a few ranches upon which there has been some inconsequential irrigation for hay. The few ditches are short, close to the river, and cover very small areas. Near the Wyoming-Colorado line the river enters a canyon from which it emerges about ten miles north of the state line upon what are known as the Laramie Plains, an area about seventy-five miles long and twenty miles wide, bounded on the west by the Medicine Bow Mountains, which constitute the western border of the Laramie drainage area in Colorado, and bounded on the east by low hills or mountains, an extension of the Green Mountain

range, but locally known as the Sherman Mountains or Black Hills. The elevation of the Laramie Plains varies from 7,000 to 7,500 feet, Laramie City, midway in the river's course across the Plains, having an altitude of 7,159 feet. At the northerly or lower end of the Laramie Plains the river turns easterly, passing through canyons in the Black Hills and thence through a narrow valley to the North Platte River at Fort Laramie.

The area of the drainage basin of the Laramie River is 4472 square miles, of which 395 square miles, or about nine per cent., lies in Colorado. This Colorado area, however, furnishes to the river a supply of water which both in quantity and in seasonal distribution of the flow is disproportionate to the area of the watershed in that State. The mountains of the Continental Divide at the headwaters of the river rise to an elevation of 13.000 feet, whereas the Medicine Bow Range on the west side of the Laramie Plains has an average elevation of less than 10,000 feet, and the Black Hills on the east side of the Laramie Plains have an average elevation of about 8,500 feet. The average annual precipitation at Laramie City is 10.2 inches, while the average annual precipitation in the mountains at the headwaters of the river reaches as high as forty inches, consisting principally of snow falling between September and May which is packed

and conserved so that the run-off is delayed beyond the period of the run-off of the lower areas, and contributes a supply to the stream when other sources have been exhausted, and during the period of greatest need.

The only important accession of the Laramie River upon the Laramie Plains is the Little Laramie River, rising in the Medicine Bow Mountains and of approximately one-half the size of the main river. Sand Creek is theoretically a tributary of the Laramie River on the east side, rising in Colorado and entering the river above Laramie City, but by reason of diversions therefrom into the Poudre Valley and the use of its water upon lands bordering it, Sand Creek for many years past has failed to contribute anything to the river. Aside from Sand Creek there is no stream of any consequence rising on the west side of the hills bordering the Laramie Plains upon the east. East of the Black Hills the Laramie River receives water from Sybille Creek, Chugwater Creek, and the North Laramie River. Chugwater Creek flows through a low valley which is irrigated to the extent that the amount of water in the stream permits, and enters the river close to its mouth. The same is generally true of the North Laramie River upon the north side of the Laramie, and water could not be obtained from either of these sources for the irrigation of the

lands now irrigated from the Laramie River. Sybille Creek is a part of the system of the Wyoming Development Company hereinafter described.

There are two principal irrigated areas along the Laramie River in Wyoming. Irrigation commenced upon the Laramie Plains at about the time of the construction of the Union Pacific Railroad in 1868. Most of the ditches are owned by individuals or by a small number of individuals, but within recent years two larger systems have been constructed—the Lake Hattie system and the Lake James system, the former incorporating the Pioneer Canal, originally constructed in 1879, and the first canal constructed for the purpose of serving others than the owners. The witnesses for the complainant itemized the numerous areas upon the Laramie Plains irrigated from the Laramie River in 1913, aggregating 70,000 acres, with 6,600 acres irrigated from Sand Creek and its tributaries, and 48,000 acres irrigated from the Little Laramie and its tributaries, a total of 124,600 acres. The witnesses for the defendants computed the irrigated acreage upon the Laramie Plains at 90,600 acres, the larger part of the discrepancy being due, probably, to the obvious difficulty of a stranger in determining the area irrigated by flooding the land for pasture purposes.

The other principal irrigated area is the Wheat-

land district, bordering the river upon the east side of the Black Hills, the construction of which was commenced by the Wyoming Development Company about 1883. The original system covered approximately 60,000 acres, lying south of the Laramie River, east of Sybille Creek and west of Chugwater Creek, but two additional units of 10,000 acres and 20,000 acres respectively, and known as the Bordeaux and Sybille units, were undertaken in 1908 and 1910. In 1913, 33,544 acres in the original tract were under actual irrigation and 1,004 acres irrigated in the Bordeaux tract; the Sybille project had not then been completed. The water supply for these lands is the Laramie River, which is diverted through a short tunnel into Blue Grass Creek in which the water flows to Sybille Creek, whence it is diverted into the several main canals. The enterprise encountered the usual exigencies of construction and colonization work, and settlers were not secured until about 1894, and in the first year when but a few hundred acres of land was being irrigated the settlers encountered a shortage of water and demanded of the company the construction of the reservoirs, offering to pay to the company an increased price above that stipulated in their water purchase contracts if the company would construct such reservoirs. This demand persisted, and in 1897 the company constructed a small reservoir within the

reclamation area, and this not satisfying the requirements of the settlers, in 1899 commenced the construction of the Wheatland No. 2 Reservoir upon the Laramie Plains, fifteen or twenty miles above the tunnel into Blue Grass Creek. This reservoir was completed in 1901. The plans of the locating engineer indicated a capacity of 120,000 acre feet (one acre foot being that amount of water sufficient to cover a superficial acre to the depth of one foot, and containing approximately 43,000 cubic feet.) No engineer who had computed the capacity of the reservoir as constructed from an actual survey of all contour lines was available as a witness, but the hydrographer of the plaintiff, from his detailed measurements of the inflow and outflow of the reservoir, and a survey of its high water mark, computed its active capacity at 83,400 acre feet, and its dead capacity, incapable of withdrawal, at 35,000 acre feet. This reservoir is a channel reservoir at the lower end of the Laramie Plains below the junction of the Laramie and Little Laramie Rivers, and below all other accessions of any significance, and necessarily stores all water flowing past the headgates upon the Laramie Plains, all water flowing into the river from gullies and small creeks, and all water returning to the river from seepage or overflow. It was definitely shown that since the completion of this reservoir in 1901

there have been but two years in which water has been permitted to flow past its dam and down the river, excepting for immediate diversion through the tunnel into Blue Grass Creek for use on the Wheatland tract. In 1907 the management became solicitous for the safety of the reservoir and opened the gates for a few days during the high water period. In 1909 the flow in the river was extraordinarily great, and the reservoir filled so rapidly that it was necessary to cut channels at one end of the reservoir to permit the water to escape and find its way back to the river. For several days a wide and very deep stream rushed from the reservoir, and the flow continued in some volume for several weeks. No estimate of the quantity of water so escaping could be made, but it must have been a very large amount. With these two exceptions this reservoir, for the thirteen years since it was constructed, has held and conserved for use upon the Wheatland area all of the water in the river at that point.

In November, 1909, eighteen months before the commencement of this suit, the Laramie-Poudre Reservoirs and Irrigation Company, under a construction contract with the Greeley-Poudre Irrigation District, commenced the construction of the tunnel from the Laramie River to the Cache la Poudre River, of which complaint is now made. The several de-

fendants allege in their answers that this project was initiated on August 25, 1902, and assert a priority of appropriation from that date, being anterior to the commencement of the construction work upon the Sybille and Bordeaux supplements to the Wheatland irrigation system, and antecedent in point of time to the commencement of actual construction work upon the two principal large enterprises upon the Laramie Plains hereinafter mentioned, the Lake Hattie and Lake James projects. It appears that about 1897 Wallis Link, a small ranchman in the valley of the Laramie River in Colorado, while hunting on the divide observed the comparative proximity of the two streams and conceived the possibility of a short tunnel through the mountain to divert water from the Laramie into the Poudre. It is the purport of the evidence for the defendants that the tunnel which was commenced twelve years later had its origin in this episode. In 1902 Link, having removed to a farm near Fort Collins, interested a neighboring farmer in the Laramie diversion project, which was given more tangible form through a series of surveys in 1902 and succeeding years and intermittent work on roads and a ditch, presently to be mentioned, up to the late months of 1909. The first survey by Link and his associate was made in 1902 for a ditch connecting with a previous ditch (the Skyline) which

had been built some years before by other parties to collect the waters, high up on the mountain side west of the sources of the Laramie and carry them in a southerly direction through a gap in the divide to Chambers Lake—an expansion of the Poudre River. Connecting their project with the upper end of the Skyline, Link and his associate extended their survey northwesterly to a series of small lakes high up on the western watershed of the Laramie, so as to drain the waters from these lakes and intercepted streams and convey them to and through the Skyline to Chambers Lake for use at such places in the Poudre Valley as might be found feasible and profitable. In 1904 a considerable amount of work was done on this ditch and in 1907 still more work was performed and some water was run in the ditch, but was not turned into the Skyline or put to any use. It was explained by the defendants' witnesses that it was the double purpose of the promoters to use and sell the water thus to be carried through this ditch—which at first passed by the name of the Link Lake Ditch and is subsequently referred to as the Rawah or Upper Rawah Ditch—and, with the revenue thus to be gained, to accomplish the much more ambitious project of diversion through the tunnel. In 1904, having admitted two more associates, Link made further surveys including several tunnel locations, and from

that time on until 1909, he and his associates or successors located numerous ditches, tunnels, dams and reservoirs, maps of which were filed from time to time in the office of the State Engineer of Colorado, all having for their purpose the diversion of the Laramie River waters into the Poudre or its tributaries. Apparently the latest of these locations examined, surveyed and projected was for a reservoir in the river some miles below the tunnel sites, with a ditch leading out of the Laramie Valley into Wyoming across Sand Creek and into Sheep Creek and the North Fork of the Poudre, which was to divert all and more water than could have been secured through the tunnel, convey it by a much longer and more circuitous route to the Greeley-Poudre District, and thereby water all of the lands embraced in the present project and a considerable additional tract to the north.

These various projects had this much in common, that they were all intended to divert—in varying amounts and by numerous and variant and in some instances by alternative means—the waters of the Laramie River to the Poudre Valley. They took no visible form, however, aside from the work on the extension of the Skyline Ditch, until near the end of 1909.

In the meantime, the application of these waters

to use was the subject of equally numerous, alternative, successive and variant projects. Starting with Link and his associate Akin, who had a scheme to use or market the water on their own farms or other lands in their neighborhood south of the Poudre, these projects, as the number and ambition of the associated promoters grew in subsequent years, expanded in size and floated about over the available sites for irrigation in the Poudre Valley until September, 1909, when the contract was drafted and submitted to the voters of the Greeley-Poudre Irrigation District, and being approved by them became effective October 4th, following which the visible and tangible works to divert the Laramie River water became fixed.

The irrigation system so contemplated was divided into two main divisions, the Laramie River or Mountain division and the Plains division. The Laramie River portion of the work consisted of the ditch upon which Link had commenced construction in 1904, and called the Upper Rawah Ditch, intercepting several tributary creeks and carrying their water into the west fork of the Laramie River; the West Side Collection Ditch, intercepting the same tributaries lower down, performing precisely the same service as the Upper Rawah Ditch and rendering that ditch of little or no value; the East Side Collection Ditch; a small reservoir in the channel of the river below the

juncture of the west fork and the east fork, and the tunnel leading from this reservoir. The function of the two collection ditches is clearly indicated upon the map "Exhibit B", attached to the bill of complaint; they start far north of the tunnel and high enough on the mountain side to give the necessary fall, and intercept the principal high mountain tributaries of the river, carrying their waters back to the tunnel reservoir; the tributaries so intercepted all enter the river below the tunnel and their waters could not be brought to the tunnel for diversion into the Poudre, were it not for these collection ditches.

The Plains division of the Greeley-Poudre system consists of an enlargement and extension of the Poudre Valley Canal, one of the existing canals on the north side of the Poudre River, so as to cover the lands within the new district, and a number of reservoirs to be used in furnishing the necessary storage for the water of the Laramie and for storing the surplus and unappropriated waters of the Poudre and its plains tributaries, aggregating, according to the report of the expert who examined the water supply for the proposed district, about 120,000 acre feet per annum.

It is alleged in the bill that the defendants intend to divert through this tunnel more than one hundred thousand acre feet per annum of the water of the Laramie River; in the answers it is admitted that the

tunnel has been constructed for the purpose of diverting 70,000 acre feet per annum. In the elaborate report of Professor L. G. Carpenter, who in 1909-10 investigated the water supply and who acted as the irrigation expert on behalf of the defendants in this case, it was stated (marginal page 3934) that the total available supply from the Laramie watershed was 70,160 acre feet per annum. The principal evidence upon this matter was given by the State Engineer of Colorado, Mr. Field, who concluded (p. 3420) that the mean annual flow in the Laramie River and the tributaries intercepted by the collection ditches leading to the reservoir, at the tunnel after upper diversions had been made was approximately 77,000 acre feet; that by reason of the porous condition of the mountain collection ditches and the impossibility of using them during the winter months, not more than seventy-five per cent. of this flow could be turned into the tunnel reservoir, so that the mean annual diversion through the tunnel would be 56,000 acre feet; he further testified that if an extension of the West Side Collection Ditch were made to McIntyre Creek as contemplated but not presently intended, an additional amount of 15,000 acre feet could be procured, making a total possible diversion of 71,000 acre feet per annum through this system. To this he added 18,000 acre feet as the average annual

diversion from the Laramie River into the Poudre through the Skyline Canal, and 2,000 acre feet as the average annual diversion from several of the east side tributaries of the Laramie into the Poudre through an earlier ditch known as the Divide or Wilson Supply Ditch, which carries water around the northern end of the mountains constituting the eastern boundary of the Laramie River drainage area. This makes the total actual and contemplated diversion from the Laramie into the Poudre, 91,000 acre feet, unless, of course, the ditches are lined with concrete or otherwise improved so as to carry water without such great loss.

These facts constituted the foundation of the plaintiff's case. They show that a very large area of arid lands in the State of Wyoming have been reclaimed through the use of the water of the Laramie River; that with the exception of 1907 and 1909 when water was permitted to waste from the Wheatland reservoir it has been found necessary as a matter of practice to conserve and use the entire flow of the river for such irrigation; and that the defendants, having already diverted 20,000 acre feet per annum from the river for use in another watershed, are now attempting to divert an additional amount of from 56,000 to 71,000 acre feet, all of which will be com-

pletely lost to the valley of the Laramie, as no seepage or return flow therefrom would be possible.

To meet this case the defendants have offered evidence to show (1) that the use of the water in the valley of the Poudre will yield immensely greater returns because that valley is a remarkably rich and fertile farming territory, whereas it is contended the Laramie Plains is practically worthless for farming purposes; (2) that after the Colorado diversion there would be abundant water in the Laramie River and its tributaries for the complete irrigation of the Wyoming lands now under irrigation; and (3) that through the storage of water in reservoirs in Wyoming an ample supply can be obtained irrespective of the Colorado diversions.

A very large part of the evidence is given over to a description of the beauties of the Poudre Valley, and the desolate aspect of the Laramie Plains. The former has an average elevation but little in excess of 5,000 feet; the latter, lying fifty miles to the north, has an average elevation in excess of 7,000 feet, and the agricultural conditions are undoubtedly most diverse. The former is unquestionably a wonderfully rich agricultural country, while the agricultural efforts on the Laramie Plains are more recent and very much less extensive in their scope and variety, and the principal industry is ranching, the water being

used chiefly for raising hay, a use which throughout the world has been considered as beneficial and the basis of appropriation of water, and without which the prosperity of this industry of the State of Wyoming cannot continue. Two extreme views of the agricultural merit of the Laramie Plains are presented by the State Engineer of Colorado, Mr. Field, who in testifying in this case (p. 414) says: "When he (any investigator) observes the new irrigation projects he wonders whether the projectors have been competently advised, and whether it is not spoiling a good ranch country to make a poor farming country which is destined ultimately to failure. This impression I received when I first went in there, and it has been borne in upon me ever since, every time I go up there." In 1910, four years before he so testified, Mr. Field was employed as an irrigation engineer to investigate and report upon the Riverside Ranch, one of the larger ranches upon the Laramie Plains, then recently purchased by a company which planned to colonize it, and portions of his report are set forth in marginal pages 3624-3637; in this report he stated that the virgin soil yielded splendid crops; that rotation of crops should be practiced and much alfalfa raised, as a result of which he believed that two hundred sacks of potatoes per acre could be produced; that the land was worth for colonizing purposes from $35 to

$75 per acre, and that it should be divided into small tracts of 160 acres or more for sale to farmers who should farm the same in connection with the raising of live stock. It is doubtful if two hundred sacks of potatoes per acre could be produced ordinarily upon the Laramie Plains, but on the other hand we do not believe that the region is so worthless and unproductive as to make the use of water a waste instead of a proper utilization of the resources of nature. It may here be said that the agricultural character of the Wheatland tract, which is 2,000 feet lower, is not subjected to the same criticism on the part of the witnesses for Colorado, who concede that it is an agricultural district of real merit.

Amount of Water in the Laramie River.

A water supply investigation involves two elements—the amount of water in the stream, and the requirements of the land; and each is complicated.

The customary and best method to ascertain the amount of water flowing in a stream, and that used by the United States Geological Survey and by the hydrographers of the parties to this suit, is as follows: A suitable site is selected for a gauging station, and several measurements are made at different stream heights to ascertain, first, the cross section area of

the water at all heights, and secondly, the average velocity of the current at all heights. The channels of all streams and particularly of all mountain streams, are irregular and more or less shifting or changeable, and the accuracy of the chart showing the cross section area at different heights depends upon the number of cross section measurements which are made and the permanency of the conditions. To ascertain the velocity requires even greater care and detail, for the velocity not only increases with the height of the stream, but the velocities of different portions of the stream differ from the velocities of other portions at the same time, and in careful measurements it is necessary to determine the velocity of each portion by using a current meter at different depths at intervals of a foot or a few feet, clear across the stream. By the use of a formula which has been developed by hydrographers, these measurements as a whole are converted into an average velocity of the stream at a given height, and by securing such velocities for a number of heights a velocity curve can be plotted which in conjunction with the cross area chart establishes a curve determining the flow of water in cubic feet per second at the various stream heights. There is placed at this gauging station a gauge from which the height of the water may be determined. Sometimes an automatic register is used, sometimes a

staff gauge which must be read at regular intervals by an observer, and in some instances both are used to check against each other. By this means the flow of the river in cubic feet per second is ascertained, and this is easily convertible into acre feet per day, as one cubic foot per second is approximately two acre feet per day. It is obvious that the value of the stream flow record thus obtained depends upon the ability and accuracy of the hydrographer who establishes the rating curve, the number of measurements made by him at various heights and times, the accuracy of his current meter, the faithfulness and care of the daily observer who notes the gauge heights, and the accuracy of the automatic register.

The evidence on behalf of Wyoming was that the flow of the Laramie River at the Pioneer Dam at the upper or southern end of the Laramie Plains below all important tributaries of that river except the Little Laramie, was 207,000 acre feet in 1912 and 109,593 acre feet in 1913, and that the mean annual flow derived from the actual measurements for the twenty-four months from April 1, 1912, to March 31, 1914, was 161,054 acre feet; that the run-off of the Little Laramie River at the head of its valley and below all important tributaries from June 1 to December 31, 1912, was 93,667 acre feet, and for the entire year 1913, 59,637 acre feet. The conclusion of the

expert who testified on behalf of Wyoming, from a consideration of all hydrographic data over a period of more than 25 years, was that the mean annual flow of the Laramie River at the upper end of the Laramie Plains was approximately 200,000 acre feet. He further testified that this with the flow of the Little Laramie constituted practically the entire flow of the Laramie River and its tributaries above the Wheatland Reservoir No. 2.

The expert testifying on behalf of Colorado with respect to the run-off of the river reached the following conclusions:

Mean annual flow of Laramie River at Wood's Landing, a few miles above the Pioneer Dam	250,500
Sand Creek	17,000
Inflow between Wood's Landing and Pioneer Dam	14,400
Inflow from east side of Laramie Plains	12,800
Mean annual run-off of Little Laramie River	120,700
Four Mile, Seven Mile, Cooper and other creeks in northwest portion of area	12,800
TOTAL	428,200

The estimated run-off at Wood's Landing of 250,500 acre feet includes 20,000 acre feet, the mean annual diversion into the Poudre watershed through the Skyline and Divide ditches, which would pass Wood's Landing if not so diverted, and the aggregate amount of 428,200 acre feet is the estimated amount

tributary to the river system above the Wheatland Reservoir No. 2. A further amount of 20,000 acre feet is credited to Sybille and Blue Grass Creeks on the east side of the Black Hills, and large but unestimated flows are attributed to the North Laramie and Chugwater Creek, which enter the Laramie just above its mouth and below the irrigable area. Of the entire run-off he concludes that Colorado contributes 237,500 acre feet, exclusive of Sand Creek, of which amount 20,000 acre feet is already being diverted into the Poudre Valley through the Skyline and Divide ditches, and 56,000 acre feet, he concludes, will be diverted through the new tunnel, with a possible addition of 15,000 acre feet if the projected extension of the West Side Collection Ditch is made to McIntyre Creek.

The evidence relative to stream flow was given on behalf of Colorado by Mr. John E. Field, the State Engineer, and on behalf of Wyoming by Mr. Ralph I. Meeker, formerly hydrographer of the United States Geological Survey, who for two years had been employed by Wyoming appropriators to devote his efforts exclusively to gathering hydrographic data principally for the purpose of this suit. Mr. Field's testimony consisted of an analysis of stream flow records made by others, and his conclusions drawn therefrom, while Mr. Meeker's testimony was

confined almost entirely to records made by himself, covering a period of two years preceding the conclusion of the presentation of the evidence in May, 1914, but taking into consideration all other available data in existence.

In his testimony Mr. Field gathered together all available records, some made by the United States Geological Survey, some by the office of the State Engineer of Wyoming, some by the office of the State Engineer of Colorado, some by Professor L. G. Carpenter, some by Mr. Meeker. They covered in all about twenty-five years, but were in no sense complete, with the exception of the records for the last two or three years, the measurements having been intermittent and not consecutive throughout several years, and generally covering but a few months in any year. It is not surprising that Mr. Field found occasion to challenge, criticise and discard from his conclusions a great many of these reports, but strangely enough a peculiarly persistent coincidence led him to criticise and discard records which in almost every instance indicated a low flow, thereby affording an opportunity to substitute higher records, and rarely did he find occasion to criticise a measurement indicating a very large flow, excepting possibly to raise it. One record subjected to such criticism, and with respect to which considerable explanation was offered,

was that of the flow of the Laramie River at the state line in May and June, 1912. The record so criticised was that published by the State Engineer of Colorado from hydrographic data supplied by an hydrographer from that office and worked up in that office. But it appeared that during the extreme high water the river had overflowed its main channel and considerable volumes of water had passed through culverts under a road crossing the river at that point, and the hydrographer and the observer had never noted this fact. It was also true that the needle in the automatic gauge register operated imperfectly and for some time indicated a gauge height approximately one foot less than the true height as indicated on the staff gauge. The result of these conditions and imperfections was that the published record of the flow at that point was very much less than the true flow. Mr. Meeker, who, experienced and careful as he was, made errors in computation and cheerfully admitted and corrected them, presented what we believe is a fair criticism of the general character of Mr. Field's evidence as follows: (Marginal Page 4293)

> "The tendency throughout his hydrographic record is to consistently accept the records which give the greatest flow at stations where there were conflicts and to discard those records which would show a less discharge, thereby showing a larger amount of water in the Laramie River

basin available for irrigation on the Laramie Plains. A specific instance where he has used my records when they were higher than the Colorado records is at Wood's Landing where one of the year's records was too low and he had those records re-computed and revised, but he ignored another year of those records which, if revised according to the data available, would show a much less discharge than the face value of the records. I find no consistent reason why he should have adopted the method of taking the high years and destroying the low years, other than he had decided upon what volume of water was available in the Laramie River basin and made his computations fit the answer. A consistent and careful analysis of these records from a hydrographic standpoint does not permit of any such deductions, and it was because of the uncertainties and errors and unknown conditions under which the old records were secured that after an extended and careful re-computation of the old records at Wood's Landing and at other stations, I came to the conclusion that only in a general way could they be taken and not used concretely. They do, in a broad way, mark the yearly run-off if the winter flow records are disregarded and the two or three years which are grossly in error are disregarded."

But what we believe is the most remarkable feature of the testimony of this witness is his arbitrary use of an independent index likewise resulting almost invariably in an increase in the amount of water

claimed to flow in the river. As has been said, the records upon the Laramie were comparatively few and the earlier ones are concededly open to question. Therefore Mr. Field took the records of the flow of the Poudre River which had been kept continuously since 1884, and from them ascertained the mean annual flow of the river. Then calling this average one hundred per cent. he determined what percentage of the mean annual flow occurred in any particular year or in any combination of years. He then assumed that there was a relation between the river flow in the Laramie River and the flow in the Poudre, and that in any ten years, say, the mean flow would bear the same ratio to the mean flow for a thirty year period as the mean flow for those same years in the Poudre bore to the thirty year mean in that river. At the outset he disclaimed any contention that in any particular year there would be such a relation between the flow in the two rivers, and in fact the records which he accepted showed in numerous cases that the flow for a particular year in the Laramie bore a very different relation to what he in this remarkable manner determined to be the true mean over a long period, than the flow in that year bore to the mean flow of the Poudre, but he did seek to utilize this method of reasoning with respect to combinations of years as low as two in number, and in some in-

stances, despite his disclaimer, applied the same principle to a single year. Needless to say, by this method he developed a mean flow in the river considerably in excess of even that mean which he had ascertained from the Laramie River records alone after discarding the low records with which he was not satisfied.

We are unable, in a statement of facts, to present a more adequate idea of the basis of the evidence offered by Colorado relative to the flow of the Laramie River. Mr. Field's testimony commences on Marginal page 3387, and occupies a considerable portion of the balance of the abstract. His general conclusions, as above outlined, are set forth commencing marginal page 3473.

We could not compete with such an earnest builder of hypotheses; neither did we believe that a fair view of the practical situation could be derived from the consideration of stream flow records, made by men whose qualifications, care and diligence are unknown, working under unknown conditions with possibly imperfect equipment, and probably forced to construct rating curves applicable to very high flows upon pure guess-work. Accordingly our evidence relative to the supply of water in this drainage area has been confined to the testimony of a qualified hydrographer who actually installed the stations,

supervised the work and compiled the data, and his conclusions are strengthened and approved beyond the possibility of attack by the outstanding physical feature of the Laramie River irrigation development—the Wheatland No. 2 Reservoir. Mr. Meeker's final conclusions and records are set forth commencing with marginal page 4272, and there are found the several tables compiled by him covering the data which he had secured during the two preceding years. In Exhibit T7 (p. 4294) he shows the total flow in the Laramie River at Pioneer Dam, at the southern end of the Laramie Plains and below all Colorado tributaries excepting Sand Creek, to have been 207,000 acre feet in 1912, and 109,593 acre feet in 1913, and for the 25 months from April, 1912, to April, 1914, an average mean flow of 161,054 acre feet, and in Exhibit T8 he shows the total flow in the Little Laramie River at the point where it enters the Laramie Plains and including the amount diverted through a large upper canal to have been 93,667 acre feet, from June 1 to December 31, 1912, and 59,637 acre feet during the entire year 1913, and the mean annual flow as determined from measurements from June 1, 1912, to May 1, 1914, to have been 68,820 acre feet.

The very large discrepancy between the stream flow records presented by Mr. Field and those of Mr. Meeker is due in part to the methods of analysis

adopted by Mr. Field and his arbitrary use of the records of the Poudre as above explained. The remainder is due to his addition of arbitrary amounts as representing the accessions of the stream from miscellaneous sources after it enters the Laramie Plains. Of these supposed accessions Mr. Meeker testified as follows: (pp. 4304-4307)

> "Referring to Mr. Field's estimate of 12,800 acre feet probable run-off from mountain territory out of Four Mile, Seven Mile, Cooper and other small streams, heading in the mountains north of the Little Laramie River on the west side of the valley, the only run-off from that area is a very small inflow at times from Mill Creek to the Little Laramie. The most of this water is diverted before reaching the river, and applied on lands in that vicinity along the creek. Except Four Mile, I should say no water enters the Laramie River from those streams other than perhaps a small volume from Four Mile after very heavy torrential rains. The meadows along Four Mile require what little natural flow there is in the foothills, so practically no water reaches the Laramie River from that creek, as I have observed in crossing it. King's survey of the 40th parallel made in the 70's shows Cooper, Dutton, Four Mile and Seven Mile Creek as not extending to the Laramie River. Cooper, Dutton and Seven Mile enter depressions, but the other tributaries are not shown as continuous to the Laramie River, showing that at that date there was no inflow. Seven Mile flows into

James Lake, to which there was no outlet prior to the construction of the James Lake Irrigation System. Cooper and Dutton Creeks flow into Cooper Lake, having no connection with the river. There is practically no inflow from the source whence Mr. Field estimates 12,800 acre feet.

"Referring further to his testimony estimating an inflow of 12,800 acre feet from the mountain area on the east side of the Laramie Plains lying south of a point opposite Two Rivers, and a point opposite the Wheatland Reservoir, being an area of about sixty miles in length by five miles in width, very little water is contributed to the river from this area and that flows in from small tributaries south of Laramie such as Soldier, Willow and Five Mile Creeks, and then only in times immediately following heavy rainfall or perhaps a very small flow may reach the river during the melting of the snows in March. From that area lying north of Laramie, there is practically no inflow to the Laramie River from the area extending along the slopes of the Black Hills to the Wheatland Reservoir. On April 25th I made a special inspection trip of those channels or draws between the steel bridge at the Two-Bar shearing pens and Laramie and outside of a few small draws which may carry a little water after very heavy rains, and which enter the Laramie River a short distance above the steel bridge or immediately north of Laramie practically no water enters the Laramie River from the Black Hills. The slight flow or run-off from this area is intercepted by lakes and ponds

and is also intercepted by the Oasis and Boughton Ditches, and in turn carried to the lakes and ponds. The run-off in the Black Hills is very meagre, occurring only after torrential rains or the melting of snow in the early spring. In frequent trips to the Wheatland Reservoir during 1912, 1913 and 1914, I have never seen in the aggregate over a few second feet in any of the ordinarily dry channels crossing the road to McGill, and then only after heavy rains or in March or the first few days of April. Some of the water originating on the slopes of the Black Hills is absorbed in transit by the sedimentary formations at its base. Reference to the Laramie Quadrangle topographic map of the U. S. G. S. shows the intermittent nature of the drainage from the Black Hills of these channels and the termination of the flow near the base of the hills. Mr. Field's estimate of this inflow is much too great."

The estimated run-off of Sybille and its tributary Blue Grass Creek is likewise unimportant. These creeks are used to carry the water from the Laramie River to the canals of the Wheatland territory, and such water as they carry during the irrigation season is utilized, although frequently some water is turned back into Sybille Creek through the sand gates below the headgates of the canals, in the process of the usual flushing and cleaning operation. The watershed of Sybille Creek is subject to occasional cloudbursts,

but the water coming from such causes is a source of danger and not of supply, for the demand upon the canal system is so heavy and the supply from the ordinary flow of the creek so small that it is necessary to divert water from the Laramie River to the capacity of the distributing canals; as it requires several days for water to travel f om the storage reservoir upon the Laramie Plains to the canals, the Laramie River supply cannot be cut off and the cloudbursts utilized; and the flow from the cloudbursts superimposed upon the capacity flow from the Laramie River frequently washes out the headgates of the distributing canals. (Testimony of J. A. Elliott, pp. 164-167).

Neither do the North Laramie River and Chugwater Creek furnish a possible source of supply for irrigation of any of the lands now irrigated from the Laramie. Not only is each stream utilized to its capacity for the irrigation of lands in its watershed, but both lie below the Wheatland area and far below the Laramie Plains, and enter the main river a short distance above its mouth.

As has before been stated, Sand Creek is not in reality a tributary of the Laramie River. A large part of its supply is diverted into the Poudre Valley through the Divide Ditch and the balance is used along its course, so that only in unusual years does any part of its w 'er reach the river.

In common with Colorado we have taken into consideration the supply from the Little Laramie River for the purpose of ascertaining the total amount of water available in the main watershed, but the question at bar is, we believe, more narrow. The Little Laramie is entirely a Wyoming stream, and it, with the Laramie, constitutes one of the principal tributaries of the North Platte, which flows into Nebraska, a State which naturally asserts some rights to the benefit of the natural flow in that river. As the Little Laramie enters the Laramie above the Wheatland Reservoir, it is to some extent a source of supply for the Wheatland lands, and it has now been made one of the sources of supply for the recently constructed Lake Hattie Project upon the Big Laramie River. It does not, however, furnish any of the water for the irrigation of the lands heretofore irrigated from the Big Laramie River above its junction with the Little Laramie, and any surplus water therein would not be available to the farmers along the Big Laramie above Laramie City, if the water they have appropriated should be diverted into the Poudre. If the present question requires a consideration of all possible sources of supply for the lands now being irrigated upon the Laramie Plains and at Wheatland, and Colorado has the right to divert the water heretofore used in Wyoming and compel the Wyoming

appropriators to seek other sources of supply, the inquiry would lead much further, for as the defendants have so diligently shown, the Lake Hattie project includes a diversion from Douglas Creek, a tributary of the North Platte River, and we assume that other outside potential sources exist.

Adequacy of Water Supply.

But whatever the volume of water flowing in the Laramie River, the principal question of fact is the adequacy of that supply. It is the contention of Colorado that the flow of the Laramie River is ample not only for all Wyoming requirements, but for the Greeley-Poudre diversion. We have shown that as a matter of fact Wyoming has actually used all of the water for a period of twelve years, excepting in 1907 and 1909, for excepting in those years no water flowed past the Wheatland Reservoir at the lower end of the Laramie Plains, and this must be the most direct and conclusive answer to the contention of the defendants. Colorado insists, however, that there is great waste in the use of water in Wyoming, that the potential duty of water is much higher than the Wyoming practice would indicate, and that through the conservation of the surplus flow Wyoming would

have a sufficient supply after all existing and proposed diversions in Colorado are made.

This contention is largely based upon the conclusions of Colorado relative to the mean or average annual flow of the river, and the attention of its witnesses was directed almost exclusively to this aspect of the investigation. The mean annual flow is misdescribed as the "normal" flow, and it is assumed that this is the amount of water actually available in practice for irrigation purposes. The continuous thirty-year record of the flow of the Poudre River (p. 3394) well shows that the supposed normal flow is in reality abnormal. That record indicates a mean flow of the Poudre of approximately 317,000 acre feet, but this figure has no intimate connection with the amount of water really available for use under actual irrigation practice. In nine of the years preceding 1914 the flow fell short of this so-called normal by more than one hundred thousand acre feet, while in only four years was it more than one hundred thousand acre feet in excess of this mean. The mean is in fact largely attributable to a few years of extremely high flow which counterbalance a much greater number of years of smaller flow, and in consequence is 353,000 acre feet less than the highest year, while only 158,000 acre feet more than the lowest. Moreover, in 1884 the flow for only part of the year was more than one

hundred per cent. in excess of the annual mean, and the following year was fifty per cent. in excess. In the eight succeeding years the flow did not reach the mean, and the farmers whose crops burned up in 1893 and the three or four preceding years perhaps gained but little comfort from the statistical information that the so-called normal flow of the river was entirely adequate for their needs. Nothing approaching the record of 1884, within 200,000 acre feet, has been experienced in the thirty years since that time, and only four years have approached within 300,000 acre feet. Only seven years in the thirty have equalled one-half of the flow of 1884. For all practical purposes, therefore, the exceptional years of extremely high flow must be disregarded. A farmer cannot wait thirty years under terrestrial conditions for the one favorable year to raise the only crop of a lifetime. Indeed, even the years of moderate excess, which seem to run in cycles of ten or fifteen years instead of alternating approximately with the years of deficiency, mean very little in their practical effect upon the farmer's operations. If he could bear the immense expense of the storage works which would carry over the surplus for more than one or two years, the unstable substance would evaporate or seep away within that time and be lost irrecoverably in spite of his pains. What actually happens in such cases, even

in the celestial region of the Poudre Valley, is well illustrated by Mr. Armstrong's table (Exhibit 123, p. 2487) showing that out of the excessive flow of 448,000 acre feet in 1909 (p. 3394) 288,000 acre feet ran out of the Poudre into the South Platte, and that even in the "normal" year of 1912, 91,000 out of 319,000 acre feet were abandoned to the same fate. By what moral or legal right can the favored Colorado irrigator throw upon his Wyoming neighbor, already handicapped by an "arctic" climate, and an irresponsive soil, the burden of spending useless sums to conserve an imaginary or elusive surplus in the Laramie, which he so freely wastes in the Poudre—and this in order to seize the cheaper and more dependable supply already appropriated by the latter?

It is contended that this theoretical normal does establish the real stream supply because it may be conserved in reservoirs and the defendants apparently do indirectly seek to impose the duty of such conservation upon the Wyoming appropriators, in order that Colorado may take into another watershed the water which heretofore Wyoming appropriators have been using. Even in the Poudre Valley, the agricultural marvel of Colorado, in which its official witnesses boast that irrigation has reached a higher point than in any other part of the mountain states, experiencing for years an increasing pressure for water, with lands

so valuable that enormously expensive reservoirs are practicable, the reservoir development has not reached the point where the surplus floods could be stored. In the cross examination of Mr. Field (pp. 3721-3729) it developed that the total reservoir capacity in the Poudre Valley in 1912 was 146,655 acre feet, and at the conclusion of the irrigation season of that year 83,794 acre feet was in storage, being held over for use in 1913, leaving 62,871 acre feet of available capacity. As shown by the table of flow at page 3394 the total flow in the Poudre in that year was 319,353 acre feet, so that even at that late period in the development of the valley a flow of 382,224 acre feet would have furnished all of the requirements of the valley during the year and would have filled every reservoir. Any flow in excess of that figure, therefore, must be disregarded in determining the mean flow of the river for practical irrigation purposes, for any greater amount could not be conserved, and where two high years occur in succession as in 1884 and 1885, assuming that all reservoirs constructed in 1912 had then been in operation, not only would 288,000 acre feet have been lost to the Poudre Valley in 1884, but none of the high flow of 1885 could have been conserved, the reservoirs all being full. If an even larger amount of the flow of 1884-85 had been conserved it would certainly have been exhausted in 1888, which was

an extremely low year, and in the five succeeding years from 1889 to 1893 inclusive, in which the flow of the river fell far below the average, the farmers would have received no aid even from a very extensive reservoir system. Again we find that in the nine years from 1899 to 1907 inclusive, the flow exceeded the average by a very large amount, with the exception of two years, and these cumulative floods could not be conserved for subsequent use.

Thus it is seen that even in the Poudre Valley, where irrigation development has reached its highest point, it is now impracticable to construct reservoirs so as to make the supply actually available in practice equal to the mean flow of the river.

Even more true is this of the Laramie Plains. The witnesses for Colorado have described in detail the agricultural imperfections of this area, and have concluded that the expenditure of money for irrigation works even of an inexpensive kind, is a waste. To this region Colorado would apply an irrigation practice for which the Poudre Valley is not yet ready, and would compel those who it is said are unable to raise remunerative crops to expend large sums and to conserve from year to year, and possibly for several years, the large floods frequently superimposed upon each other, even such floods as that of 1909, which for six weeks poured in a torrent from the hurriedly

constructed spillway of the Wheatland Reservoir.

The following is the view of Professor Carpenter, Colorado's principal exponent of the complete utilization of water supply (pp. 3936-49):

> "With regard to financial practicability of construction of reservoirs on Poudre River capable of conserving extraordinary floods, will state that they call for an expenditure that could be utilized only occasionally. It would be similar to financial proposition of people in Florida preparing to heat their houses in the same manner as those in the northern part of the United States. For years of unusually high flow in the Poudre River, conservation works, to utilize the excess waters in that stream, would have to count on carrying water over more than one year. The utilization of this water means the presence of population on the land; *that population must have a living from year to year* and they are not justified in going out on to the land and settling to raise a crop only once in three or four years. They must have sufficient to make a living from one year to another, and consequently the investment must be such that there can be sufficient water every year to keep these people on the land, and when water can only be conserved once in every three to five years, there must be provision for carrying over water or the people cannot live. It is a question of population as well as investment. The population has to exist and stay on the ground. From standpoint of investment, conservation of flow such as extreme flow of 1884 would be impractical to the extent that it exceeded

the ordinary high year. Of such character would be the floods of 1885, 1900 and 1909, three years in thirty."

Not only would such reservoir construction be impracticable, but it would be futile, for as emphasized by the witnesses for the defendants, the evaporation upon the Laramie Plains is very rapid, being perhaps as much as six feet per annum, and it may easily be computed how much of the water stored in 1909 in a reservoir even as much as thirty feet deep would remain for use even three years later.

The agricultural and industrial development of the Laramie Plains which the State of Wyoming now seeks to protect, came from the utilization of the natural flow of this stream through direct diversion. Prior to 1908 practically no reservoirs had been constructed for the conservation of water for use upon those lands. The principal and almost the only use has been for raising hay, the one great necessity of that stock-growing region, and the witnesses for the defendants insist that this is the only use which can be made of the water with any profit. Wyoming does not believe that Colorado, which has fully utilized so far as its territory will permit, all of the water of that river within its own valley, may now divert a large part of its flow into another watershed, and impose upon these prior appropriators in Wyoming

the expense of a reservoir development which Colorado itself has not attained, which would be prohibitive in cost and which would be largely futile.

Time of Use.

The time in the year when water must be used upon the lands on the Laramie Plains presents in a narrower form the same question as the contention of Colorado that the average water supply over a long period of years must be the basis of determining the adequacy of the supply. The defendants insist that because it is possible to construct reservoirs to conserve water from one year to another, the average flow of the stream is the decisive factor, a deficiency in any year being made up by water drawn from these reservoirs. Likewise they ask us to view a whole year as an entirety, and consider the flow throughout the year without reference to its distribution, but this view likewise depends upon the assumption that reservoirs can be constructed, that the expense of such construction would be justified by the returns from the use of water, and that the Wyoming appropriators can be subjected to such expense in order that Colorado may divert the large amount it proposes to take into the watershed of the Poudre. But the Wyoming appropriators do not have such reservoirs and their appropriations, far prior in point of time to the con-

templated diversion in Colorado, are from the natural flow of the stream, and just as the historical existence of a large flow three or four or six years before cannot diminish the loss of the farmer who in any year of comparatively low flow is unable to raise feed for his cattle by reason of the Colorado diversions, so these old appropriators cannot, in July and August, be solaced by the thought that in May and the first two or three weeks of June there had been an abundant supply. May and June are ordinarily the months of the greatest rainfall. They likewise are the first warm months following the winter, when the grass is deriving growth from the moisture stored in the ground from the winter snows. July and August are the warmer months with less rainfall, with no moisture conserved from winter, and consequently the months of the greatest need for water. The flow of the stream, however, comes in May and June, and in the latter part of June and during July and August when the need is greatest the flow is smallest. Furthermore the high mountain area at the head of the Laramie River contributes a proportionately larger amount to the river in the latter part of the season than during the months of May and June.

Defendants' Exhibit 125 (p. 3418) gives the discharge of the Laramie River at its highest gauging station, Glendevey, a short distance below the Greeley-

Poudre tunnel, and covering parts of six years. The months from September to March inclusive furnish but very little water; in April the run-off was about doubled over that of March, and in that month the average run-off was a little less than four per cent. of the annual flow. In May, during the latter part of which the mountain snows begin to melt, twenty per cent. of the annual run-off occurred, and this was doubled to more than forty per cent. in June. July had more than thirteen per cent. and August a little less than four and one-half per cent. The records at this station do not take into account the water diverted into the Poudre watershed by the Skyline and Divide ditches, the mean annual amount of these diversions, according to the note attached to the exhibit, being a little over 20,000 acre feet; these diversions commence in June and continue until about October, and are proportionately greater in July and August as compared to the total flow of the stream, than in June, so that if these amounts were added to the records at Glendevey the percentage of the total run-off of the stream from April until August inclusive would be almost ninety per cent. of the annual discharge, and the percentage of the discharge in July and August would be likewise increased.

Defendants' Exhibit 128 (p. 3440) shows the discharge of the Laramie River for fifteen years at

Wood's Landing at the head of the Laramie Plains, with an average annual flow of 254,111 acre feet. It will be observed that the winter flow is proportionately greater than at Glendevey, higher in the mountains, and is larger in the first few months of the year than during the first months of the winter, a fact which led both Mr. Field and Mr. Meeker to question and discard the winter records. By this table it is shown that the average monthly discharge increases from four per cent. in April to twenty-three per cent. in May and to thirty per cent. in June, in which month the average discharge was 76,107 acre feet. This falls to 22,293 acre feet in July, and 7460 acre feet in August, the July flow being less than nine per cent. and the August flow less than three per cent. of the annual flow as compared to thirteen per cent. and four and a half per cent. respectively in the same months at Glendevey, indicating that the percentage of the discharge in the higher areas in July and August is fifty per cent. greater than the discharge of the entire watershed. The discharge at Glendevey in May is only twenty-three per cent. of the discharge of the river at Wood's Landing, but the discharge in July is forty-five per cent. of the discharge at Wood's Landing, and the discharge in August is more than forty per cent. of the Wood's Landing flow. This condition would be further aggravated if the diversions

through the Skyline and Divide ditches were taken into consideration, and it is probable that the discharge at Glendevey in July and August including those diversions amounts to more than one-half of the entire water supply of the Laramie River.

The witnesses for Colorado testified that not more than seventy-five per cent. of the water intercepted by the Greeley Poudre collection ditches can be diverted into the Poudre on account of the condition of the ditches and the impossibility of catching all of the water, but they further say that during periods of pressure such as in years of very low flow or during July, August and September of each year, a relatively greater amount of water can and will be taken. If the amount diverted is only eighty per cent. of the flow intercepted by these ditches, it will mean a loss to the farmers in Wyoming of more than forty per cent. of the entire available supply during these months of greatest need.

Referring to the conclusion of the State Engineer of Colorado (p. 3626) that the greatest demand for water upon lands on the Laramie Plains is in July, when three-fourths of an acre foot per acre will be required, even his excessive estimate of 22,293 acre feet discharge at Wood's Landing in July would furnish water for only 30,000 acres of land, and of this Colorado threatens to divert more than 9,000 acre feet.

Methods of Use.

As a part of the investigation of the adequacy of the water supply, Colorado contends that there is great waste in the use of water in Wyoming, this complaint being directed against the appropriators upon the Laramie Plains. Much evidence was offered with respect to the "duty of water", a term upon the definition of which no two experts seemed to agree, but which may be described as determining the amount of land which may properly be irrigated from a given quantity of water. Necessarily the duty of water must differ as conditions differ. Not only is it affected by the rainfall, the humidity and temperature and the length of the season, but it varies with the crop, the soil, and the method of use, and the method of use must necessarily depend largely upon the character and value of the crop. The experimental plot, watered carefully from the sprinkling can, may be brought to maturity with much less water than the open field, irrigated from laterals, and the careful conservation of water in the orange groves of California will develop a much higher duty of water than the distribution from open ditches upon the beet fields of the Poudre Valley, just as such use in the Poudre may develop a higher duty of water than the irrigation of hay meadows by flooding them.

Upon the Laramie Plains the practice in the irri-

gation of the hay meadows is to spread the water over the land from occasional laterals, flooding the land for several days at a time. Possibly as compared to the method of irrigation of cultivated crops worth one hundred or five hundred dollars per acre, this method may seem wasteful. Taking into consideration the crop raised, however, it is the only possible method, and is the method which of necessity has been used throughout Colorado and in every other mountain State. The crop is not a sowed or cultivated crop and the water cannot be conducted through furrows. It cannot, in the nature of things, be applied otherwise than in a sheet spread over the surface and percolating downward into the turf, which does not absorb water as readily or quickly as tilled soils. Though the amount applied is large, the actual consumption is relatively small, and this method is not so wasteful as might be supposed. The longest of the old canals upon the Laramie Plains was the Pioneer Canal, irrigating in 1913 less than 12,000 acres, and covering land not more than five or six miles from the river. All of the other canals are short, irrigate but a few hundred or at the most a few thousand acres, and the lands irrigated lie within a mile or two of the river. From the meadows irrigated in the manner described, the water returns very rapidly to the river channel and there is not even much seep-

age, the return flow being largely from the surface. The method of use in the Laramie Valley in Colorado is identical, but the appropriators are even more generous in the application of water. The practice in that region is shown by Mr. Field in his report made in 1910 upon the Riverside Ranch, wherein he said (p. 3625):

> "A number of the Colorado canals take water from tributaries of the main stream and the diversion by them is probably much less than is indicated by the published statement of decrees. This less diversion is also probable from the fact that decrees in Colorado are almost always excessive and many have never been used at all. The capacity of all canals reported on by the Water Commissioner of District Number 48 is given as 563 cubic feet per second, while the irrigable area is given as 4,720 acres, using 57,894 acre feet, or nearly 12 acre feet per acre per annum, an amount obviously wasteful and excessive."

In the same report (p. 3626) he expressed his opinion relative to the methods of use, the water requirements, and the waste upon the Riverside and Hoge ranches upon the Laramie Plains, as follows:

> "On the Riverside and Hoge farms the duty of water should not be very low, as on the meadows during the high water period, that is, in May and June, there will be a certain amount of sub-irrigation and overflow. The greatest demand will

probably come in July, during which month probably three-fourths of an acre foot per acre will be required, or one cubic foot per second will probably serve about eighty-three acres. The decrees of the Company call for one cubic foot per second for each seventy acres.

"The canals serving the land are comparatively short, and the losses proportionately small, and even that which is lost by seepage in transit will be of benefit to the land under which it passes on its way to the river.

"In August and September little water will be used, as most of the crops will have been harvested and even the late maturing crops will have begun to ripen and the water will have been taken off of such crops. In all two and one-half acre feet per annum per acre is doubtless an ample supply, and the decrees owned by the Company and the water available in the river will furnish that amount."

Even more interesting is the testimony of John L. Armstrong, who had been Water Commissioner upon the Poudre River for twenty-four years, and is justly credited in Colorado with being a remarkably efficient and able administrator of water distribution. He was encouraged to describe in detail his remarkable efforts to prevent the waste of water; how he made secret trips at night to headgates to prevent surreptitious diversions, and how he used the devious tactics of a fugitive from justice to prevent water users from knowing his whereabouts, so that he might drop upon

them unawares. Upon his cross examination (pp. 2515-16) he stated the amount of water used in 1909 and 1910 through a large number of Poudre Valley ditches, each with an appropriation in excess of 25 second feet, an amount supposed to be sufficient in Colorado for the irrigation of at least 2,000 acres of land, and it appeared that these ditches used as little as .59 acre feet per acre to as much as 7.94 acre feet per acre, a number of them using more than 3 acre feet per acre. As these amounts exceeded so greatly the duty of water in that valley as testified to by him and other witnesses, the defendants pursued the inquiry much further upon re-direct examination, and thereupon Mr. Armstrong said:

> "The B. H. Eaton Ditch has old decree and irrigates bottom land. It has excessive appropriation and appropriates all water that it has use for. They generally take all they care to run. I do not remember having shut the headgates of either of these canals during my life. It don't make any difference to me how much or how little they take. If they take more than they can use the surplus goes right back into the river and is available for other ditches below. There could be no actual waste in that regard." (p. 2522)

> "Ditches diverting water and applying it along banks of Cache la Poudre River, occurring between mouth of canal and diversion by Ogilvie

Ditch and which I used for irrigation of bottom lands, are Dry Creek Ditch, Whitney Ditch, B. H. Eaton Ditch, J. G. Coy Ditch, Josh Ames Ditch, Bristol No. 1 and No. 2 from Box Elder Creek, Burnham and Emerson Ditch from Long Pine Creek. Very little difference is made in flow of stream by allowing diversions to these canals, because if they take more water than they need on the land, it returns immediately to the stream and we get a great deal of that which they use. There are other small ditches taking water from branches of the Cache la Poudre River and noted on this table. Conditions are practically the same with relation to these.

"None of the ditches I have named are in any way to be compared with the larger canals such as Larimer County, Larimer and Weld, Greeley No. 2 and North Poudre system. The decrees of those smaller ditches are always excessive, more than they can possibly use. They are always entitled to water; whether they take more than they are entitled to or not is immaterial. For example, the John G. Coy Ditch has never been considered by me in carrying water down past the Larimer and Weld Canal. I regulate river at Larimer and Weld Canal to supply what I know is needed for larger ditches below that go out to irrigate land on plains. But in sending down amount required, I do not consider whether John G. Coy Ditch is irrigating or not. It makes no practical difference, and even if they are using water, the bulk of what they use goes back into river anyway and is available below for other ditches." (p. 2526-27)

"I presume the Poudre Valley prides itself on having the most efficient administration of the distribution of water and the most economical use of it of any part of the mountain region. I have very little knowledge as to the method of administration of use in other parts of the State, however.

"The smaller ditches in District No. 3 are mostly old ditches in the river bottom and having early priorities so that it is not necessary to give a great deal of supervision to their use of water. In my opinion it is not a matter of much difference whether they take more water than they have an absolute need for or not, for the water will return to the stream very quickly. This return is not only through the water flowing from the end of the ditch to the stream, but through the water which has been spread over the land seeping back to the river." (p. 2536)

"Among the ditches with early priorities and which do not materially affect the irrigation from the stream on account of seepage returned is the Dry Creek Ditch, irrigating about 2,300 acres. It is about 4½ miles long and carries water more than a mile distant from the river. Another such ditch is the Whitney Ditch which irrigates 3,500 acres, is four or five miles long, and the land irrigated may extend for a mile from the river. With a lateral at the end of the ditch it may be 7 miles long." (p. 2538)

Upon this same general subject Mr. Meeker testified as follows (pp. 4317-21):

"From my records and experience, the duty of water diverted from the Laramie River between the Pioneer Dam and Two Rivers Stations is approximately one acre foot per acre. This includes copious flooding of the meadow lands and irrigation of the pasture land adjacent to the river. If all the lands irrigated between these stations were included, the duty of water would be higher. I am familiar with the method of diverting, carrying and applying water in the Laramie Plains and also in Colorado. The irrigation on the bench lands of the Laramie Plains is very similar to the irrigation generally in Colorado, notably on the Gunnison, the South Platte and the North Platte Rivers, and the Arkansas, and other streams where native hay is raised in large quantities. I am familiar with the character of the diversion dams, headgates and other similar irrigation works in the Poudre Valley in Colorado, and those on the Laramie Plains, with the exception of some very small dams. The works on the Laramie Plains compare very favorably with those in the Poudre Valley in efficiency and with respect to waste of water, and those ditches which have temporary dams usually only require those for the late meadow irrigation or otherwise the dams would be more permanent in character. The temporary character of the dams does not result in a waste of water because there are large numbers of ditches below that have prior requirements to which water must be passed. Taking into consideration the entire system of ditches and reservoirs on the Laramie Plains and especially the

location and character of the Wheatland Reservoir No. 2, the net loss or waste of water resulting is no greater than in other irrigated areas generally and for the reason that the Wheatland Reservoir No. 2, which is a channel reservoir and has a large priority over many of the ditches above receives all the return flow of the river and its tributaries above that point and uses it, making it available for use on the Wheatland lands below, there being no corresponding condition in Poudre Valley, where water is more likely to be lost than in the Laramie Valley. The return flow from the irrigated lands along the Laramie River is very rapid."

The evidence in the case as above outlined clearly shows that the methods of use upon the Laramie Plains are identical with the methods of irrigation under similar circumstances in Colorado and other districts, and that it is not only the only practicable method applicable to irrigation for hay, the only crop which Colorado thinks can be raised upon the Laramie Plains, but is not in reality wasteful, the return of the surplus water to the river channel being rapid and proportionately large in volume. The strategic position of the Wheatland reservoir at the lower end of the Laramie Plains makes the methods of use in that district unusually efficient, for that channel reservoir catches and conserves the entire return flow, all seepage and all miscellaneous accessions of the

river. Theoretical testimony with respect to an ideal duty of water and the requirements of irrigation must yield to the fact; the entire flow of the river has for many years been utilized in Wyoming under a system which Colorado's greatest practical expert designates as non-wasteful. Surely we need not consider the difficult question of the probable amount of water necessary for the irrigation of a single acre, nor seek to arrive at an exact determination of the number of acres of land irrigated nor the number of acre feet of water flowing in the stream; we have shown that the actual requirements of the entire area call for the use of the entire flow of the stream.

In connection with its evidence relative to the waste of water upon the Laramie Plains, Colorado offered the testimony of its engineers, George P. Woodhall and John E. Field, concerning numerous ponds and lakes of waste water and saturated areas of waste lands. Mr. Woodhall (pp. 2741-50) mentioned in a general way a large number of such ponds without attempting to give the acreage of all of them. Mr. Field, however (p. 3569), stated that the area of such ponds and lakes as he had been able to tabulate aggregated over 6,000 acres, and that altogether there was probably as much as 10,000 acres of such water surface, the annual evaporation from which he estimated to be as much as six feet (p. 3754), but

fixed conservatively at five feet (p. 3575) making the total evaporation from these waste bodies of water as much as 30,000 acre feet per annum. He further estimated the acreage of the waste wet areas at 10,000 acres, from which he estimated an evaporation of another 30,000 acre feet per annum (p. 3575, p. 3641). He was unable to point out the location of such saturated areas, excepting that the principal one was a strip of land extending along both sides of the Pioneer Canal for about fifteen miles (p. 3754). The total annual evaporation from these waste lakes and saturated areas was thus ascertained to be about 60,000 acre feet, or more than the amount which the witnesses for Colorado testify can now be diverted through the Greeley-Poudre tunnel.

The natural inference from the testimony of Mr. Field and Mr. Woodhall relative to these waste ponds and lakes was that they were the result of an excessive and wasteful use of water and represented diversions from the Laramie River very largely in excess of the amount necessary for the irrigation of the land. Upon cross examination, however, Mr. Field produced a schedule of these lakes and ponds (p. 3644) aggregating 6379 acres, of which 3200 acres constituted Cooper Lake, a natural lake in the northwest part of the Laramie Plains region fed by Cooper and Dutton Creeks, and, as stated by Mr. Field, never a tributary

of the Laramie River. No part of this lake was due to the diversion of water from the Laramie River or from any other stream, but on the contrary, whatever irrigation development had taken place along Cooper and Dutton Creeks had to that degree affected the supply of this natural lake. Likewise 147 acres lay in Creighton Lake and 392 acres in Hutton Lake, connected with Creighton Lake, both of which are natural lakes with a water supply from Antelope and Sand Creeks, and both of which had been turned into reservoirs.

After Mr. Field had so testified, Mr. Meeker, on behalf of Wyoming, made a reconnaissance of the sections of the Laramie Plains which Mr. Field asserted were saturated waste land, and for the purpose of illustrating the inevitable occurrence of ponds and seeped areas even under the best irrigation practice, he made an examination of about one-third of the irrigated area of the Poudre Valley, and he testified as follows with respect to the situation in both districts:

> "I heard the testimony given by John E. Field, at Denver in relation to waste of water on Laramie Plains and recall roughly his testimony on that subject, applying to the area lying along the Pioneer Canal from a point south of Lake Hattie Reservoir to a point near Fraser's Ranch, taking in also the area in the neighborhood of

the Soda Lakes, and the area to the north of the Pioneer Canal as well as to the south. Since this testimony, I have examined anew this section of country with this testimony especially in view. I was also over that neighborhood at different times in 1912, 1913 and 1914 and became reasonably familiar with it. A recent examination of this area shows 261 acres of seeped waste land. That land is pretty well saturated with water and has alkali on it, produced no plant of value for stock feeding; should be classed as thoroughly waste; of the general character described by Mr. Field, except that he went a little further and said that it was practically barren. It supports alkali weeds and very small vegetation of no value.

"I also heard Mr. Field's testimony in regard to similar areas in the vicinity of the Bath and Alsop Lakes and the Little Laramie Valley, and have since made a particular examination of that region. Excluding land in the big basin not now covered but later in the season covered with water, I would say that in the vicinity of the Bath and Alsop ranches and through that portion of the country there is not to exceed 50 acres of seeped waste land. This region was examined on the 18th of May and the area under the Pioneer Canal on April 16th. Since Mr. Field's testimony, I have made a trip through the Poudre Valley in Colorado on April 20, 21, 22 and 23 by automobile for the purpose of examining the areas of seeped waste land and water surfaces, etc. I took note and platted on topographic sheets the larger areas encountered

of seeped waste lands, amounting to 1441 acres. I covered approximately 100,000 acres, about one-third of the irrigated lands in that valley. The seeped areas are very similar to those found on the Laramie Plains."

This testimony is generally corroborated by Mr. Sevison, who accompanied Mr. Meeker. (pp. 4203-4207).

With respect to the discrepancy between the testimony of the witnesses for the respective parties concerning the area of land under irrigation upon the Laramie Plains we have said that it is probably explained in large part by the obvious difficulty of a stranger in determining the limits of the lands upon which water is turned for the purpose of increasing the growth of native grasses; the discrepancy is further accounted for by the difference in the conclusions of witnesses as to the character of the land as just illustrated, for it is apparent that the unfavorable observers who made examination on behalf of the defendants concluded that land upon which comparatively little water had been used had not been irrigated, but where the land was thoroughly saturated by very recent irrigation they determined that it was a waste area.

Extension of Irrigation.

The record develops one other important element

of this case, the future irrigation development of this district. It is shown that irrigation development is always gradual and cannot be forced; that in Colorado, water rights are adjudicated for a definite amount of water, and as the owner of the right brings his lands under cultivation, fills up the subsoil, and establishes economies in the use of water he extends the use of that given quantity over additional areas or sells or rents to other land owners some portion of the water right, and so from year to year the area reclaimed expands and the ditch is extended from one piece to another, all without loss of priority. This method of development is discussed by Professor Carpenter, the Colorado expert, on pages 2314-2316. He states that in 1870 the Poudre River supplied water for the irrigation of about 10,000 acres, in 1880 perhaps 40,000 acres, in 1890 about 130,000 acres, and in 1913, 260,000 acres, and that the struggle between appropriators is much less now than twenty-five years ago. He explained how the land gradually became saturated and the water level raised, lessening the requirements of that particular land so that the same amount of water could be used over an enlarged area. Such likewise is the history of irrigation upon the Laramie River in Wyoming, although the process has necessarily been much slower, and the courts of Wyoming have recognized, as have the courts of all

other States, the right of the appropriator to take the necessary time for the complete reclamation of all of his land. In the Wheatland tract there are 57,000 acres, of which 33,000 acres are now under cultivation. At the time the testimony was taken only ten per cent. of the 10,000 acres in the Bordeaux tract had been reclaimed, and no irrigation had yet taken place upon the Sybille tract, both of these being natural extensions of the Wheatland system. The same is true upon the Laramie Plains, Mr. Field testifying (p. 3638) that but fifty per cent. of the land lying under the old constructed ditches was under irrigation in 1913, and in addition there were tens of thousands of acres of new land under the ditches of the Lake Hattie and James Lake projects.

The James Lake project derives its principal supply from the Little Laramie River, and covers 30,000 acres. The original surveys for the project were commenced on March 22, 1908, (p. 638) and the construction work upon the James Lake Reservoir, with a capacity of more than 40,000 acre feet, upon the outlet Canal, the North Canal, one of the main distributing canals thirty-two miles in length, and the South Canal, nine miles in length, in the same year, and all were completed by July, 1909 (p. 633). The supply ditch leading into the reservoir was completed to a point where it could be used in 1909, and finished in 1911.

The Lake Hattie project is larger, planned to cover 60,000 acres of land outside the original irrigated area (p. 649) but finally constructed to cover 43,100 acres under its North Canal, now completed, 37,760 acres under the Stewart Canal, substantially completed, and 31,360 acres under the High Line Canal, upon which work had not commenced in 1914. (p. 781). In view of the contention of Colorado that the Greeley-Poudre system is entitled to assert a priority of appropriation relating to the time of the vision of Wallis Link, despite the many years which passed before any real work was performed, it is interesting to note that the Lake Hattie system was constructed by the owners of the Pioneer Canal, and that their predecessors had had surveys made from time to time commencing in 1886, for a canal substantially identical in location with the Pioneer High Line Canal. In 1886 Loback and Bellamy made a reconnaissance of this line and in 1887 Loback ran a survey of it (p. 751). In 1893 Bellamy made a preliminary survey and commenced to set stakes for final location when the panic of that year stopped the work, but not before the company had put in a flume upon the Pioneer Canal large enough to carry the water of that canal and also the water of the proposed High Line. (p. 770-71). In 1897 and 1898 Roach and Owen again surveyed the line, but the company could not

finance the construction, and in August, 1906, Roach also surveyed a line of canal corresponding with the subsequently constructed North Canal of the Lake Hattie system. When Sevison made a survey preliminary to actual construction of the High Line Canal in 1908 he found the stakes of one of these old surveys and followed the line so marked very closely. These stakes, from their condition, he judged to be at least ten years old (p. 660). Finally, on April 16, 1908, new surveys were commenced which continued for more than a year, and the preliminary work having been accomplished, the definite location survey was commenced on May 1, 1909, the construction contract let on June 14, 1909, and actual construction begun on July 11, 1909 (p. 646). By July, 1910, the work of enlarging the Pioneer Canal from the capacity of 300 second feet to the capacity of 1200 second feet had been completed, Supply Canal No. 1 into Lake Hattie Reservoir was completed to within 2000 feet of its end, and earth-work of the dam completed, the North Canal finished to a point opposite Laramie City, the South Canal completed to a point where it was intended to cross the river (p. 648), and prior to December 1, 1910, $944,000.00 had been actually expended upon the system. The principal units of the system were in operation early in 1912, and in that year a large quantity of water was stored

in the reservoir, and in 1913 water was carried through the North Canal, the principal distributing canal, and land irrigated from it. At the time testimony with reference to this work was taken in October, 1913, $1,418,000.00 had been expended thereon.

It is not our purpose here to discuss any fine and close questions of technical priority between individual ditches, but to note that final surveys were made for these two new projects while only desultory work was being performed upon the Poudre River diversion works of the Colorado scheme; that the James Lake project was devised, surveyed and practically completed before the final plans of the Greeley-Poudre project were made, and before the contract had been made for the construction of the system; and that the preliminary and final surveys were completed, work actually commenced with diligence and with the expenditure of large sums upon the Lake Hattie system before the Greeley-Poudre construction contract was made in September, 1909.

And so the State of Wyoming, through its citizens, has been following the practice of all individual appropriators, has constructed and put in operation irrigation works covering vast areas, has already irrigated a portion of these lands, finding the use of all of the water in the stream necessary for that purpose, and as economies in the use of water are possible and

the development of the country justifies, it is extending the irrigated acreage. It has recognized as between its citizens this right to extend the use of water without loss of priority, and by the decrees of its courts, which have been offered in evidence, has adjudicated water rights prior in point of time to the year 1900 for more than 200,000 acres of land to be irrigated from the Laramie River, more than 48,000 acres to be irrigated from the Little Laramie River, more than 3,000 acres to be irrigated from Sand Creek, 2,000 acres to be irrigated from Willow Creek, 6,000 acres to be irrigated from Sybille Creek, and 3,700 acres to be irrigated from the North Laramie River. In the 200,000 acres for which water rights from the Laramie River under ditches constructed prior to 1900 were adjudicated, there are some duplications, but the net amount is in excess of 180,000 acres. The total of these adjudicated rights is more than 240,000 acres, and in addition are the 100,000 acres of land in the Lake Hattie system, the 30,000 acres in the James Lake system, and the 30,000 acres in the Sybille and Bordeaux units of the Wheatland district, a total of 400,000 acres now being irrigated and proposed to be irrigated in Wyoming under ditches far older than or at least contemporaneous with the Greeley-Poudre project. For all of this land being gradually brought to an increased state of productivity through the use of

Nor are defendants in better case under the rule of equitable distribution of the waters. This rule of equitable distribution is an administrative application of the doctrine of riparian rights and confines itself to lands within the watershed.

It would not be equitable distribution to permit the Poudre Valley to use the large flow of the Poudre, and then add waters from the Grand, and then add waters from the Michigan, and then add the waters heretofore taken from the Laramie, and now still further take from the Laramie for use in the Poudre Valley the further large quantity of water here threatened to be taken.

2. The General Doctrine of Prior Appropriation.

Whether this court shall deem it necessary here to adopt the doctrine of riparian rights or the doctrine of prior appropriation, the issues and the evidence furnish the means to deal out equity between the parties.

As is proper, in order that the court may have before it the entire situation the record as we have seen discloses the facts necessary for the determination of the rights of the parties under the riparian rights doctrine.

In like manner the record discloses the necessary

facts for applying the doctrine of prior appropriation. And among these facts the plaintiff alleges on the one side, and the defendants admit on the other, that in the region in controversy, "in accordance with the customs and usages of the people, recognized by the laws and decisions of the Courts of both Colorado and Wyoming, in all cases where prior rights to the contrary have not intervened it has been the custom to divert and apply the waters of the natural streams to supply the deficiency in the annual precipitation to cultivate the lands within the drainage basin of said streams and make the same productive. Under the said customs, usages, laws and decisions it has been established, enacted, held and decided in both States as to the waters of all streams and other sources of water supply where prior rights to the contrary have not intervened that such waters are open for a reasonable appropriation and use for irrigation purposes; that except as aforesaid priority of appropriation gives priority of right."

It may not be amiss, besides, to make brief reference to some of the declarations of the people and courts of Colorado, Wyoming and other States upon the question.

The Constitution of Colorado, Article XVI., Sections 5 and 6, contains this language:

"SEC. 5. The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the State, subject to appropriation as hereinafter provided."

"SEC. 6. The right to divert unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."

Many Colorado cases state and illustrate the same doctrine.

Coffin v. Left Hand Ditch Co., 6 Colo. 443.
Hammond v. Rose, 11 Colo. 524.
Schilling v. Rominger, 4 Colo. 100.
Wyatt v. Larimer etc. Irrigation Co., 1 Colo. App. 480.
Beaver Brook Reservoir Co. v. St. Vrain Reservoir Co., 6 Colo. App. 130.

The Constitution of Wyoming, Article VIII., Sections 1 and 3, are as follows:

"SECTION 1. The water of all natural streams, springs, lakes or other collections of still water,

within the boundaries of the State, are hereby declared to be the property of the State."

"SEC. 3. Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests."

The decisions in Wyoming further illustrate the same matter.

Farm Investment Co. v. Carpenter, 9 Wyo. 110.
Willey v. Decker, 11 Wyo. 496.

Similar decisions occur throughout the arid region.

Atchison v. Peterson, 1 Mont. 561.
Crane v. Winsor, 2 Utah 248.
Jones v. Adams, 19 Nev. 78.
Barnes v. Sabron, 10 Nev. 217.
Irwin v. Phillips, 5 Cal. 140.
Kidd v. Laird, 15 Cal. 161.
Sharp v. Hoffman, 79 Cal. 404.

3. In Colorado and Wyoming Simple Doctrine of Prior Appropriation Existed Prior to Their Constitutions.

The view and principle as adopted by the constitutions and statutes of Wyoming and of Colorado, and the customs of the people in these two States as disclosed and announced in the decisions of the courts in both States, reject the common law doctrine of riparian rights, and substitute instead the principle

that any and all unappropriated waters may be appropriated, and that, as stated in the constitution of both States, priority of appropriation shall give the better right. Indeed it is held in both States that this principle existed as the law of the region prior to the enactment of their constitutions.

> "The history of water rights in this State will show that the rights and principles declared in the constitution were recognized and acted upon by the people years before they were formulated and declared in that instrument; that such rights had their inception in the earliest attempt at agriculture, when it was found that climatic conditions demanded the artificial use of water to produce crops. The title of the public and the people to the water in the streams, and the right to divert and appropriate, were recognized and acted upon, the only requirement being an application to a beneficial use; and such rights to the use of water as between different consumers or users were established upon the broad equitable basis that preferences were to be controlled by the respective dates when the conflicting appropriations were made."
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> *Wyatt et al. v. Larimer & Weld Irrigation Co.*, 1 Colo. App. 480, 497, (29 Pac. 906).

"The common law doctrine relating to the rights of a riparian proprietor in the water of a natural stream, and the use thereof, is unsuited to our requirements and necessities, and never obtained in Wyoming. So much only of the

common law as may be applicable has been adopted in this jurisdiction. The doctrine invoked is inapplicable. A different principle better adapted to the material conditions of this region has been recognized. That principle, briefly stated, is that the right to the use of water for beneficial purposes depends upon a prior appropriation. Our statutes have repeatedly recognized this right, and the constitution of the State declares it. We incline strongly to the view expressed by the Supreme Court of Colorado, to the effect that such right and the obligation to protect it existed anterior to any legislation upon the subject."

Moyer v. Preston, 6 Wyo. 308, 318.

4. Doctrine of Prior Appropriation Strict and Exclusive.

Some confusion has occasionally arisen, and seems to us in this case to have been indulged by the defendants, because of a failure to measure the real doctrine of prior appropriation where it is substituted for the doctrine of riparian rights. When the arid region rejected the doctrine of riparian rights, it was not at all intended that the region should be without any rule as to the use of water. Indeed the customs of the people and the constitutions and laws and rulings of courts substituted a principle even more strict than the common law principle and doctrine of riparian rights. The prior appropriator under the one system

is even more rigidly and strictly protected than the lower riparian proprietor under the other system. In cases of drought and shortage of water, under the common law system the different riparian proprietors were each required to modify their uses of the water in proportion to its deficiency. This resulted from the view that all riparian owners were equal in right, and had an equal right to the customary flow of the water.

On the other hand, the doctrine of prior appropriation by its very expression and by the very rule that "priority of appropriation gives the better right" is exclusive.

> "As opposed to the correlative rights of the common law, whereby all riparian owners on the stream have equal rights, under the law of appropriation the rights of the claimants are unequal. Each has an exclusive right to the extent of his prior appropriation, and appropriations vary greatly in the extent of right appropriated. 'A party appropriating water has the *sole and exclusive* right to use the same for the purposes for which it was appropriated.' So long as the water is put to beneficial use, priority alone governs. Full protection is given to the prior appropriator against all later comers. This exclusiveness includes the right to tributaries and sources, even tributary percolating water so far as proof traces it as tributary, and also storm waters that are of annual occurrence. It is held:

'The prior appropriator of a particular quantity of water from a stream is entitled to the use of that water, or so much thereof as naturally flows in the stream, unimpaired and unaffected by any subsequent changes which, in the course of nature, may have been wrought. To the extent of his appropriation his supply will be measured by the waters naturally flowing in the stream and its tributaries above the head of his ditch, whether those waters be furnished by the usual rains or snows, by extraordinary rain or snow fall, or by springs or seepage which directly contribute.' It is said, 'The appropriator took the water with the right to have the stream flow as it was wont to flow,' which is as strict a statement as the '*aqua currit et debet currere ut currere solebat*' of riparian rights."

1 Wiel on Water Rights (3d Ed.) Section 279.

"But the prior appropriator of the waters of a certain stream has the right to insist that the water continue to flow as it did when he first made the appropriation, as far as the interference by other subsequent appropriators is concerned. 'The appropriator took the water with the right to have the stream flow as it was wont to flow' is the language of the law under the Arid Region Doctrine of appropriation, which is as strict a rule as that of the common law of riparian rights, *aqua currit et debet currere ut currere solebat.* He has also the right to insist on this flow and that no change be made in it by later comers to his material injury."

2 Kinney on Irrigation (2d Ed.) Sec. 801, page 1398.

"It is a recognized rule of law that a person who has appropriated water at a certain point in a stream is entitled to have so much of the waters of said stream as he has appropriated flow down to him to the point of his diversion."

Conant, et al. v. Deep Creek etc. Irr. Co., et al., (23 Utah 627), 66 Pac. 188, 190.

"The reasons which constitute the groundwork of the common law upon this subject remain undisturbed. The conditions to which we are called upon to apply them are changed, and not the rules themselves. The maxim, *sic utere tuo ut alienum non laedas*, upon which they are grounded, has lost none of its governing force; on the contrary, it remains now, and in the mining regions of this State, as operative a test of the lawful use of water as at any time in the past, or in any other country. When the law declares that a riparian proprietor is entitled to have the water of a stream flow in its natural channel *ubi currere solebat* without diminution or alteration, it does so because its flow imparts fertility to his land, and because water in its pure state is indispensable for domestic uses. But this rule is not applicable to miners and ditch-owners, simply because the conditions upon which it is founded do not exist in their case. They seek the water for a particular purpose, which is not only compatible with its diversion from its natural channel, but more frequently necessitates such diversion, and moreover does not require the water in a pure state in order to insure its reasonable and beneficial use. Yet the maxim above mentioned upon which the rule is founded

is equally as applicable to the ditch-owner and to the miner as to the riparian proprietor, and neither can so use the water as to injure or prejudice the prior rights to a like use by the other. This maxim is one which every riparian proprietor is bound to respect, and it is no less obligatory upon those who use and divert water for mining purposes. So that in all controversies like the present the question to be determined after all is the same as that presented by a like controversy between riparian proprietors, to-wit: has the plaintiff's use and enjoyment of the water *for the purposes for which he claims its use* been impaired by the acts of the defendant? This is purely a question of fact for the jury, and all the law applicable to it is found, as stated by the learned counsel for appellants, in the case of the Phoenix W. Co. v. Fletcher (23 Cal. 483), embraced in the three following maxims: *Qui prior est in tempore, potior est in jure; Ubi jus, ibi remedium; Sic utere tuo ut alienum non laedas*; and beyond these principles they do not require to be instructed. What diminution in quantity or what deterioration in quality will injuriously affect the use of the water by the plaintiff may be safely left to the determination of the jury, guided only by the foregoing maxims."

Hill v. Smith, 27 Cal. 476, 482.

"The right to the use of the running water (that is, the right to appropriate water on one's own land) is a corporeal hereditament; but the water when once appropriated includes and comprehends an incorporeal hereditament, to-wit,

the right to have the water flow in the stream, without diminution or deterioration, to the head of the ditch or place of diversion—an easement in the stream, and a servitude upon upper riparian lands."

Smith v. Deniff, (24 Mont. 20), 60 Pac. 398, 400.

"The prior appropriator is clearly entitled to protection against acts which materially diminish the quantity of water to which he is entitled, or deteriorate its quality, for the uses to which he wishes to apply it."

Phoenix Water Co. v. Fletcher, 23 Cal. 482, 487.

"The right acquired to water by an appropriator under our system is of the same character as that defined by the foregoing authorities as an incorporeal hereditament and easement. The consumer under a ditch possesses a like property. He is an appropriator from the natural stream, through the intermediate agency of the ditch, and has a right to have the quantity of water so appropriated flow in the natural stream, and through the ditch, for his use."

Wyatt v. Larimer & Weld Irrigation Co., 18 Colo. 298, (33 Pac. 144, 150.)

"The doctrine that the first appropriator has the superior right, 'where the right to the use of running water is based upon appropriation, and not upon an ownership in the soil,' has been recognized and acknowledged by the decisions

of this Court in Lobdell v. Simpson (2 Nev. 274), and the Ophir S. M. Co. v. Carpenter et al. (4 Nev. 534).

"The facts of this case do not call in question the correctness of the decision in Van Sickle v. Haines (7 Nev. 249), where the title to the land had been obtained from the government prior to the acts of Congress herein referred to.

"It logically follows from the legal principles we have announced that the plaintiff, as the first appropriator of the waters of Currant Creek, has the right to insist that the water flowing therein shall, during the irrigating season, be subject to his reasonable use and enjoyment to the full extent of his original appropriation and beneficial use."

Barnes v. Sabron, 10 Nev. 217, 233.

" 'That a valid appropriation of water from a natural stream constitutes an easement in the stream, and that such easement is an incorporeal hereditament, the appropriation being in perpetuity, cannot well be disputed.' He refers to the discussion of property in water by Washburn in his work on Easements and Servitudes (p. 276), and Angell on Water Courses (Sec. 141), and adds: 'The right acquired to water by an appropriator under our system is of the same character as that defined by the foregoing authorities as an incorporeal hereditament and easement. The consumer under a ditch possesses a like property. He is an appropriator from the natural stream, through the intermediate agency of the ditch, and has the right to have the quan-

tity of water so appropriated flow in the natural stream, and through the ditch for his use.' "

Willey v. Decker, 11 Wyo. 496, 544.

The Act of Congress of July 26, 1866, contains this language:

"Whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed."

Revised Statutes, Sec. 2339.
United States v. Rio Grande Dam etc. Co., 174 U. S. 704.

5. Effect of State Lines upon Rights of Appropriators.

The question of the effect of State lines upon the rights of appropriators in different States has been before the courts of the arid region in a number of cases, and so far as we have been able to find has always been decided in the same way. The universal holding is that priority of appropriation gives priority of right on interstate streams the same as on streams wholly within one State.

"We had occasion recently to consider whether the right of a citizen to use water within the State for irrigation of lands is granted by the State or general government, and we were unable to discover any principle of that kind. Mohl v. Lamar Canal Co. (C. C.) 128 Fed. 776. The idea of an exclusive right in the people of a State to divert its running waters to the injury of riparian owners in another State must be equally untenable. Indeed, the doctrine of riparian ownership and use of running water is not subject to political boundaries. Between hostile States the doctrine may not be recognized, but any such repudiation would be simple *vis major*. Between States dwelling in peace and concord, as are the States of our Union, the equal right of the inhabitants of each State to the waters of intersecting streams must always be recognized. Water is essential to human life in the same degree as light and air, and no bounds can be set to its use for supplying the natural wants of men other than the mighty barriers which the Creator has made on the face of the earth.

* * * * * * * * *

"It is enough that complainants and their grantors were in the possession and enjoyment of the water a long time prior to respondents' diversion, and therefore the first appropriators under the law of the land as understood in Wyoming and Colorado."

Hoge v. Eaton, et al., 135 Fed. 411, 414.

The above case was decided by the District Court of the United States for Colorado. The Judge

who sat was on the Supreme Bench of Colorado before the admission of that State into the Union, and became United States District Judge upon the admission. The case was reversed by the Court of Appeals (Eaton v. Hoge, 141 Fed. 64) but the reversal was upon another point and should not weaken the case as authority upon the point here under discussion.

> "It would seem, upon both reason and authority, that the courts of this State, in ascertaining, decreeing, and protecting property rights in water appropriations within the jurisdiction of the State, may at the same time and for that purpose inquire into and determine rights and priorities on the same stream that are located and situated beyond the State line, in order to fairly and finally judicially determine the relative rights of the parties and decree the extent of the title and right of possession of the thing or subject-matter within this jurisdiction. This proposition ought to be accorded a special recognition and application by the courts in water and irrigation litigation. Streams rise in one State and flow into another, irrespective of boundary lines, and still the rules and doctrines of priority of appropriation and use are the same in most of the arid States. This is particularly true with respect to this case. Here the riparian doctrine of the common law has been abrogated in both Idaho and Wyoming, and the rule of 'first in time is first in right' is recognized and enforced in both states. Drake v. Earhart, 2 Idaho, 750, 23 Pac. 541; Moyer v. Preston, 6 Wyo. 308,

44 Pac. 845, 71 Am. St. Rep. 914; Farm Investment Co. v. Carpenter, 9 Wyo. 110, 61 Pac. 258, 50 L. R. A. 747, 87 Am. St. Rep. 918; Willey v. Decker, supra. The relative rights, therefore, of appropriators of the water of an interstate stream are the same, whether the appropriations are all in the same State, or some in one State and the balance in another State. This proposition is accentuated in a case like this, where the court not only has jurisdiction of the res or subject-matter, but also obtains jurisdiction of the person of the defendant. In the case at bar the diversion by the defendants, being the act that causes the injury, takes place in Wyoming; but the injury itself that flows from the wrongful act takes place in this State. It has long been recognized as a general rule that, where an act is committed in one jurisdiction that occasions injury or damage in another jurisdiction, the injured person may elect to bring his action in either jurisdiction."

Taylor v. Hulett, 15 Ida. 265.

"It is a recognized rule of law that a person who has appropriated water at a certain point in a stream is entitled to have so much of the waters of said stream as he has appropriated flow down to him to the point of his diversion; and if the settlers higher up on the stream, in another State, whose appropriations are subsequent, divert any of the waters of the stream which have been so first appropriated, then the courts of the latter State will protect the first settler in his rights. Howell v. Johnson (C. C.) 89 Fed. 556. The Idaho courts, therefore, have ample

and complete jurisdiction to protect the rights of respondents to have the waters which they have appropriated, and which they divert in Utah, flow through the channel of the stream, and to limit and determine the rights of the Idaho appropriators with reference thereto; and by the decree entered in the suit in the district court of Oneida County, Idaho, such rights were fully protected, and may be enforced by proper proceedings in that court."

Conant v. Deep Creek etc. Co., 23 Utah 627.

"This court has stated that the statutory and constitutional declarations seemed rather to declare and confirm a principle already existing than to announce a new one, for the reason that under the rule permitting the acquisition of rights by appropriation the waters became perforce *publici juris*.

* * * * * * * * * * *

"The obvious meaning and effect of the expression that the water is the property of the public is that it is the property of the people as a whole. Whatever title, therefore, is held in and to such water resides in the sovereign as representative of the people. The public ownership, if any distinction is material, is rather that of sovereign than proprietor. (Farm Inv. Co. v. Carpenter, supra.) That ownership however, is subject to a particular trust or use, specially defined in the statutes and in the constitution. And that trust or use, in the absence of statute, is just as prominently and intrinsically attached to such public ownership. The waters are held

subject to appropriation for beneficial uses. And we have endeavored to show that the right of appropriation is not, in the absence of statute at least, restricted locally nor by state lines. The trust is to be considered as co-extensive with the right on which it rests. Upon the general principles governing such appropriation, we perceive no reason, if the same be not prohibited by statute, why the owner of lands in another State may not at a point in this State lawfully divert the water of a stream flowing in both States and conduct such water upon his lands for their irrigation, and thereby secure a valid water right. There is nothing in the essential character of the trust or use for which the waters are held by the public that, in our judgment, prevents the acquirement of a water right on such stream in that manner, provided the appropriator is able to comply with the statutory provisions regulating and controlling the appropriation and diversion of the public waters.

"Moreover, a desirable comity between the States within whose respective dominions the same stream may flow, and a due regard by each for the rights of the residents and land owners in the adjoining State, would seem to require a liberal view of this matter. In an interesting case in Wisconsin, where the question arose whether the State could constitutionally sell the ice formed upon public waters, it was held that where the term 'people of the State' is used to designate the beneficiaries of the trust in navigable waters, all the people who may choose to enjoy the same within the State are referred to,

whether citizens of the State or persons who came within its territory, for the purpose of enjoying such public rights. (Rossmiller v. State, 114 Wis., 169.)"

Willey, et al., v. Decker, et al., 11 Wyo. 496, 533.

Farm Investment Co. v. Carpenter, 9 Wyo. 110.

The case of Howell v. Johnson (C. C. Mont.) 89 Fed. 556, involved a question between Wyoming lands and Montana lands, each party claiming appropriations from a non-navigable interstate stream. The contention was made that the Wyoming citizens owning the Wyoming lands could not maintain the action in Montana because the State of Montana owned the waters in that State. This contention was overruled by the Court, which held that the rights must be determined without reference to State lines.

In the case of Anderson v. Bassman, (C. C. Cal.) 140 Fed. 14, the same question arose between land-owners in California and land-owners in Nevada, each claiming as an appropriator of water from the same non-navigable interstate stream. The Court quotes from the cases of Howell v. Johnson and Hoge v. Eaton, supra, and endorses the views expressed in those cases, saying:

"This court is in entire accord with the views of these two Courts upon this question."

In the case of Morris v. Bean, (C. C. Mont.) 123 Fed. 618, the Court was considering the relative rights of Wyoming and Montana appropriators from the same interstate stream, and held that the prior appropriator is protected in his right "as against subsequent appropriators although the latter withdraw the water within the limits of a different State."

The final hearing of the case was in the same Circuit Court, but before a different Judge.

The contention was again made at the final hearing that an appropriator in Wyoming could not in a court in Montana assert rights as against an appropriator in Montana. The Court overruled this contention, announcing, among other things, the following:

> "In the early stages of this suit Judge Knowles refused to sustain the views thus presented by the defendants. Whether the ruling made is the law of this case does not become material, because the reasons which actuated him in his decision are not only based upon sound principles, but are sustainable upon authority. No case has been cited where the distinction sought to be drawn has prevailed in the courts, but, on the contrary, apparently, wherever the question has arisen the holding has been the other way."
>
> *Morris v. Bean*, 146 Fed. 423.

The case last above cited went to the United States Circuit Court of Appeals for the Ninth Circuit

and was there affirmed, the Court saying, among other things:

> "The right to divert or appropriate for a useful purpose the waters of a non-navigable stream is recognized by the laws of Montana and Wyoming, and by sections 2339 and 2340 of the Revised Statutes (U. S. Comp. St. 1901, p. 1437); and the broad principle which underlies the relative rights of appropriators from the same stream is, that whoever is first in time is first in right, and the fact that the stream, the waters of which are appropriated, is interstate and non-navigable, does not affect the rule."
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> *Bean v. Morris*, 159 Fed. 651, 655.

A similar question arose in the case of Miller, et al., v. Rickey, et al., (C. C.) 127 Fed. 573. On appeal, the Circuit Court of Appeals for the Ninth Circuit used the following language:

> "The water in the stream, which has a propensity to seek its level, and will continue in its current to the sea, is in strict reality the veritable thing in controversy. It knows not imaginary State or county lines, and is a thing in which no man has a property until captured to be applied to a beneficial use. The right of appropriation is recognized in law, which means the right of diversion and use. It is the right, not to any specific water, but to some definite quantity of that which may at the time be running in the stream. So the right acquired by an appropriation includes the right to have the water

flow in the stream to the point of diversion. The fact of a State line intersecting the stream does not, within itself, impinge upon the right. In other words, the appropriation may still be acquired although the stream is interstate and not local to one State; nor will the mere fact that the stream has its source in one State authorize a diversion of all the water thereof as against an earlier and prior appropriator across the line in another State. On the contrary, one who has acquired a right to the water of a stream by prior appropriation, in accordance with the laws of the State where made, is protected in such right as against subsequent appropriators, though the latter withdrew the water within the limits of a different State."

Rickey Land & Cattle Co. v. Miller, et al., (C. C. A. 9th Cir.) 152 Fed. 11, 17.

The question has been somewhat involved in several cases before this court, but perhaps not clearly or definitely decided.

In the case of Kansas v. Colorado, 185 U. S. 125, and 206 U. S. 46, two sovereign States were litigating as to the waters of the Arkansas River. In that case the State of Colorado claimed the "paramount right to the exclusive use of the water of her natural streams in so far as her necessities require the use of such waters for beneficial purposes within the State." The opinion of the court *arguendo* at least takes strong grounds against the doctrine claimed,

and the general spirit of the decision seems to be against that contention. Besides in that case the court makes use of the following language:

> "Colorado could not be upheld in appropriating the entire flow of the Arkansas River, on the ground that it is willing to give, and does give, to Kansas something else which may be considered of equal value." (206 U. S. 100.)

And at another place in that case this Court said:

> "At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes." (Page 117.)

In another case this Court uses the following language:

> "It is conceivable, to be sure, that the decisions of this court may determine that the States have rights as against each other *in invitum* in streams that flow through the land of both. Kansas v. Colorado, 206 U. S. 46, 84. Missouri v. Illinois, 200 U. S. 496, 519, 520. These rights may vary according to the system of law required by natural conditions. They may be more or less analogous to common law rights between upper and lower proprietors, where irrigation

is not necessary, as in most of the older States. See New York v. Pine, 185 U. S. 93, 96. There may be some, perhaps limited, right of appropriation in the upper State, at least in the watershed of the stream, where irrigation is the condition of using the land. See Kansas v. Colorado, 206 U. S. 46, 100-104, 117. But whatever this court may decide, if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his State, and those rights, the petitioner insists, can, or at least should be, determined only in a suit brought by the State itself.

* * * * * * * * *

"We are of opinion that the petitioner fails to establish the conclusion for which it contends. The alleged rights of Miller and Lux involve a relation between parcels of land that cannot be brought within the same jurisdiction. This relation depends as well upon the permission of the laws of Nevada as upon the compulsion of the laws of California. It is true that the acts necessary to enforce it must be done in California and require the assent of that State so far as this court does not decide that they may be demanded as a consequence of whatever right, if any, it may attribute to Nevada. But, leaving the latter possibility on one side, if California recognizes private rights that cross the border line, the analogies are in favor of allowing them to be enforced within the jurisdiction of either party to the joint arrangement."

Rickey Land & Cattle Co. v. Miller & Lux, 218 U. S. 258.

And in still another case this Court uses this language:

> "We know no reason to doubt, and we assume, that, subject to such rights as the lower State might be decided by this court to have, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that State. Kansas v. Colorado, 206 U. S. 46, 93-95. Therefore, subject to the same qualifications, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. Missouri v. Illinois, 200 U. S. 496, 521. Rickey Land & Cattle Co. v. Müller & Lux, 218 U. S. 258, 260. But with regard to such rights as came into question in the older States, we believe that it always was assumed, in the absence of legislation to the contrary, that the States were willing to ignore boundaries, and allowed the same rights to be acquired from outside the State that could be acquired from within. Mannville Co. v. Worcester, 138 Massachusetts, 89. Thayer v. Brooks, 17 Ohio, 489. Slack v. Walcott, 3 Mason, 508, 516. Stillman v. White Rock Manuf. Co., 3 Woodb. & M. 538. Rundle v. Delaware & Raritan Canal Co., 1 Wall. Jr. 275, 14 How. 80. Foot v. Edwards, 2 Blatchf. 310. See Wooster v. Great Falls Manuf. Co., 5 Maine, 246, 253, Armendiaz v. Stillman, 54 Texas, 623; State v. Lord, 16 N. H. 357. Howard v. Ingersoll, 17

Alabama, 780, 793. There is even stronger reason for the same assumption here. Montana cannot be presumed to be intent on suicide, and there are as many if not more cases in which it would lose as there are in which it would gain, if it invoked a trial of strength with its neighbors. In this very instance, as has been said, the Big Horn, after it has received the waters of Sage Creek, flows back into that State. But this is the least consideration. The doctrine of appropriation has prevailed in these regions probably from the first moment they knew of any law, and has continued since they became territory of the United States. It was recognized by the statutes of the United States, while Montana and Wyoming were such territory, Rev. Stat., Secs. 2339, 2340, p. 429, Act of March 3, 1877, c. 107, 19 Stat. 377, and is recognized by both States now. Before the State lines were drawn of course the principle prevailed between the lands that were destined to be thus artificially divided. Indeed, Morris had made his appropriation before either State was admitted to the Union. The only reasonable presumption is that the States upon their incorporation continued the system that had prevailed theretofore, and made no changes other than those necessarily implied or expressed. See Willey v. Decker, 11 Wyoming, 496; Smith v. Deniff, 24 Montana, 20."

Bean v. Morris, 221 U. S. 485.

"The rights of the respective States and of the citizens thereof in and to the use of waters

of an interstate stream depend somewhat upon the laws of those States governing waters. If the common law is the only law of waters governing two adjoining States through which an interstate river flows, or if both States have adopted the Arid Region Doctrine of appropriation, the right to the use of the waters of an interstate stream is not affected by the boundary line which divides the States. But where there is conflict of the laws relative to the subject of water, that is to say, the lower State upon the stream having only the common law of riparian rights, and the upper State having adopted the Arid Region Doctrine of appropriation, the rule is different, and will be discussed in a subsequent section of this chapter.

"The rights as between appropriators of the waters of an interstate stream are not affected by the boundary line between the two States. As was said by a Wyoming case: 'The separation of lands capable of irrigation from such streams is of no consequence.' As was said in a recent Idaho case, 'The relative rights, therefore, of appropriators of waters of an interstate stream are the same, whether the appropriations are all in the same State or some in one State and the balance in another State.' 'The right to divert running waters for irrigating lands in an arid country is not controlled or affected by political divisions. It is the same in all States through which the streams may pass.' "

3 Kinney on Irrigation, (2d Ed.) Sec. 1225, page 2216.

The case of Kansas vs. Colorado is perhaps

the only case which has been before this court in which the rights pertaining to the States as such, in distinction from the rights of the citizens of different States, with respect to the use of waters of interstate streams for irrigation, have received consideration. Indeed no other court could entertain a controversy over this subject or authoritatively dispose of such controversy.

> "It is recognized that the State as quasi-sovereign and representative of the interests of the public has a standing in court to protect the atmosphere, the water, and the forests within its territory irrespective of the assent or dissent of private owners of the land most immediately concerned."
>
> *Hudson Water Co. v. McCarter*, 209 U. S. 349, 355.
> *Georgia v. Tenn. Copper Co.*, 206 U. S. 237.
> *Kansas v. Colorado*, 206 U. S. 99.

It was pointed out in the Kansas-Colorado case that there was no written law, nor, under the constitution, any legislative power, to furnish a rule by which such controversy could be determined; but that the power (and of course the corresponding duty) rested upon this court, as the general reservoir of the judicial power of the United States, to furnish such rule, (206 U. S. 95).

Naturally the court in exercising this power will

have regard for the natural laws peculiar to the subject and the common experience of mankind, especially as such experience is embodied in the systems of law which, through the ages, have been established to deal with a subject which is not local or temporary but universal and lasting in its nature.

Climatic and other physical conditions vary greatly in the different regions of the earth, and social conditions, if not physical conditions, change profoundly from age to age as well as with change of place.

One cannot obtain a just and comprehensive view of the rights and relations of different riparian owners merely from observation of the local or particular customs prevailing in any one place or at any one time. Ephemeral conditions or circumstances may seem important, and they do influence largely the actual conduct of men. The controversy before the court in this case, however, is merely a small, concrete part of a question of wide range and scope, which presents a certain solidarity not to be lost sight of in disposing of a single law suit. The question presented to-day between Wyoming and Colorado will to-morrow arise between Wyoming and Nebraska, or between Colorado and Nebraska, between Montana and one or both of the Dakotas, between Idaho on the one hand and Washington or Oregon on the other hand, between Colorado and Utah on one side and

Arizona or California on the other. Indeed there is no reasonable limit which can be set to the locations or circumstances and conditions under which water rights may be brought in controversy between different States or the citizens of different States, thus bringing into direct conflict opposing or varying State policies.

Wyoming and Colorado on the upper reaches of the great rivers, at the crest of the continent, may not be early called upon to consider seriously riparian rights; but the communities of the east as well as those of the extreme west have had to consider such rights most seriously, to test the different doctrines in a variety of circumstances, and to choose that which seemed best to promote the general welfare. The States bordering on the Pacific, as well as those along the Missouri River and other streams to the east, generally recognize the doctrine of prior appropriation of water, if at all, only in subordination to the doctrine of riparian rights. This court will unquestionably be called upon often and urgently to reconcile these two doctrines or at least make it possible for them to dwell in harmony in the neighboring States of a common country. Therefore, it is important that the court in the present case should consider the question in its larger aspects, since it is unthinkable that a rule of interstate relations can be established

and maintained between Colorado and Wyoming which is opposed to, or materially different from, the rule determining such relations between Wyoming and Nebraska. Streams which rise in Colorado flow through Wyoming into Nebraska. It would establish chaos rather than order to apply one rule between Colorado and Wyoming and a different or inconsistent rule between Wyoming and Nebraska respecting their several rights to the integral flow of the North Platte River or the Laramie River.

We feel bound to concede that the common law doctrine of riparian rights is substantially a world doctrine which has persisted throughout historical times. It was the Roman law, as appears from the Pandects of Justinian; it is the modern French law, embodied in the Code Napoleon (article 644); it was the Spanish law, or at least the Mexican law at the time of the acquisition of our Mexican territory (1 Wiel on Water Rights 68, 685, 1026); and of course it has been the law of English speaking countries from time immemorial. Irrigation has been practiced beyond memory in all of these jurisdictions under conditions where it seemed to be a required or natural use. Therefore, it would seem to be axiomatic that the use of water for irrigation is not necessarily inconsistent with the doctrine of riparian rights.

Yet it has often been said by the courts of certain

States in the arid regions (including those of Wyoming and Colorado) that the doctrine of riparian rights cannot co-exist with the doctrine of appropriation and has been abrogated by the latter, wherever established by custom or by written laws. The question, therefore, recurs and persists whether there is room in a single country at the same time for the two doctrines—whether they can be reconciled and brought into harmonious relation through the functions of this court in disposing of interstate controversies. It may not, and probably will not, be found necessary in this case to settle or determine the controlling principles of interstate water rights. We are simply suggesting that the elements of the present controversy are an inseparable part of the question in its larger and final form.

In the present case, as we have already pointed out, Colorado and her citizens are not regulating their conduct by either of the two doctrines referred to. Having exercised all the rights of riparian ownership and also their rights of appropriation to a point near the limit of supply in the valley of the Poudre River itself, and having helped themselves somewhat liberally in previous years to supplies from neighboring streams, they now propose to seize a third or a half of the supply of another watershed, scuttle its basin and divert the flow from those who have the highest

natural and moral, as well as legal right, to supply their own necessities within the valley of the Laramie. Many instances were testified to by Professor Carpenter, who testified for Colorado, where diversions had been made in various quarters of the world from one watershed to another; but with one exception presently to be mentioned, no objection was known to have been raised and no injury was known to have been sustained by reason of such diversions. Under the riparian doctrine we have been able to find but a single case which can be taken even on trust as authority for such an act. In the case of Jones vs. Conn. 39 Ore. 30, 64 Pac. 855, it appeared that an appropriator had led water from the stream to the opposite side of a bluff, whence the seepage would not return to the parent stream. It did not appear that the water was actually diverted into another watershed. This was held to be a permissible use as against the riparian owners. On the other hand it seems to be thoroughly well established that such conduct is not consistent with the rights of riparian proprietors where such rights are recognized, and that lands beyond the watershed are not riparian to the stream.

1 Wiel on Water Rights (Third Edition) p. 849.

1 Kinney on Irrigation, p. 782.

2 Farnham on Waters 1572, 3 Id. 1903.

Wiggins vs. Water Co., 113 Cal. 182, 45 Pac. p. 160.
Bathgate vs. Irvine, 125 Cal. 135, 58 Pac. p. 442.
Southern Cal. Inv. Co. vs. Wilshire, 144 Cal. 68.
Anaheim Union Water Co. vs. Fuller, 150 Cal. 327, 88 Pac. 978, 980.
Clark vs. Allaman, 71 Kans. 206, 80 Pac. 571, 585.
Watkins Land Co. vs. Clements, 98 Tex. Civ. App. 578.
Matagorda Canal Co. vs. Markham Irr. Co., ...Tex. Civ. App.....154 S. W. 1176.
McCarter vs. Hudson Water Co., 70 N. J. E. 695, 65 A. 489, 494.

For the most part the cases cited were decided by courts of States where the right of prior appropriation is recognized but in subordination to riparian rights. Apparently the underlying physical or natural reason of these decisions is the fact that water diverted beyond the watershed does not return in whole or in part to the parent stream as it does when used within the watershed. The obligation to return surplus water is very generally established in the arid States by statute or the decisions of courts.

1 Wiel on Water Rights 282.
Hutchinson vs. Watson Ditch Co., 16 Ida. 484.

Colorado alone seems to have dissented from this rule.

Coffin vs. Left Hand Ditch Co., 6 Colo. 443.

Even there it is not permitted to change the use, under an appropriation once established, so that the surplus water will not return to the stream.

Ft. Collins M. & E. Co. vs. Larimer & Weld Irr. Co., . . .Colo. . . . . 156 Pac. 140, 143.

Conceding this to be the domestic rule established in Colorado such rule cannot, as was said by this court in the Kansas-Colorado case, be imposed upon other States.

Each watershed has a natural unity and sanctity of its own. There can be no equitable division of its waters between lands or inhabitants within the watershed and those located in other watersheds, which does not recognize the laws of nature and the natural preference which is inherent in the lands and people of the valley. The taking away of surplus waters which the inhabitants do not need and cannot use would perhaps be *damnum absque injuria.* Colorado again pays tribute to the natural integrity of a watershed by certain constitutional provisions preferring certain natural uses of riparian owners to the right to deplete the stream by appropriation. Under Section 6 of Article 16 of the State Constitution, declaring such preferences, the Supreme Court of Colorado has said:

> "*The use protected by the constitutions is such as the riparian owner has at common law to take*

water for himself, his family, or his stock and the like."

Montrose Canal Co. vs. Loutsenhizer Ditch Co., 23 Colo. 233.

Another inherent limitation upon the use of running streams is expressed in the general agreement that "Neither sovereign nor subject can acquire anything more than a mere usufructuary right therein."

Sweet vs. Syracuse, 129 N. Y. 335.

And this proposition holds good equally under the riparian doctrine and under the appropriation doctrine.

1 Wiel on Water Rights 18.
Kidd vs. Laird, 15 Cal. 162.

Being a usufructuary right rather than a right of absolute dominion it follows that an appropriator no more than a riparian owner can divert water from a stream arbitrarily or without putting it to use, but in doing so he takes the water, as it were, upon trust to apply it to a beneficiary use recognized by the law, and to return all that is not needed for such use. This he may well do where the water is not withdrawn from the watershed; when that is done it is beyond his power to return it and the mischief of an over-diversion is irremediable.

It would be interesting to discuss the historical development of the doctrine of appropriation, but

this would be impracticable within the limits of this brief. We content ourselves with a summary of the discussion found in the works of a philosophical and accurate writer of authority on this subject. In the third edition of his work on Water Rights, Mr. Wiel shows in a very clear and comprehensive way that the doctrine of appropriation, as it is recognized in the arid regions of the western States, had its origin among the miners of California where the custom grew up to divert the water of the mountain streams for the purposes of hydraulic mining—a use which did not consume the substance of the water, though it often impaired its quality—and which was determined as to its location by the presence of gold bearing deposits.

When this practice attained a growth and prevalence which demanded legislative recognition, both at the hands of the States and in Congress, the expression of these customs in the statutes was found generally in legislation defining mining rights, though in the case of the Act of Congress it comprehended "mining, agriculture, manufacturing, or other purposes", (R. S. U. S. 2339, A. C. July 26, 1866).

Thus it came about that mining customs with respect to the use of water became applicable to its use by irrigators, and many courts in defining these customs have applied them indiscriminately without

taking into consideration their origin or the essential differences between the two diverse uses.

1 Wiel on Water Rights 66-122.

The pioneer case in this court also discusses the origin and development of these customs in an illuminating way and applies them with a more discriminating understanding to rights of appropriation for the purposes of irrigation.

Speaking of the "paramount right" of the prior appropriator (where there were no riparian rights involved) it was said that such right was to be "exercised within reasonable limits, for this right to water, like the right to prior occupancy of mining ground, or agricultural land, is not unrestricted. It must be exercised with reference to the general condition of the country and the necessities of the people and not so as to deprive a whole neighborhood or community of its use and vest an absolute monopoly in a single individual."

Basey vs. Gallagher, 20 Wall. 670.

The courts of California, where the doctrine of appropriation originated, in the manner already shown, might perhaps have been expected to deal with the subject, in the development of water law, with the intelligence born of familiarity with the actual conditions out of which the customs grew into law. In

that State the courts harbored no delusion on the subject of the inherent strength and wide prevalence of the doctrine of riparian rights. It was never thought in California that the necessity of extending the use of water in arid regions called for the subversion or the destruction of this doctrine; and in the case of Lux vs. Haggin, 69 Cal. 255, and subsequent cases, that doctrine has been emphatically declared and perpetuated alongside, and in greater or less harmony with, the doctrine of appropriation. The other Pacific States have generally followed this policy.

On the other side of the Rocky Mountains will be found either a want of coherent doctrines, an avoidance of determination or a more or less curious mixture of the two doctrines, as illustrated in the following cases:

Winters vs. U. S., 143 F. 740, 749; 207 U. S. 564, 578.
Bigelow vs. Draper, 6 N. D. 152.
Lone Tree Ditch Co. vs. Cyclone Ditch Co., 15 S. D. 519, 26 S. D. 307.
Sturr vs. Beck, 133 U. S. 541.
Crawford Co. vs. Hathaway, 60 Neb. 754; 67 Neb. 325.
Clark vs. Allaman, 71 Kan. 206.
Barrett vs. Metcalf, 12 Tex. Civ. App. 247.
Hall vs. Carter, 33 Tex. Civ. App. 230 and other cases;

so that from Montana to Texas, the States of this region have shown a tendency to maintain

with greater or less modification, both doctrines concurrently. It is only in the States lying along the crest of the mountains that we find the extreme views already referred to, announced by the courts, that the doctrine of appropriation has superseded and destroyed the doctrine of riparian rights.

At page five of the Bill of Complaint can be found a reference to the derivation of the territory including the Laramie Valley in Wyoming from the territory of Dakota. This fact gives to the doctrines of North and South Dakota and the discussion of the subject in the case of Sturr vs. Beck, supra, special significance. In the transition from Dakota to Wyoming the settlers in the Laramie Valley of course took with them whatever rights had accrued and become vested under the Dakota laws.

6. The Contention that Colorado as a Sovereign State may do as she will with Waters Found within her Boundaries Regardless of Resulting Injuries to Others.

(a) In presenting a demurrer to the petition in this case, the defendant, The State of Colorado, contended that as a sovereign it is not bound to recognize any rights to waters in controversy in favor of the plaintiff or its citizens, contending that as an absolute sovereign within its own limits it has the right to

avail itself, without restriction, of everything found within its boundaries, answering to no one for the use it may make of whatever it finds there. In support of this contention, the defendant, The State of Colorado, cited an opinion by Judson Harmon, Attorney General of the United States, given in 1895. (Opinions of the Attorneys General, Vol. 21, page 274,) and also cited the case of Hilton v. Guyot, 159 U. S. 113.

It is true that Mr. Harmon, as Attorney General, in the opinion cited, used this language:

> "The case presented is a novel one. Whether the circumstances make it possible or proper to take any action from considerations of comity, is a question which does not pertain to this Department; but that question should be decided as one of policy only, because, in my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States."

If by the word "novel" the Attorney General intended to say that the question was one of first impression, he was apparently, to some extent at least, in error. On June 12, 1880, Mr. Evarts, as Secretary of State, enclosed to the United States Legation in Mexico certain complaints from citizens of Texas living on the Rio Grande. These complaints were to the effect that certain Mexicans in Mexico were in the habit of diverting the waters of the Rio Grande

into their ditches, thereby preventing the complainants from obtaining water for the irrigation of their crops.

> "This", said Mr. Evarts, "if true, would be in direct opposition to the recognized rights of riparian owners, and, if persisted in, must result in disaster and ruin to our farming population on the line of the Rio Grande, and might eventually, if not amicably adjusted through the medium of diplomatic intervention, be productive of constant strife and breaches of the peace between the inhabitants of either shore."
>
> 1 Moore's Dig. Int. L. 653.

It is worthy of notice that the complaints made by the Mexican Minister concerning which the opinion of Mr. Attorney General Harmon was written, continued in one form or another for many years after 1895. They resulted in an action brought by the Attorney General of the United States in the District Court of the Third Judicial District of New Mexico against the Rio Grande Dam & Irrigation Company on May 24, 1897. That case reached this Court, and is found as United States v. Rio Grande Dam & Irrigation Company, 174 U. S. 690. The complaint still persisted, and resulted in a special treaty confined to the distribution of the waters of the Rio Grande. In that treaty between the United States and Mexico, the United States agreed, without expense to Mexico,

to furnish and deliver to Mexico 60,000 acre feet of water annually. Mexico agreed on its part in consideration of the delivery of the water above stated, to waive any and all claims to the waters of the Rio Grande between the head of the Mexican Canal and Fort Quitman, Texas, and also declared fully settled and disposed of and waived "all claims heretofore asserted or existing, or that may hereafter arise, or be asserted, against the United States on account of any damages alleged to have been sustained by the owners of land in Mexico, by reason of the diversion by citizens of the United States of waters of the Rio Grande." (34 Statutes at Large, Part 3, Page 2953.)

It is true that the United States in that treaty stipulated that it did not concede any basis for the claims asserted by Mexico, nor concede the establishment of any general principle or precedent by the concluding of the treaty.

(b) In our view, the cases above cited, where courts of the arid region uniformly have disregarded State boundaries in determining questions of right in and to the waters of interstate streams, are strong authorities in point against the contention of Colorado. It would indeed be an anomaly if on an interstate stream the private citizen in one State in a court of justice could sustain his right against a citizen of the

upper riparian State, while the State might not in behalf of numerous of its citizens in like case as *parens patriae*, trustee, guardian, or representative be able to enforce the same rights.

Colorado, as well as Wyoming, has uniformly held that as between individuals no upper riparian proprietor has any right to divert waters from the stream if such diversion shall deprive a lower appropriator from the stream of any portion of the water to which he is entitled. The holding is that the lower appropriator by being prior in time acquires not only a moral right but a right of such force and quality as to be available in a court of equity against the upper riparian proprietor who attempts by later appropriation to deprive the prior appropriator of any portion of his water. The holding of both of these States, and of other States in the arid region, is that the inherent principles of equity require the recognition of the rights of the prior appropriator as of full force, and that the upper riparian proprietor has no right, either growing out of his position as upper proprietor or otherwise, to diminish the flow required by the prior appropriations of the lower proprietor. The fact that he finds the waters on his premises gives him no right whatever to invade the strong equitable, and indeed legal right, which all of the arid States insist has been acquired by the prior appropriation,

and every court that has been required to pass upon the question holds that the interposition of a State boundary in nowise affects the validity of these private rights.

If it is equitable as between individuals that the prior appropriator shall be prior in right, it is difficult to see why the equity should not be the same if the two proprietors happen to be States instead of individuals. Shall not a State also do equity?

(c) Colorado and Wyoming were a part of the public domain, with no State boundary between them, at a time when, according to the decisions of both States, the doctrine of prior appropriation was in force here. Neither State had been admitted into the Union when Congress enacted the law of 1866. Indeed many of the prior appropriations made in Wyoming from the stream in controversy, as shown by the evidence here, were made when no State boundary had been interposed between the source and the mouth of the Laramie River. The language of this Court in the case of Bean v. Morris, 221 U. S. 485, is applicable here. In that case this Court said:

> "The doctrine of appropriation has prevailed in these regions probably from the first moment that they knew of any law, and has continued since they became territory of the United States. It was recognized by the statutes of the United

States, while Montana and Wyoming were such territory, and is recognized by both States now. Before the State lines were drawn of course the principle prevailed between the lands that were destined to be thus artificially divided. Indeed, Morris had made his appropriation before either State was admitted to the Union. The only reasonable presumption is that the States upon their incorporation continued the system that had prevailed theretofore, and made no changes other than those necessarily implied or expressed."

In the case of Bean v. Morris last above cited, this Court used this further language:

"But with regard to such rights as came into question in the older States, we believe that it always was assumed, in the absence of legislation to the contrary, that the States were willing to ignore boundaries, and allowed the same rights to be acquired from outside the State that could be acquired from within." Citing, Mannville Co. v. Worcester, 138 Massachusetts, 89. Thayer v. Brooks, 17 Ohio, 489. Slack v. Walcott, 3 Mason, 508, 516. Stillman v. White Rock Manuf. Co., 3 Woodb. & M. 538. Rundle v. Delaware & Raritan Canal Co., 1 Wall. Jr. 275, 14 How. 80. Foot v. Edwards, 3 Blatchf. 310. Wooster v. Great Falls Manuf. Co., 39 Maine, 246, 253. Armendiaz v. Stillman, 54 Texas, 623; State v. Lord, 16 N. H. 357. Howard v. Ingersoll, 17 Alabama, 780, 793.

(d) The decisions of this Court in the case of

Kansas v. Colorado, seem to us to go far towards denying the defense that Colorado attempts to make in this case through its alleged rights as a sovereign State. In passing on the demurrer in that case, the Court considers, first, the question whether the cause of action presented there was of a justiciable nature. This discussion arose upon a claim there made on behalf of Colorado on the ground of its sovereignty identical with the claim here. This court, after reviewing a number of earlier decisions of the Court on the question of controversies between States, used this language:

> "Applying the principles settled in previous cases, we have no special difficulty with the bare question whether facts might not exist which would justify our interposition."
>
> *Kansas v. Colorado*, 185 U. S. 125, 144.

In the decision of that case on the merits, while the State of Kansas was denied relief upon the facts, the Court uses this language:

> "It is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes."
>
> *Kansas v. Colorado*, 206 U. S. 46, 117.

The defendants have sought to weave into a defense several theories.

One of the matters sought to be proven is that there is a very large mean flow of water in the Laramie River. Upon this the defendants produce the theories of Mr. Field, formed not from his own observations but from observations and records made by others. In reaching his results, moreover, this witness, as we have seen, accepts and uses the high figures of the various observers, and rejects figures showing low stream flow, and only low figures.

Over against the theories of the defendants so formed, the plaintiff has given the actual computations of the witness Meeker, made from his own actual observations and measurements. Besides this testimony the plaintiff has also put in evidence the acid test of experience—the actual share of the river's flow that is required by the lands irrigated in Wyoming, as determined by the actual experience of many years. This actual experience discloses that in every year save two, there were no surplus waters in the stream above the amount required for the irrigation of the Wyoming lands, and that on the contrary there was in several of the years an actual shortage of water to such an extent that owners of lands under the Wheatland project actually assessed themselves $2.50 per acre in order to increase their insufficient supply of water.

Not only is the preponderance of the evidence with the plaintiff as to the amount of the annual flow of the Laramie River and therefore the amount of the so-called mean flow but the law and the evidence make plain that the mean flow of the river bears but slightly upon any matter here in issue.

The heavy flow of the floods in the river cuts no figure in the case of one who takes water for his needs from day to day out of the river channel. The excess flow above his requirements yesterday would have done him damage rather than benefit if flooded over his lands. At least it has passed on down the river and is not available to meet the deficiency in to-day's supply.

The appropriator is not required, as against one who comes later to the stream, to store the surplus of the floods. He may equitably insist that to the extent of his requirements the stream shall flow down to him each day as it has been wont to flow. This is the equitable rule which, as we have seen, is reached by all the authorities, and the reasons for it are too plain to require argument.

In this case even the aggregate flow is required by the prior appropriators in Wyoming, much more is it true that the reduced flow of later June and the whole of July and August is already below the requirements of the prior Wyoming appropriators.

But it is urged that we should not be permitted to retain and use the water, although our appropriations are prior to those of the defendant, because the water can be made more valuable in the Poudre Valley in Colorado. The fact that the water can be made more valuable there must be conceded on the evidence. This has nothing which seems to us even remotely a ground for depriving the Wyoming appropriators of their prior right. The use of the water in Wyoming has been beneficial. This is all that is required.

In a contest for property of any kind we have never known a case where it was held material that one of the parties could make better use of the property involved than the other.

We submit that the defendants should be enjoined as prayed.

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In the Supreme Court of the United States.

OCTOBER TERM, 1916.

No. 8, Original.

IN EQUITY.

THE STATE OF WYOMING, COMPLAINANT,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS & IRRIGATION COMPANY, DEFENDANTS.

BRIEF FOR DEFENDANTS.

VOLUME I.

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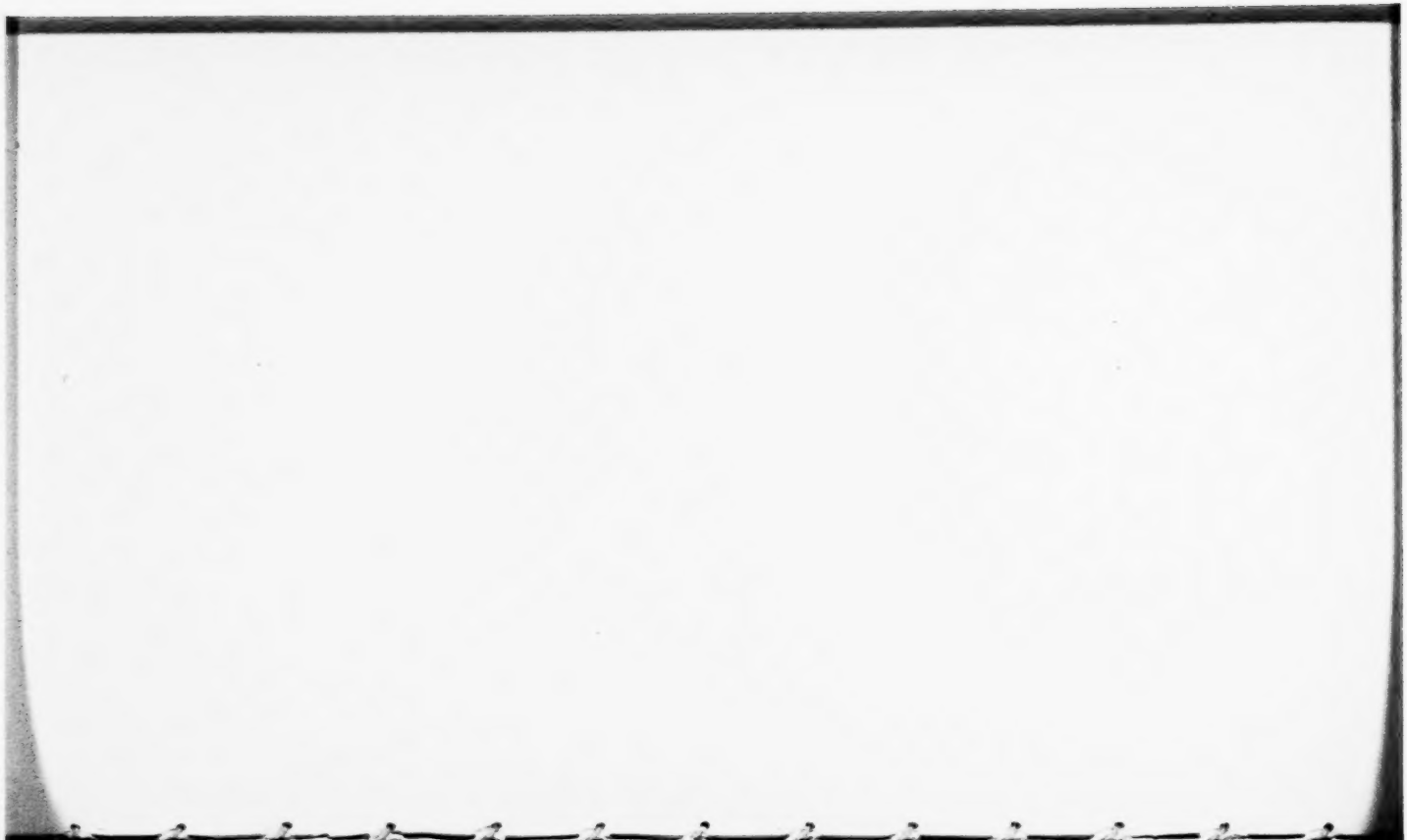
NOTE

The original transcript, together with all exhibits in this case, is filed in the office of the Clerk of the Court at Washington. This original transcript consists of nine volumes of typewritten matter, the first three being the evidence of the complainant in chief, the fourth to eighth, inclusive, the evidence introduced by the defendants, and the ninth complainant's evidence in rebuttal.

Pursuant to an order of court, an abstract of this evidence containing certain selected exhibits has been printed with the pleadings, the motions, orders, etc. In this abstracted transcript, which consists of two volumes, so printed, the pages of the original transcript are shown in the margin and it is these original transcript pages or marginal abstract pages to which reference is made in this brief.

This brief consists of two volumes, the first being a general treatment of the facts and the law; the second volume is devoted exclusively to a discussion of the facts and the law relating to Inter-watershed Diversions and Priority of Diversions, the evidence upon these two subjects being so voluminous and complicated that it was thought better to treat the discussion of them in a separate volume rather than to attempt to incorporate it into the main brief.

A brief descriptive list of defendants' exhibits is placed in an appendix at the end of each volume of this brief.



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In the Supreme Court of the United States.

OCTOBER TERM, 1916.

No. 7, Original.

THE STATE OF WYOMING, COMPLAINANT,
vs.
THE STATE OF COLORADO, ET AL., DEFENDANTS.

BRIEF FOR DEFENDANTS.

This is an original proceeding in this court, instituted by the State of Wyoming as Complainant, vs. The State of Colorado, The Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs & Irrigation Company as Defendants, to enjoin a present and threatened diversion of water from the interstate stream, the Laramie River. The diversion is made from a section of the stream within Colorado and the irrigation system and point of application are within that state. The stream is non-navigable.

The cause came on upon demurrer, the demurrer was overruled without prejudice, and the cause ordered heard upon the merits. In course, answers were filed by the defendants, and a replication thereto by the complainant. Other mention of these pleadings is unnecessary at this stage.

The action was instituted in May, 1911. The controlling facts are without dispute. The court will take judicial notice of many of the most important facts, and as to such facts as are in conflict, the conflict is of such a character as not to affect the merits of the case.

> "It has been very justly observed at the bar that the court is bound to take notice of public facts and geographical positions."
>
> United States vs. Rio Grande Irr. Co., 174 U. S., 690

"The law of any state of the Union, whether depending upon statutes or upon judicial opinions, is a matter of which the courts of the United States are bound to take judicial notice."

Lamar vs. Micou, 114 U. S., 218, 223.

It is thought the case will not turn upon any nice distinctions of fact.

The facts, certain of which will be hereafter discussed under subheads, are these: The Laramie River rises in the Medicine Bow and Green Mountains in Larimer County, Colorado, flows thence northerly through a narrow valley lying between the Medicine Bow Mountains and the Green Mountains, a distance of about 27 miles, to the Colorado-Wyoming line, thence through the Laramie Plains in a northeasterly direction. The Laramie is joined on the Laramie Plains by the Little Laramie before it reaches the Wheatland Reservoir, a channel reservoir. The river flows thence through the mountains and on past the Wheatland country to its junction with the North Platte River at Fort Laramie. Among other tributaries to the stream in this last mentioned section are the North Laramie, the Sybille and the Chugwater streams. The length of the stream from its origin in the Medicine Bow mountains to its union with the North Platte River at Fort Laramie is 150 miles or more.

Substantially all of the tributaries of the Laramie River which drain the Colorado watershed, except Sand Creek, Johnson Creek and Beaver Creek, join the river before it reaches the Colorado-Wyoming line. This Colorado drainage area is 393 square miles, and while there is some conflict as to the run-off therefrom, which conflict will be later discussed, we are justified for the present consideration in stating it to be, at the Colorado-Wyoming line, an annual run-off of 250,000 to 300,000 acre feet. The total drainage area of the Laramie River is 4,076 square miles, about 3,600 square miles of which drainage area is within the State of Wyoming, no part of which drainage area within Wyoming contributes to the diversions sought to be enjoined in this suit or any other diversions which it is practicable for Colorado to make in the future. Only 63.5 miles of this drainage area within Colorado is tapped by the diversion sought to be enjoined herein. The total run-off of the Laramie River in Colorado and Wyoming is in excess of 470,000 acre feet. The only portion of the Colorado run-off that can be availed of in the State of Colorado within the watershed of the Laramie River is that portion which is applied upon 4,250 acres which lie along the section of the stream within the State of Colorado and constituting the narrow valley herein-

before mentioned. The only water that can be diverted from the upper reaches of the Laramie River or any other part of the stream for use within the State of Colorado is a maximum of 91,000 acre feet and it can only be availed of by carrying it to another watershed. Natural conditions have placed a limitation upon the possibility of diverting any larger amount of water from the Laramie River for uses in Colorado.

Some years ago a diversion was made by the Sky Line ditch from a section of the Laramie River in the Medicine Bow Mountains, and the water carried over and dropped into the Poudre River and applied for irrigation purposes to lands in the Poudre Valley, another watershed. The average possible diversion through this ditch is 16,000 acre feet annually.

Another diversion from a tributary of the upper section of the Laramie River is the Sand Creek diversion of 4,000 acre feet annually. This water is carried from Sand Creek into Sheep Creek and thence for irrigation purposes in the Poudre Valley.

These two diversions, aggregating 20,000 acre feet, are not attacked in this proceeding. These diversions cannot be enlarged. The actual diversion that is being attacked is 56,000 acre feet annually, which the evidence shows can be diverted through what is known as the tunnel and the tunnel reservoir. This water is to be conveyed through the tunnel, thence into the Poudre River, a tributary of the South Platte River, and thence on for application to a beneficial use in the Greeley-Poudre District.

It is possible for the Greeley-Poudre District to enlarge this diversion of 56,000 acre feet by 15,000 acre feet through certain collection ditches which might be constructed to a tributary known as McIntyre Creek on the Colorado section of the Laramie watershed. If the enlarged diversion be made, the aggregate diversion through the tunnel will be 71,000 acre feet. This actual and proposed diversion is attacked in this proceeding, that is, Wyoming is not contesting the diversions of 16,000 acre feet through the Sky Line Ditch or the 4,000 acre feet diversion through Sand Creek, but is contesting the present and proposed diversion through the tunnel which may reach an aggregate of 71,000 acre feet. Wyoming is thus contending that from a run-off of 470,000 acre feet of an interstate stream, 300,000 acre feet of which is provided by the Colorado watershed and enters the stream within Colorado, Colorado should have 20,000 acre feet and Wyoming 450,000 acre feet.

As hereinbefore stated, the aggregate diversions that are possible from the Colorado section of the Laramie River watershed are 91,000 acre feet. If this bill be dismissed, the Colorado interests will be entitled, without question, to make aggregate diversions of 91,000 acre feet.

The State of Colorado is here represented by her Attorney General, insisting upon and claiming the right in her sovereign capacity to divert the 91,000 acre feet annually. The controversy is not between private parties; it does not involve a question of private interests, but is between the two sovereignties of Wyoming and Colorado, Wyoming denying the right of Colorado to avail herself of a reasonable part of this great natural resource and Colorado insisting that it is a reasonable exercise of one of her rights as a sovereignty to appropriate from this great natural resource which is originated and created within her limits the 71,000 acre feet sought to be enjoined herein.

Colorado became a state in 1876. At that time there were no diversions from the Laramie River in the State of Wyoming except two small diversions, aggregating not to exceed 51.33 second feet, which diversions cannot be affected by the diversion which Colorado herein insists upon her right to make. The question of vested rights, therefore, cannot arise in this proceeding.

Wyoming became a state in 1890. The two new states came in with equal rights and vested with all of the rights as to their respective natural resources as were held by the original thirteen states.

Every diversion that Wyoming citizens had made prior to 1890 from the Laramie River, and also those subsequent to 1890, can be satisfied without impairing the diversions, the rights to which are insisted upon by Colorado in this proceeding. When Colorado became a state, there was no appropriation in Wyoming but what could be satisfied and yet have an excess of water to satisfy the diversions sought to be enjoined herein. Further, all diversions in Wyoming existent when Wyoming became a state can be satisfied and yet leave more than sufficient water to supply the demands of Colorado presented herein. No question of disturbing rights which had vested prior to the erection of the two states is presented.

The doctrine of prior appropriation by reason of the necessities existing in the arid region prevailed at all times therein, furthermore, as far back as 1866 by federal legislation the existence of such doctrine was recognized to be applicable to the arid regions.

> "The Congress of the United States, appreciating that nearly one-half of the National Domain consists of arid lands which can be utilized for occupancy only by free use of waters from flowing streams, recognized this necessity for such use in numerous acts, commencing with the act of July 26, 1866, and including the Reclamation Act of June 17, 1902, and one or more subsequent acts. These acts are cited simply for the purpose of

showing the recognition by the legislative department of the Government of the conditions which made the arid portion of our country different from the humid portion and which required a wider scope for necessary natural uses than would be the case in a region of abundant rain fall.

This legislation has been held by this court not to be the creation of new rights among the people *inter sese* so much as a recognition of existing rights."

Broder vs. Water Co., 101 U. S., 274, 276.

U. S. vs. Rio Grande Irr. Co., 174 U. S., 690, 704.

Gutierres vs Albuquerque Land Co., 188 U. S., 545, 553.

The relation of the Federal Government to the waters of streams like the Laramie was that of sovereignty. This relation passed to the states upon their erection without any express legislation. The passage of such right to the states arose just like the doctrine of prior appropriation, that is, through the doctrine of necessity. The original thirteen states were the owners of the great natural resources. The new state, in its sovereign capacity, became the owner of such resources.

Martin vs. Waddell et al., 16 Peters, 367.

The original thirteen states were owners, in their sovereign capacities, of the waters of their rivers, navigable and non-navigable. As to the navigable streams, this ownership in their sovereign capacities was subject to the paramount right of control in the National Government over such streams for purposes of navigation, but subject to this paramount easement in the National Government, the ownership in their sovereign capacities was as absolute in navigable streams as in non-navigable streams.

"By the preceding course of reasoning we have arrived at these general conclusions: First, the shores of navigable waters and the soils under them were not granted by the Constitution to the United States, but were reserved to the States respectively. Secondly, the new States have the same rights, sovereignty, and jurisdiction over this subject as the original States."

Pollard's Lessee vs. Hagan et al., 3 Howard, 230, Decided in 1845.

"In like manner, the States own the tide waters themselves, and the fish in them, so far as they are capable of ownership while running. For this purpose the State

represents its people, and the ownership is that of the people in their united sovereignty."

McCready vs. Virginia, 94 U. S., 394.

"The title thus held is subject to the paramount right of navigation, the regulation of which, in respect to foreign and interstate commerce, has been granted to the United States. There has been, however, no such grant of power over the fisheries. These remain under the exclusive control of the State, which has consequently the right, in its discretion, to appropriate its tide waters and their beds to be used by its people as a common for taking and cultivating fish, so far as it may be done without obstructing navigation."

Ib.

"Upon the admission of California into the Union upon equal footing with the original States, absolute property in and dominion and sovereignty over, all soils under the tide waters within her limits passed to the State, with the consequent right to dispose of the title to any part of said soils in such manner as she might deem proper, subject only to the paramount right of navigation over the waters, so far as such navigation might be required by the necessities of commerce with foreign nations or among the several States, the regulation of which was vested in the General Government."

Weber vs. Harbor Commissioners, 18 Wall., 57, 65.

"California was admitted into the Union, September 9, 1850, and the act of Congress admitting her declares that she is so admitted on equal footing, in all respects, with the original States. The settled rules of law in this court is, that the shores of navigable waters and the soils under the same in the original States were not granted by the Constitution to the United States, but were reserved to the several States, and that the new States since admitted have the same rights, sovereignty and jurisdiction in that behalf as the original States possess within their respective borders.

When the Revolution took place the people of each State became themselves sovereign, and in that character hold the absolute right to all their navigable waters and the soils under them, subject only to the rights since surrendered by the Constitution.

Necessary conclusion is, that the ownership of the lot in question, when the State was admitted into the

Union, became vested in the State as the absolute owner, subject only to the paramount right of navigation."

Mumford vs. Wardwell, 6 Wall., 435, Decided in 1867.

"For when the Revolution took place, the people of each State became themselves the sovereign; and in that character hold the absolute right to all their navigable waters and the soils under them for their own common use, subject only to the rights since surrendered by the Constitution to the General Government."

Martin vs. Waddell, 16 Peters, 367, 411.

" 'The original States possessing this interest in the waters within their jurisdictional limits, the new States can not stand upon an equal footing with them as members of the Union, if the United States still retain over their navigable waters any other right than is necessary to the exercise of its constitutional powers.' "

Mobile vs. Eslava, 16 Peters, 253.

"The United States, then, may claim for the public an easement for transportation of merchandise, etc., in the navigable waters of the original States, while the right of property remains in the States."

Ib.

"If sovereign over navigable waters, is there any reason to say the States are not sovereign over the non-navigable waters? How did the States retain their right? They retained it by withholding it from the General Government."

Senator Teller.

"The right of Alabama and every other new State, to exercise all the powers of government, which belong to, and may be exercised by the original States of the Union, must be admitted, and remain unquestioned, except so far as they are temporarily deprived of control over the public lands."

Pollard's Lessee vs. Hagan, 3 How., 224.

See also Illinois Central Ry. Co. vs. Illinois, 146 U. S., 435.

In Martin vs. Waddell, 16 Pet., 367, it was held that, when the American Revolution was concluded,

> "the people of each state became themselves sovereign; and in that character hold the absolute right to all their navigable waters, and the soils under them, for their own common use, subject only to the rights since surrendered by the Constitution."

In Pollard vs. Hagan, 3 How., 212, it was held:

> "That the shores of navigable waters and the soils under them were not granted by the Constitution of the United States, but were reserved to the States respectively, and the new states had the same rights, sovereignty, and jurisdiction over the subject as the original States."

In the case of The Genesee Chief, 12 Howard, 443, it is said (in reference to the proprietorship of the bed and shores of the Great Lakes and other navigable waters, above as well as below the flow of the tide):

> "It properly belongs to the States by their inherent sovereignty, and the United States has wisely abstained from extending (if it could extend) its survey and grants beyond the limits of high water."

In Hardin vs. Jordan, 140 U. S., 371, it was held that:

> "Grants by the United States of its public lands bounded on streams and other waters, made without reservation or restriction, are to be construed, as to their effect, according to the law of the State in which the lands lie."

In the opinion, after stating that the title to the shore and lands under water is in the States and is regarded as incidental to its sovereignty, it is said:

> " 'The lands are subject to state regulation and control, under the condition, however, of not interfering with the regulations which may be made by Congress with regard to public navigation and commerce. * * * This right of the States to regulate and control the shores * * * is the same as that which is exercised by the crown in England.' "

The pith of this decision is that it is one of the sovereign rights of a State to own and control its waters, subject, how-

ever, to the superior control of the National Government for the purposes of navigation and commerce, the Federal Government being limited to certain excepted and enumerated powers, among which is the right to control all navigable streams for purposes of navigation and commerce.

In the Enabling Act it is recited:

> "Which state (Colorado), when formed, shall be admitted into the Union upon an equal footing with the original states in all respects whatever, as hereinafter provided."
>
> Enabling Act, 1 Mills Ann. Colo. Stats., —, c. 23.

The Constitution, made in pursuance of said Enabling Act, prescribes:

> "The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided."
>
> Article 16, Sec. 5, Colorado Constitution.

This was simply the declaration of sovereign ownership, common ownership for the people of the State at large.

The proclamation admitting the State provides:

> "And for the admission of such state into the Union on equal footing with the original states."

Colorado judicial construction and Colorado development have proceeded upon this theory of state ownership of the waters of the streams of the state.

The case of Stockman vs. Leddy, 55 Colo., 24, involved the validity of an appropriation by the state legislature for the protection of the rights of the state and its citizens in the natural streams of the state. The appropriation was held valid and that the General Assembly had the power and was charged with the duty of protecting the interests of the state in the natural streams. *Inter alia* the court said:

> "This constitution of ours was ratified and adopted by the legal voters of the state in accordance with the conditions prescribed by the enabling act of congress, and the president of the United States in his proclamation admitting Colorado into the Union found the fact to be that the fundamental conditions imposed by con-

gress on the State of Colorado to entitle it to such admission had been complied with. Congress, in passing the enabling act, and the President, in issuing his proclamation, were aware of the existing physicial conditions and of the topography and geography of the state. The federal government, by its lawmaking and executive bodies, knew that the natural streams of this state are, in fact, nonnavigable within its territorial limits, and practically all of them have their sources within its own boundaries, and that no stream of any importance whose source is without those boundaries, flows into or through this state. The entire volume of these streams is therefore made up of rains and snows that fall upon the surface of lands included within the exterior lines of this state and of springs which issue from the earth within the same area. Such being the peculiar conditions, the state was justified in asserting its ownership of all the natural streams within its boundaries. When Colorado was admitted into the Union with such a constitution, the federal government, through its lawmaking and executive departments, thereby recognized and confirmed such right of ownership as belonging to the state in its sovereign capacity. We therefore find it to be not only that our state constitution and pertinent statutes, but the decisions of the courts and duly announced public policy, all are in accord on the proposition to which the federal government has, as we have just shown, given its consent that the waters of the natural streams of this state belong to the people, to the state, in its sovereign capacity, and that its right to their distribution and control within its borders is free from any interference by any other sovereignty."

* * * * * * * *

"The right of congress to regulate and control navigable interstate streams and the jurisdiction of the Supreme Court of the United States to determine, in a controversy between two or more sovereign states over the waters of an interstate stream, whether they are reasonably exercising their inherent powers of sovereignty, are not overlooked or questioned by us; but these considerations do not, for the reasons above stated, affect or bear upon the right of ownership and control by Colorado of its own natural streams, and its power and authority to regulate the distribution of their waters, within its own territory, for beneficial purposes. We find nothing in United States v. Rio Grande Irrigation

Co., 174 U. S. 690, 19 Sup. Ct., 770, 43 L. Ed. 1136. Kansas v. Colorado, 206 U. S. 46, 27 Sup. Ct. 655, 51 L. Ed. 956, Rickey L. & C. Co. v. Miller & Lux, 218 U. S. 258, 31 Sup. Ct. 11, 54 L. Ed. 1032, Bean v. Morris, 221 U. S. 485, 31 Sup. Ct. 703, 55 L. Ed. 821, or in any other case that has been brought to our attention, which militates against our conclusion, when these cases are considered, as they should be, in connection with the facts on which they were determined. We therefore conclude that the general assembly, in order to protect the rights of the state in our natural streams and their waters, and the interests which its citizens have acquired thereunder, may make a valid appropriation of money for the purpose of protecting and defending them."

"The rights of riparian owners of land situated upon navigable rivers are to be measured by the rules and decisions of the courts of the state in which the land is situated, whether it be one of the original states or a state admitted after the adoption of the Constitution."

St. Anthony Falls W. P. C. v. St. Paul Water Commissioners, 168 U. S. 349.

Further, that the extent to which a sovereign state may insist upon this right rests largely with her.

In Hudson Water Co. vs. McCarter, 209 U. S. 349, 357, it is said:

"It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will."

Observe also the significant language appearing elsewhere in the opinion of the court in this same case:

"But we agree with the New Jersey Courts, and think it quite beyond any rational view of riparian rights that an agreement, *of no matter what private owners*, could sanction the diversion of an important stream outside the boundaries of the state in which it flows. *The private right to appropriate* is subject not only to the rights of lower owners, but to the initial limitation that *it might not substantially diminish* one of the great foundations of public welfare and health." (Italics ours.)

And in Georgia vs. Tennessee Copper Co, 206 U. S. 230:

> "If any such demand is to be enforced, this must be notwithstanding the hesitation that we might feel if the suit were *between private parties*." (Italics ours.)

and in the same case:

> "Whether Georgia, by insisting upon this claim, is doing more harm than good to her own citizens, is for her to determine."

And in Hudson Water Co. vs. McCarter, supra, this language:

> "But it is recognized that the state, as quasi sovereign and representative of the interests of the public, has a standing in court to protect the atmosphere, the water and the forests within its territory irrespective of the assent or dissent of the private owners of the land most immediately concerned."

And observe this language:

> "But when the *state itself* is concerned and by its legislation expressly repudiates the rights set up, an entirely different question is presented."

August 25, 1902, when there was an abundance of water to satisfy all appropriations existent and initiated for the purpose of irrigating Wyoming lands, Colorado citizens initiated the appropriation rights which are sought to be enjoined in this proceeding.

A large section of the most fertile lands within the State of Colorado, to-wit, the lands embraced within the Greeley-Poudre Irrigation District, were lying arid and without the possibility of development without irrigation. They were located at a favorable altitude, were productive in character, and were contiguous to lands which had been developed by irrigation and which were among the most valuable and productive lands in the United States. All this area of 125,000 acres, most of which at that time was unoccupied Government land, required to be brought to a high state of fertility was the presence of water for irrigation purposes. The capacity of the immediate streams and watersheds for securing water was exhausted. The only source from which water could be secured to reclaim this land was to enter another watershed and tap the upper reaches of the Laramie River. This was the only practicable source of securing water. Engineers were employed, investigations were made, and the conclusion reached that it was practicable, at enormous cost, to reach these waters, gather and equalize

them in the reservoir known as the tunnel reservoir, shown on Defendants' Exhibit 1, drive a tunnel through the Green Mountains about two miles in length, deposit the waters in the Poudre River and thence convey them along the river and through artificial channels a distance of about 125 miles to the Greeley-Poudre District. Filings in aid of water rights were made, ditch and reservoir construction entered upon, and from that date to this, there has been a continuity of the struggles of these people to build and use this system. Fortunes have vanished, lives have been lost, but still the struggle has gone valiantly on. The undertaking was of a more stupendous character than its bold conceivers at first dreamed. Heavy construction work for gathering the waters to be precipitated into the tunnel was involved. The construction of a tunnel reservoir, the driving of a tunnel at a cost of more than half a million dollars and the various other steps detailed in the fuller discussion of this undertaking were made for the purpose of bringing it to a practical conclusion. Under the laws of Colorado, an irrigation district was formed of 125,000 acres in Weld County, bonds were voted amounting to $5,100,000 which constituted, as to their payment, a lien upon the lands of the district. Bonds of the par value of about $2,700,000 of this issue have gone into this construction. The bonds were issued in December, 1909, and work went vigorously on until the institution of this suit. After the institution of this suit in 1911, the sale of the bonds was materially impaired and further construction has proceeded according to the resources of the district, which have been limited.

The construction of this system is practicable. The construction of this system will be completed if Colorado prevails in this suit. If the system is completed, the water will be used for the reclamation of one of the most valuable districts of the west. If this system is not completed, which it will not be if this suit is lost, instead of the waters of the Laramie River being applied to the reclamation of valuable lands, they will be wasted, comparatively speaking, upon the arid lands of the Laramie Plains. If this water be applied upon the Laramie Plains, it will be applied to a district of country which has an altitude of about 7,000 feet, where the soil is indifferent, the growing season is short, being about 56 days, where the yield per acre under any system of agriculture or irrigation will be slight as compared with the production of the Poudre Valley, and will be confined to such crops as hay, alfalfa and crops which can be grown in a very short season. The hay yield, whether as to natural hay or alfalfa, will be small and far inferior in quantity to the yield in the Poudre Valley. If the water which is now used upon the Laramie Plains were economically used, it is ample to supply many times all the lands

there under cultivation, leaving unimpaired the threatened diversion for Colorado. The better portion of the Wyoming land lies in the Wheatland district. Water to supply all of this country can be furnished by the diversions from the Laramie River, Sybille and Chugwater Creeks and yet leave water sufficient to supply all reasonable needs of the Laramie Plains and also the Colorado diversions.

If this diversion be allowed to Colorado, it will go to land which can be watered from no other source; it will be applied upon land from which the highest returns that are practicable under irrigation will be secured; it will be applied to lands where every favorable condition exists. If this diversion be taken from Colorado, it will work no substantial benefit to Wyoming, where its non-productive lands are now sufficiently supplied with water and will, in effect, be wasting not only a great natural resource of the State of Colorado, but a great natural resource that will mean not only great beneficial results to the people of the State of Colorado, but great practical results indirectly to the people of the nation. To deprive Colorado of this natural resource is simply to annihilate, in a degree, the producing power of the lands of the country which is needed for the sustenance of its people.

The Wyoming priorities as they existed at the time of the initiation of the Colorado diversion, August 25, 1902, will be discussed exhaustively hereafter. The character of the Wyoming lands as to productiveness, the system of irrigation in Wyoming as it exists, the great loss in dead storage, the great loss in wasteful irrigation, will also be discussed hereinafter and all go to show that if Wyoming irrigators would economically use the waters that are going to them after the Colorado diversions, they would have no shortage in their supply.

To sum up the facts, the water which Colorado seeks to divert is a part of a great natural resource within the state. The conditions within this state are such as to render necessary this diversion for uses within Colorado. The necessity for this use cannot be supplied from any other source. It is the contention of Colorado that these waters belong to her in her sovereign capacity, that it is but a reasonable exercise of one of her rights of sovereignty to divert this water and apply it to her necessary uses within her limits; that in so doing she is exercising reasonably one of her rights of sovereignty, and in truth is working no practical damage to the State of Wyoming. On the other hand, to sustain this bill and sustain the contention of the State of Wyoming would be to give her practically all of the waters of an interstate stream, to take from the State of Colorado practically all of a great natural resource, to take from Colorado a portion of this resource which would be, in a large measure, wasted upon unproductive lands and even the loss of which

could be abundantly supplied by Wyoming reasonably and economically using that which she now has.

Were Wyoming to prevail in this suit, it would mean to take a great natural resource from her sister state and fasten upon her streams and her lands a servitude unreasonable in its prejudicial effects upon Colorado and wasteful in its beneficial effects to Wyoming. In fact, if this suit were to be dismissed, Colorado, by reason of natural conditions, could never divert more than a maximum of 91,000 acre feet annually from this stream, and if Wyoming would economically use the water remaining and eliminate her present wasteful use, she would save for beneficial use more water than is involved herein.

As stated in the inception, this case will turn upon no nice distinctions of fact. The facts which are in this record without substantial dispute, aided by facts of which the court takes judicial notice, will suffice as to fact to enable this court to rule this case. Take for example such subjects as the development of the Greeley-Poudre Irrigation system, its difficulties, its extent, its highly beneficial purposes, the productiveness of the Poudre Valley, the irrigation system of the Laramie River, its condition when the Greeley-Poudre diversions were initiated, its steps chronologically since, the altitude, the climatic conditions, the character of the soil, nonproductiveness of the Laramie Plains, the interwatershed diversions, national, international, interstate, intrastate, all deserve and will receive full discussion as this brief proceeds.

As to the subject of interwatershed diversions. The time has been in the history of jurisprudence when water in some jurisdictions was not permitted to go beyond the watershed, but the common law being interpreted consistently with natural conditions has, at all times, yielded in the West, through the arid states, to the necessities of natural conditions. So the riparian doctrine has adjusted itself to conditions where it obtained. In some jurisdictions the law has been interpreted as requiring the water to go by practically unabated, in other jurisdictions it has been construed as permitting a reasonable amount to be withheld for purposes of irrigation; further, that the amount so withheld should depend on the size of the stream, the necessities of the situation, and other like conditions.

Evans vs. Merriweather, 3 Scan., 492, 495.
Irrigation Co. vs. Vivian, 74 Tex., 170.

If waters were confined for the purposes of irrigation to the watershed of the stream, the beneficial results from irrigation would frequently be destroyed, because fertile fields of extent can frequently only be reached by entering another watershed. Such conditions have caused the common law to

yield or to make it rather adapt itself as the winds and the atmosphere adapt themselves to the undulations of the earth, to the varied conditions it may find. All of the arid states—Colorado, Wyoming—permit these diversions to another watershed. Instances will be shown where Wyomnig is carrying water to other watersheds throughout the state, in fact, where she is even now diverting water from Colorado to another watershed within her state. She is not in a condition to complain that Colorado, being entitled to avail herself of a part of this water as one of her resources, cannot carry it wherever her laws and her natural conditions permit.

DISCUSSION OF THE FACTS.

In detail, the facts lend themselves to several specific subjects. Some of these are intimately co-related. Primarily, there is the question of water supply, and, in connection therewith, it is pertinent to discuss the amount of land which a given quantity of water will adequately irrigate, in other words, the duty of water, and the total amount of land under irrigation from the Laramie River and its tributaries. Further, the question of the relative priorities of diversions from the Laramie River in the two states, particularly the more recent projects; the question of the methods of administration of water and the methods of use; the question of interwatershed diversions and the productive value of the Wyoming area in controversy compared with the Colorado area which the defendants seek to reclaim by water from the Laramie River, and, ultimately, the broad question of equity between the two sovereign states in view of all the circumstances involved.

In the discussion of these various subjects, we wish, primarily, to establish the facts as disclosed by the testimony and then to draw our conclusions therefrom.

THE WATER SUPPLY.

The complainant seeks to restrain the State of Colorado. The Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs & Irrigation Company from diverting water through a tunnel from the Laramie River into the Poudre River for the irrigation of 125,000 acres of land included within the Greeley-Poudre Irrigation District and lying in the watershed of the Poudre River outside and to the east of the mountains.

The Greeley-Poudre Irrigation District is a municipal or quasi-municipal corporation, organized under a general law of the State of Colorado permitting the formation of districts whereby the lands included are burdened by a system of taxation for the purpose of securing water for irrigation. The law permits the election of officers for the management of the affairs of the district by the owners of the land residing within the district, and the right of the district to issue bonds in order to acquire, by purchase or construction, necessary irrigation works and water for irrigation.

The third defendant, The Laramie-Poudre Reservoirs & Irrigation Company, is, so far as the present status of the case is concerned, merely the construction company, occupying a contractual relationship with the Greeley-Poudre Irrigation District for the construction of the irrigation works, although, at the outset, the Laramie-Poudre Reservoirs & Irrigation Company and its predecessors in interest were the real parties in interest in the diversion of the water from the Laramie River. A more detailed description of this relationship will be given later.

The measurement of water in running streams is not an exact science; although definite methods have been adopted by hydrographers and definite machines employed, nevertheless, it will readily be seen that flowing water, particularly in a swift current, does not lend itself to absolute accuracy of measurement. This is particularly true if it is sought to establish the normal flow of a stream from measurements or a series of measurements limited to one or two years or fractions of years. However, when records covering a number of years are known, it is possible to arrive at a fairly accurate determination of the normal flow of the stream. It will, of course, be recognized that any test of the amount of water flowing in the Laramie River must be based upon what appears to be the normal flow rather than upon the flow for any one particular year, inasmuch as the proposed diversion which is sought to be restrained will, unless enjoined, constitute a continuing diversion.

The Poudre River cannot supply the water necessary for the irrigation of the lands of the Greeley-Poudre District. This is almost self-evident when it is recalled that the defendants have gone to an enormous expense in the construction of a monumental engineering work, that is, the tunnel and collection ditches, in order to divert water from the Laramie into the Poudre, and also that other companies have similar works, notably, The Water Supply & Storage Company, operating in the Poudre Valley, has already constructed, at enormous expense, three interwatershed diversion ditches, one bringing water from the upper reaches of the Grand River across the Continental Divide into the Poudre, another bringing water

from the Michigan, a tributary of the North Platte, and the third bringing water from the Laramie River through the Sky Line canal into the Poudre; that another mutual irrigation company, The Mountain Supply Ditch Company, now merged into The North Poudre Irrigation Company, brings water from the Michigan, a tributary of the North Platte, into the Poudre, and the Divide Canal Company (Wilson Supply Ditch) diverts water from the upper reaches of Deadman, a tributary to the Laramie, into Sand Creek, thence into a tributary of the Poudre. In this cause none of these diversions other than the Greeley-Poudre project is attacked.

It is, however, proper to review the evidence as to the water supply in the Poudre and the demands thereon for irrigation in order to show, beyond a doubt, that there is not sufficient water in that stream for the irrigation of the Greeley-Poudre District.

Water Supply, Poudre River.

The evidence, as a whole, discloses that the Poudre Valley watered by irrigation from the Poudre River is an area of high agricultural development. This has been made possible solely by irrigation, and in this valley is probably found the highest development of irrigation in the United States. The demand for the necessary water for the irrigation of lands under the ditches has been so great that the result is a system whereby the administration of water has received scientific study and treatment. The administration of the officials of the state whose duty it is to police the streams and apportion the water to the various ditches is constant and definite. The methods of exchange whereby a ditch heading on the river in the upper portion of the area stores flood waters, which, during the irrigation season it releases for the use of an older ditch further down the river, and in turn takes the water otherwise unavailable, to which the older ditch would be entitled; the methods of exchange between reservoirs and the general community of interest in the valley show to anyone familiar with the situation that the area under primitive methods was short of water years ago and that a higher development and a greater reclamation of the lands within the valley has been accomplished because the need of water brought about better methods.

The evidence discloses that other ditches for projects other than the Greeley-Poudre project have been undertaken, with a view to and with the effect of enlarging the amount of water available in the Poudre River for the irrigation of this area.

The Water Supply & Storage Company, as has been definitely shown in the discussion of the subject of interwatershed diversions, built, not one, but three, ditches for the purpose of bringing water across the Continental Divide into the Poudre

River. Of these the third to be constructed was the Sky Line Ditch, diverting water from the Laramie River. It was commenced in 1891 and required three years to construct, although it is only five miles in length (2206). These ditches were constructed because the supply from the Poudre River was not sufficient for the needs of the water users under the main canal of the company known as the Larimer County Ditch (2205, 2213-2214).

The Mountain Supply Ditch Company built one, now belonging to the North Poudre Irrigation Company, and the Divide Canal Company built another.

It is obvious that the ditches and engineering works by which these interwatershed diversions were accomplished are of extraordinary cost. The expense is enormous. These four diversions were made at a date far earlier than the inception of the Greeley-Poudre project and have entailed the expenditure of probably hundreds of thousands of dollars, and when it is considered that the ordinary diversion and distribution systems from the Poudre River for the irrigation of the lands in the Poudre Valley have to be constructed and maintained in addition to these interwatershed diversion ditches in the mountains, in order that the water which is dropped into the Poudre River near the crest of the continent may be, at the proper place, taken from the river and applied to the land, there would seem to be no argument that the Poudre Valley was not short of water for the area already under irrigation exclusive of the Greeley-Poudre Irrigation District before the commencement of that later project. To argue otherwise would be to say that the users of water in the Poudre Valley had lost their senses and had spent vast sums of money for the construction of needless ditches.

Professor L. G. Carpenter made an investigation of the water supply available for the Greeley-Poudre Irrigation District in 1909 and 1910. That was before the filing of this suit. He made a report on this project, portions of which were introduced in evidence by the complainant in the course of the cross-examination of Professor Carpenter and a portion of this report is quoted in the testimony (3933), but in order that this report may be correctly understood, it must be borne in mind that the Greeley-Poudre system contemplates the construction of at least one large reservoir in the channel of the Poudre River in order that the peak flow of the flood waters which cannot be profitably intercepted by any ditch might be impounded. This plan is discussed elsewhere in the brief. Professor Carpenter, in his report, estimated that there was available in the Poudre River an average of 120,000 acre feet, but that this 120,000 acre feet cannot be diverted by the proposed system because of inability of the ditches to carry the full

amount of water which might be available for a very short length of time, but that the channel reservoir planned will be of material assistance and will lead to much better development of the system through exchange and through its ability to intercept the flood waters, and that in this way from 60,000 to 90,000 acre feet of Poudre water might become available for the use of the district within a few years (3936).

The total available water for the Greeley-Poudre District, according to Professor Carpenter's estimate in 1910, is summed up as follows: From the Laramie River, 70,100 acre feet; from the Poudre River, 60,000 and 90,000 acre feet; from Dowdy Lakes, that being a system of lakes lying in the mountains on the Poudre side which form part of the reservoir system of the district, 2,990 acre feet; from Douglas Reservoir, which is a reservoir already existing and in which the Greeley-Poudre district has an interest, 5,833 acre feet, and from flood waters of Lone Tree and Crow Creeks, from 3,000 to 10,000 acre feet, making a total of from 142,000 to 179,000 acre feet (3936).

It must be remembered that the 70,100 acre feet which the witness estimated to be available from the Laramie is measured at the tunnel and from that point it is subject to the loss by seepage and evaporation as it flows down through the canyon of the Poudre River to the headgate of the diversion ditch and to the loss by seepage and evaporation as it flows through the miles intervening between the headgate of the ditch and the lands of the district, and that all water from the Poudre River is likewise subject to the loss in transit from the head of the same ditch to the point of application.

The witness John R. Wortham, engineer for the Greeley-Poudre District, testified that the whole water supply obtainable from the several sources was necessary for the irrigation from year to year of the land within the Greeley-Poudre District (1708).

Under the law of the State of Colorado the Poudre River is subject to a demand for water when necessary to supply prior appropriations on the South Platte River below the mouth of the Poudre. That is to say, if the flow in the South Platte River below the mouth of the Poudre is not sufficient to supply the demands in that district, then the Poudre River must supply, in proportionate share with other tributary streams of the South Platte River, a sufficient quantity of water to furnish prior appropriations below. Accordingly, a junior appropriator on the Poudre may be compelled to relinquish his right to obtain water although it is available in the Poudre River, if it is necessary to supply an earlier appropriation on the South Platte. For this reason it sometimes happens that late appropriations on the Poudre are denied water because of a shortage on the main stream, so that in arriving at an estimate

of the quantity of water available from the Poudre River it is not possible to consider alone the normal flow of the Poudre River and the needs of the 300,000 acres of land irrigated in the Poudre Valley. The relationship of appropriators of water in Water District No. 3 of the State of Colorado, that is, the Poudre Valley, to the appropriators on the South Platte River below the mouth of the Poudre, must be considered. (3411.)

The normal yearly flow in the Poudre River, based upon a record of thirty years, is, according to Exhibit 123, 315,896 acre feet, measured at the mouth of the Poudre canyon, but in order to arrive at the normal flow of the Poudre River itself, there must be deducted from the amount measured at this point the amount of inflow from interwatershed diversions entering the Poudre, and there must be added the amount which is diverted by ditches above the gauging station, these being shown by Exhibit 124, and in order to get the total supply of the Poudre River, there must also be added inflow from some small tributary streams having some flood water flow, below the gauging station, making the average water supply of the Poudre River, in round numbers, 367,000 acre feet per annum (3410-3411).

A conclusion, therefore, based alone upon the fact that there is an annual water supply of 367,000 acre feet on the Poudre River, and that there is now under irrigation in the Poudre Valley, as will be shown later, exclusive of the lands in the Greeley-Poudre District, approximately 300,000 acres, and that the duty of water, measured at the land, including the use of the original and available seepage and return waters, is approximately one acre foot per acre, does not necessarily mean that the Poudre Valley allows 67,000 acre feet per annum to go to waste, and, even if it did, and assuming that this 67,000 acre feet per annum was available for the use of the Greeley-Poudre Irrigation District, nevertheless it alone would not be sufficient for the irrigation of the Greeley-Poudre District, which contains 125,000 acres.

Exhibits 123 and 124 were prepared by State Engineer John E. Field, based upon records in the office of the State Engineer, and the conclusion of the total water supply of 367,000 acre feet per annum on the Poudre is likewise Mr. Field's conclusion. Assuming 300,000 acre feet per annum necessary for the irrigation of the 300,000 acres of land in the Poudre Valley and assuming also that there will never be a demand on the Poudre for water for the South Platte, we then have 67,000 acre feet available for the use of the Greeley-Poudre District if it be possible to intercept it. It is noticeable that this corroborates Professor Carpenter's estimate that there is from 60,000 to 90,000 acre feet available. It probably shows also that Mr. Field, the State Engineer, was conservative in

his estimates. However that may be, the duty of water as established for the Poudre Valley as approximately one acre foot per acre prevails as the water is applied to the land, not according to measurement made at the head of the ditch. There is of necessity considerable loss in transit and we do not contend that one acre foot is the duty of water in the Poudre Valley measured at the headgate. However, it is significant that inasmuch as there seems to be an average of about 110,000 acre feet per annum, including original and seepage waters, passing out of the Poudre into the Platte (3411) of which probably fifty per cent is seepage water (see Exhibit 113 and testimony of John L. Armstrong, Water Commissioner, pages 2487-2498) and the balance original water, that the loss in transit in the ditches is almost exactly offset by the re-use or, in other words, the use of the seepage water available in the valley.

Witness Armstrong, who has been Water Commissioner of the District included in the Poudre Valley for a great many years and is thoroughly familiar with the supply and the demands, also testifies that the Greeley-Poudre Irrigation District could not depend for irrigation upon surplus water available from the Poudre River alone, and that in order to irrigate these lands it would be necessary to supplement the available Poudre Valley supply by water from the Laramie River (2494).

The primary need of the Poudre Valley, according to Charles R. Hedke, at one time an engineer for The Laramie Poudre Company, is and will be for all time in the future, the problem of securing water for its lands still unreclaimed (1735-1739).

Water Supply, Laramie River.

In discussing the question of the water supply of the Laramie River, it is necessary to understand something of the geography and topography of the watershed. As already stated, the stream has two branches which are particularly involved in this cause, the main branch commonly called the Laramie River and sometimes referred to as the Big Laramie, heads in Colorado; the other branch, called the Little Laramie, is entirely within the State of Wyoming. These two unite at a distance of approxmately twenty miles below the City of Laramie. The Big Laramie arises about twenty-seven miles in an air line south of the Wyoming-Colorado line, and during its entire course in the State of Colorado, flows in a general northerly direction through a narrow mountain valley at a very high altitude. This valley lies between two ranges of mountains forming the divides on the west between the Laramie River and the tributaries of the North Platte, and on the east between

the Laramie and the tributaries of the Poudre. By actual measurement, the amount of land irrigated in the Laramie Valley in Colorado from this river and its tributaries is 4,250 acres (Ex. 130). The agriculture in this area is confined to the production of native hay. These irrigated lands are a thread along the river and at no point is the water diverted any considerable distance from the channel. The ditches by which this diversion is made comply with the law of Colorado and have received decrees adjudicating their rights. They are not attacked in this proceeding.

The consumptive use of this water is slight, owing to the topography of the country and the proximity of the application to the stream (3460), and in the conclusions made by the hydrographers for both complainant and defendants, no charge is made against the flow of the stream for this use. In other words, this use is not considered in the determination of the flow of the stream, and may be eliminated. The same condition is true both as to the general character of the country, the kind and character of the agriculture and the application of water and also as to the charge against the flow of the stream, on the upper reaches of the Little Laramie River, generally referred to as the Centennial Valley. In other words, on both streams in both states the consumptive use for irrigation in the mountain regions near the sources of the streams has been eliminated from consideration in so far as the measurements of the two streams are concerned, and the measurements have been taken and considered as though no such diversions existed.

Returning now to the Laramie River, at a point about nine miles north of the Wyoming-Colorado line, the river emerges from the mountain valley and enters the Laramie Plains. From this point the mountain ranges or divides referred to diverge, forming the Laramie Plains, a high mountain plateau surrounded on three sides by mountain ranges. At this point also irrigation in a material way commences, everything above this point being of the character described.

In this Laramie Plains area there are a number of old ditches diverting water both from the Big Laramie and the Little Laramie, the largest of which is the Pioneer Canal, dating from 1879, most of the irrigation, however, being above the junction of the two streams. Below the junction, the river continues its northerly flow for a distance in an air line of about thirty miles and then, for the first time in its course, cuts through a mountain range, flowing in a northeasterly direction until it reaches the North Platte at the site of the historical post known as Fort Laramie. Fort Laramie and Laramie City are to be distinguished. After the river passes through this mountain range and enters the plains country, it traverses the northerly

edge of an agricultural district generally known as the Wheatland District.

The average elevation of the Laramie Plains is about 7,000 feet, while the average elevation of the Wheatland area is about 4,700 feet above sea level.

The natural conditions divide the irrigated districts on this watershed into that inside of the mountains on the Laramie Plains and that on the outside, the Wheatland area.

The controversy here does not so much involve these older ditches on the Laramie Plains above mentioned as it does some newer projects, and in this connection it is necessary to keep in mind three reservoirs which have a material bearing upon the question, these reservoirs being of great capacity, two of them at any rate being far above the average capacity of reservoirs and many times larger than any reservoirs in the Poudre Valley. The first of these is Lake Hattie, a material factor in the project of the Laramie Water Company. Its intake from the river is an enlargement of the upper portion of the Pioneer Canal. It has a total capacity, according to the testimony of Lyman E. Bishop, an engineer employed in its construction, who testified in behalf of the State of Wyoming, of 110,500 acre feet, of which amount 68,500 is available to be withdrawn from the reservoir, while 42,000 acre feet is dead water which cannot be withdrawn under the present circumstances, but which could be withdrawn, at least in part, by the construction of a cut between two natural basins upon which the reservoir is constructed (786, 787). Lake Hattie also has an intake from the Little Laramie River.

The next reservoir is Lake James, the source of supply of which is the Little Laramie River, Four Mile, Seven Mile and Mill Creeks, the last three being small creeks. Lake James has a capacity, according to Wyoming testimony, of 41,100 acre feet (632).

The third reservoir is the Wheatland Reservoir No. 2, usually referred to as the Wheatland Reservoir. This reservoir is located on the Laramie Plains, just above the canyon in which the river passes through the mountains. It is to be distinguished from Wheatland Reservoir No. 1, which is a smaller reservoir located near the center of the Wheatland tract. This Wheatland Reservoir No. 2, or Wheatland Reservoir, is what is termed a channel reservoir, that is to say, it is formed by the construction of a dam across the channel of the river and is of material significance on this account as will be shown later. It is very large, having a capacity of 126,000 acre feet according to the testimony introduced by the State of Wyoming, the witness being M. R. Johnson, for many years the manager of the company owning the Wheatland system, he testifying to that capacity as determined by a survey made under his supervision

(6, 60). This also appears to be the capacity shown by the filings made in the office of the State Engineer of Wyoming, although the complainant later, over the objection of defendants, attempted to contradict this testimony by its witness R. I. Meeker, an engineer and hydrographer employed by The Laramie Water Company, the owner of Lake Hattie, it appearing from the testimony that a controversy had heretofore existed between the Lake Hattie people and the Wheatland Company relative to the capacity of the Wheatland Reservoir. Meeker's testimony places the capacity of this reservoir at 83,400 acre feet (4309).

A glance at the map, Exhibit 1, attached to the answer of the defendants, The Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs & Irrigation Company, will show that the Laramie River throughout its course in Colorado and through the Laramie Plains, flows parallel to and between the two ranges of mountains before mentioned, the enlarged valley between these two ranges constituting the Laramie Plains. The range on the west side of the river is known as the Medicine Bow Range, although in Wyoming at the head of the Little Laramie River the mountains are frequently termed the Centennial Mountains. The range on the east is known in Colorado as the Green Mountains and in Wyoming as the Laramie Mountains and the Black Hills. It is also to be noticed that throughout this portion of the watershed, the greatest inflow, as indicated by the tributary streams, is from the west, that is, from the Medicine Bow Range. The largest of these tributaries is the Little Laramie River.

It is the contention of Wyoming that their water supply from this range is inferior to that of Colorado, and inasmuch as Colorado will divert water from the main stream by means of the Greeley-Poudre tunnel, they will have an insufficient quantity of water. Later we will have occasion to show the relatively small proportion of the flow of the stream in Colorado which can be taken through the tunnel and the relatively small area of the drainage which will contribute to that supply.

In order to meet this contention and also to supplement measurements of the stream flow, measurements of the depth of the snow along this divide to the west, that is, the Medicine Bow Mountains, were taken. This was, because of the nature of country, a very perilous undertaking. A very graphic representation of the snow conditions along this divide is made through a number of photographs introduced by the defendants herein (Ex. 156). It is impossible to describe the snow conditions as adequately as these pictures show them. We therefore earnestly urge an inspection of this exhibit. There are some thirty photographs in the exhibit, with a legend giving the date upon which each picture was taken and the location of the

scene. These pictures were taken under the supervision of Professor L. G. Carpenter, an engineer of known ability, in order to supplement his investigation of the supply of water through stream measurements. In making these snow measurements, two hundred or more observations of the depth of the snow were taken and the quantity of water determined by measurements from time to time (3823).

The two ranges above mentioned converge at the head waters of the Laramie. In that vicinity the highest peaks in the mountain sheds contributing to the Laramie River are situated, but the Medicine Bow Range is narrower in Colorado than it is in Wyoming, so that while Colorado has possibly a higher average elevation for the range, that is in a measure offset by the greater breadth of the watershed in Wyoming. The lowest portion of the range is apparently near the line between the two states, the elevation decreasing from the head waters of the Laramie northward to this lower portion and then increasing again toward the area at the head waters of the Little Laramie where the elevation is again very high, Medicine Bow Peak, sometimes called Centennial Peak, having an altitude in excess of 12,000 feet, whereas the highest peak in the Colorado watershed is Clark's Peak with an elevation slightly in excess of 13,000 feet (3816-3823). The conclusion is irresistible that no marked difference exists in the precipitation along this divide between the Colorado area and the Wyoming area.

The range of mountains to the east of the Laramie River is not as high as the range to the west and there is much less precipitation and consequently less run-off from it, although one tributary of the river (Sand Creek) which is of considerable importance to this cause arises on this range in Colorado and flows almost due north into Wyoming, joining the Laramie River about nine miles above the City of Laramie. There are also tributaries to the river from the watershed on the east side of this range, these tributaries all converging near Wheatland, Wyoming. The principal ones are the North Laramie, the Sybille and the Chugwater. It is to be noted that all of the water of these three streams and also that of the Little Laramie and various other small tributaries of the river originate within the territorial limits of the State of Wyoming.

The total drainage area of the Laramie River and its tributaries, as has been stated, is 4,076 square miles, and of this a total of 393 square miles is in Colorado, 312 being in the drainage area above the state line on the Laramie River itself and 81 on Sand Creek.

The complainant, in connection with the testimony of its hydrographer, Mr. R. I. Meeker, introduced in evidence Exhibit C, being a small map indicating various points upon the stream and some of its tributaries at which gauging stations

for measurements were made. It is noticeable, however, that these gauging stations so indicated are for the year 1912 only and the exhibit in no wise indicates all of the stations which have been maintained in other years. As a matter of fact, it will be observed later that the Wyoming hydrographer bases his conclusions as to the normal flow of the stream almost completely upon measurements taken during a portion of the years 1912 and 1913 (on rebuttal modified by some measurements made in 1914), whereas the conclusions reached by the Colorado experts are based upon an analysis of the measurements made through a very much longer period.

In order that the court may understand the geographic location of the various stations, it is well at this time to describe the locations where measurements have been taken and testified to. Measurements have been made of the diversions through the Sky Line Canal and the Wilson Supply or Divide Canal; then upon the river itself, the highest station on the stream is at the Lanning Bridge, a short distance below the Greeley-Poudre tunnel; next at Glendevey, some nine miles below the tunnel; at Decker's Ranch, immediately above the Colorado-Wyoming line, and then at Boswells, immediately at the state line, these last two stations being only about a mile apart. Measurements were also made on various tributary streams in Colorado. Then in Wyoming measurements were made for a number of years at Woods Landing, which is the point above referred to where the river emerges from the mountains on to the Laramie Plains. Mr. Meeker, the Wyoming hydrographer, also took measurements, as shown by his exhibits and his testimony, at the head of the Pioneer canal, about four or five miles below Woods Landing. This is termed the Pioneer Dam. Measurements were also made upon the Big Laramie immediately above the junction of the Big and Little Laramies at a point called Two Rivers.

Passing now to the Little Laramie, measurements were taken at several places near the point where the stream emerges from the mountains on to the plains area, these being Filmore or Wright's Ranch, Hatton and May's Ranch. Mr. Meeker took measurements in 1912 and 1913 at the head of the Lake Hattie inlet from the Little Laramie, commonly referred to as No. 2 dam, but which is to be distinguished from the dam of the Wheatland Reservoir No. 2, and measurements were also taken on the Little Laramie immediately above its junction with the Big Laramie, this point also being termed Two Rivers. Another station maintained by Mr. Meeker and possibly others was immediately above the Wheatland Reservoir. This station is usually termed Lookout, although at times referred to as the Steel Bridge. Measurements have also been taken and are referred to at McGill, which is a short distance below the

Wheatland Reservoir but above the canon of the river, also at Wheeler's Bridge, which is below the canon. Measurements were also taken on Sybille Creek, on Chugwater and on the main stream at Uva, that being below all tributary streams except the Chugwater.

These measurements were not all taken by the same authority, nor at the same times, but, generally speaking, four authorities either co-operated or made separate measurements, they being the United States Geological Survey, the State of Wyoming, the State of Colorado, and The Laramie Water Company, through the hydrographer mentioned, Mr. Meeker.

Four witnesses testified to the flow of water in the Laramie River; one for Wyoming, Mr. R. I. Meeker, hydrographer for The Laramie Water Company, and three for Colorado, Mr. John E. Field, State Engineer of Colorado, Professor L. G. Carpenter and Mr. Charles R. Hedke.

One very important question is the amount of water supplied to the Laramie River by the State of Colorado, not alone the water flowing in the main stream at the state line, but also that contributed by tributary streams arising within the State of Colorado.

It is not advisable at this time to attempt any comparison of ability between witnesses for Colorado and the witness for Wyoming on this question. We will concede that Mr. Meeker was painstaking and conscientious. As stated before, however, his conclusions are based almost wholly upon measurements made during the years 1912 and 1913, as shown by his exhibits. On the other hand, Professor Carpenter, who is a recognized authority on matters of irrigation in the western states, bases his conclusions upon measurements made through a series of years by the State of Colorado, State of Wyoming and the United States Geological Survey, supplemented by measurements made by himself personally or under his immediate supervision, together with his general investigation of the whole country tributary to the Laramie River, including the snow measurements before mentioned. Mr. Field, as the evidence discloses, had had a wide experience as an irrigation engineer; had made investigations of the Laramie River in behalf of the United States Reclamation Service, with which bureau he had at one time been identified, and, as State Engineer of Colorado, had occasion to supervise measurements made in behalf of the state. His conclusions are reached after a complete analysis of all records at the various stations mentioned in the testimony. Mr. Hedke, as engineer for The Laramie-Poudre Reservoirs & Irrigation Company, had not only co-operated with Professor Carpenter to some extent, but had made an independent investigation of the water supply of the Laramie River

and the amount available through the tunnel for the Greeley-Poudre District.

It is conceded by the State of Colorado that the average annual diversion from the Laramie River by the Sky Line Ditch will probably amount to 16,000 acre feet per annum, while the average annual diversion by the Wilson Supply or Divide Canal will be about 4,000 acre feet per annum, making an aggregate of 20,000 acre feet as the average annual amount of water now diverted from the Laramie River by means of these two interwatershed diversion systems, and in determining the average annual flow of water from the Colorado area, this amount, 20,000 acre feet, must be taken into consideration. Some of the estimates of the flow at the state line include, while others exclude this amount.

Professor Carpenter testifies that the average run-off from the Colorado area, excluding the 20,000 acre feet through the Sky Line and Divide Ditches, is in excess of 300,000 acre feet per annum (3956). Adding to his estimated flow the Sky Line and Divide diversions, we have therefore a gross amount in excess of 320,000 acre feet per annum.

Mr. Hedke testified that, according to his investigation, there was an average amount of 70,000 acre feet available through the Greeley-Poudre system at the tunnel, that being about one-fourth of the total flow of the river at the state line (1823, 1852). Therefore his estimate is 280,000 acre feet net at the state line, excluding the Sky Line and Divide diversions, or a total of 300,000 acre feet.

Mr. Field, after making a thorough analysis of all records and measurements of the Laramie River, including the measurements made by the State of Colorado, the State of Wyoming, the United States Geological Survvey, measurements made by Professor Carpenter and certain unpublished records furnished by the State Engineer of Wyoming and others furnished by Mr. Meeker during the course of his cross-examination, reaches what he testifies to be a very conservative conclusion that the average flow at the state line, including the Sky Line and Divide diversions, will exceed 250,000 acre feet per annum (3477).

The complainant attempted no conclusion of this question until the introduction of its evidence in rebuttal, whereupon Mr. Meeker, as a summation of his evidence in this regard, estimates the average annual run-off at Woods Landing to be 200,000 acre feet per annum (4296). While Woods Landing is some nine miles north of the state line, and the flow at that point includes some Wyoming water entering the stream below the state line, nevertheless Mr. Meeker made no allowance whatsoever for any flow from Colorado into Wyoming through the

tributary stream Sand Creek, which is estimated by Mr. Field to be 17,000 acre feet per annum, and which probably more than offsets the Wyoming water entering the stream between the state line and Woods Landing. An analysis of Mr. Meeker's evidence discloses that this amount, 200,000 acre feet, is the net amount after deducting the Sky Line and Divide diversions. He did not testify to the amount of the Sky Line and Divide diversions, so, accepting the defendants' evidence upon this point, it means that Meeker's estimate of the Colorado run-off is approximately 220,000 acre feet per annum.

For the sake of clarity, let us tabulate the testimony of these four witnesses, showing the average gross amount of the annual flow at the Colorado-Wyoming line:

Professor Carpenter	320,000 acre feet
Charles R. Hedke	300,000 acre feet
John E. Field	250,000 acre feet
R. I. Meeker	220,000 acre feet

The methods by which these conclusions were reached are based upon so many and varied measurements and engineering calculations that we recognize a decided difficulty in making a brief statement that will fully explain them all. Probably nothing short of an anaysis of the evidence would suffice to make clear the processes by which the conclusions were reached, and we fear that the matter is so technical that it is rather a subject for the labor of a hydrographer than for a lawyer. Probably the conclusions themselves will, after all, be the most valuable to the court in determining the facts. However, we will attempt a brief review of the evidence, taking first the evidence of Mr. Meeker, who testified in this behalf for Wyoming.

Early in the presentation of the evidence in behalf of complainant, Mr. Meeker testified and produced a table introduced as Exhibit B, purporting to give the run-off of the Laramie River at the Pioneer Dam, which, as heretofore stated, is a short distance below Woods Landing. Mr. Meeker, according to his own testimony, while he had had considerable experience in hydrographic matters prior to his employment by the Laramie Water Company, had nevertheless been engaged in hydrographic investigation on the Laramie River only since May, 1912 (218). He testified the first time on August 22, 1913, so that his experience and observations on the Laramie River were limited to the period between those dates. His Exhibit B purports to show the run-off at the point indicated, based upon measurements made by himself from April to December, inclusive, 1912, and from January to August 18, 1913. While there were many records in existence of the flow of the

Laramie River at the time Mr. Meeker commenced his measurements, taken in some instances by the United States Geological Survey and in others by the State of Wyoming through the State Engineer's department and by the State of Colorado through its State Engineer's department, nevertheless Mr. Meeker did not see fit to include them in his table. He seems to have had either a lack of confidence in the measurements made by other hydrographers or a desire to discard them for the possible reason that they show a greater discharge than he found, but, at the same time, he evinces supreme confidence in his own measurements, although his confidence was possibly shaken before the conclusion of the testimony, judging from the number of errors which he admitted and the number of changes which he made. According to his table, Exhibit B, he found that the discharge of the Laramie River from April to December, 1912, amounted to 198,867 acre feet, and from January to August, 1913, 95,682 acre feet, these measurements being shown for the respective months covered. From these he endeavored to establish a mean, although such a mean must have been based upon one record for the months of September, October, November and December, 1912, and the months of January, February and March, 1913, and for the months of April, May, June, July and August, his mean is based upon the records for the two years. His total mean discharge for the year was then given at 160,498 acre feet. This is obviously too limited a period from which to establish a mean which would represent the average discharge of the stream. This is particularly true in view of the admitted fact that the year 1913 was one of extremely low precipitation and the run-off of the streams correspondingly low:

On this same table Mr. Meeker makes an estimate of the total flow for 1912, based upon the records for that year for the months designated and an estimate of the flow for the months not measured, in the total amount of 207,000 acre feet, and he seeks to show the distribution of that water from the point of measurement as follows: To the Pioneer Canal, 17,703 acre feet; into Lake Hattie Reservoir, 69,855 acre feet, and by referring to another table produced by the same witness, Exhibit K, we learn that the Lake Hattie commenced storing on April 8, 1912, and continued until October 5, 1912. Apparently they again recommended, because he notes that they ceased a second time on December 26, 1912. It is noticeable that water was being stored during the entire irrigation season. He then finds that there was distributed to all the ditches between the Pioneer Dam, the point of his measurements, and Two Rivers, the junction of the Big and Little Laramies, the further sum of 29,892 acre feet, and that there was distributed to the Wheatland Reservoir and any ditches diverting water between Two Rivers

and the Wheatland Reservoir, 89,550 acre feet, making up his total of 207,600 acre feet, and thereby balancing with the estimated flow at Pioneer Dam. It is noticeable that inasmuch as there are three or possibly four ditches diverting water between Two Rivers and the Wheatland Reservoir, only one of which is of any considerable size, and assuming the correctness of Mr. Meeker's figures, probably the greater portion of this 89,550 acre feet which he distributes to the intermediate ditches below Two Rivers, to the Wheatland Reservoir, found its way into Wheatland Reservoir. This, of course, does not include any other water than that flowing in the Big Laramie as counterdistinguished from the Little Laramie and other tributary streams below the Pioneer Dam.

For the year 1913, Mr. Meeker does not attempt an estimate for the full year, but confines himself to a statement limited to the amount shown by his measurements for that year, that is, 95,682 acre feet, which he distributes as follows, for that period: Pioneer Canal, 10,983 acre feet; Lake Hattie Reservoir, 28,470 acre feet. Referring again to Exhibit K, we find that the storage commenced from the Big Laramie in this reservoir April 25, 1913, and ceased on June 13, 1913. Following the same plan for showing distribution, he charges to all the ditches between the Pioneer Dam and Two Rivers, 18,167 acre feet, and to Wheatland Reservoir and intermediate ditches below Two Rivers, the sum of 38,062 acre feet. It is to be remembered that this table, Exhibit B, and the foregoing figures refer to water from the Big Laramie River only.

At a later date, November 13, 1913, and before the complainant rested its case, Mr. Meeker produced a second table similar to Exhibit B, introduced as Exhibit I (1035), which continues his measurements for the year 1913 to and including the 15th of November, increasing, however, two of his former monthly discharge records, Exhibit B, giving a discharge for July, 1913, of 6,764 acre feet while on Exhibit I he gives it as 6,825 acre feet, and for August, 1913, Exhibit B gives 3,038 acre feet while Exhibit I gives it 3,130 acre feet. He maintains his estimate of the flow and the distribution for the year 1912 as given before, but modifies his 1913 distribution to meet the enlarged flow coming from his longer record, and at the same time, endeavors to strike a mean based still upon his experience for a portion of the two years, 1912 and 1913, but with the enlarged experience of additional measurements for September, October and November, 1913. In this connection it is noticeable that inasmuch as 1913 showed a flow very much less than 1912, he reduces his mean from 160,498 to 158,206 acre feet.

Let us merely call attention at this time to the fact that Mr. Meeker, testifying in rebuttal, later modified this table a

third time, Exhibit T-7, and then was compelled, upon cross-examination, to correct it again (4322). This will be considered later.

He adopted the same method of treatment for the Little Laramie River, Exhibit J, establishing a mean upon records for the months of June to December, inclusive, 1912, and January to November, inclusive, 1913. In this table he finds the mean to be 68,727 acre feet. The measurements were made at the head of Lake Hattie Supply Canal No. 2 dam, that being a short distance below the station known as Filmore but below the diversion made through the Bellamy Canal, the intake to Lake James Reservoir, and also below the Loback canal. In this exhibit he estimates the total run-off for the year, 1912, at No. 2 dam, including the amount diverted by the Bellamy canal but excluding the Loback canal, to be 93,667 acre feet, which he distributes as follows: Bellamy Canal and James Lake Reservoir, 24,793; Lake Hattie Supply Canal No. 2, that being the name of the inlet from the Little Laramie to Lake Hattie, 14,053 acre feet; to the ditches between No. 2 dam and Two Rivers, 17,245 acre feet, and below Two Rivers to the intermediate ditches and Wheatland Reservoir, 37,556 acre feet.

We find, Exhibit K, that storage in Lake James from the Little Laramie commenced about April 21, 1912, and ceased about August 3, 1912, and that storage from the Little Laramie River in Lake Hattie Reservoir commenced about June 4, 1912, and ceased August 10, 1912.

Based upon his eleven months record for 1913, and adding the amount charged to the Bellamy Canal, he estimates the total discharge for the year as 58,361 acre feet, distributing to the Bellamy Canal and Lake James 12,310 acre feet; nothing to Lake Hattie from the Little Laramie in 1913, but to the ditches between this point of measurement and Two Rivers, 22,254 acre feet and to Wheatland Reservoir and the intermediate ditches below Two Rivers, 23,397 acre feet. It must be borne in mind that the mean referred to in this table does not include the amount of water diverted by the Bellamy Canal; contended for by Mr. Meeker.
that would have to be added to get the total amount even as

Exhibit J was superseded by Exhibit T-8, introduced when Mr. Meeker was called by the complainant in rebuttal. It purports to give full measurements for the year 1913, and for the months of January, February, March, April and May, 1914. Having his full record for the year, 1913, he increases his total flow for that year from 58,361, estimated from eleven months record (Exhibit J), to 59,637 acre feet.

It is to be noted that these tables charge nothing against the diversions made above the points of measurement, in other words, in Exhibit B, I and T-7, the measurements refer to the

flow of the Laramie River at the Pioneer Dam and do not include water diverted above that point. This exclusion covers whatever irrigation there may be in Wyoming above that point and also the irrigation on the Laramie Valley in Colorado, together with the diversions through the Sky Line and the Divide Canal or Wilson Supply, these last two diversions being 20,000 acre feet per annum as an average. The exhibits referring to the Little Laramie, that is J and T-8, show the measurement of water flowing in the Little Laramie after diversions for the irrigation of the Centennial Valley, and diversions by the Loback canal have been made. Attention is directed at this time to the fact that while Mr. Meeker made no charge against the Little Laramie River for this irrigation, he nevertheless did include this Centennial Valley land so irrigated in his estimate of the total amount of land irrigated in the Little Laramie Valley (Exhibit E), which will be referred to later. We contend that inasmuch as he neglected to charge anything for the irrigation of these lands, this plan being consistent with that adopted by Colorado with respect to the lands irrigated in the valley of the Big Laramie in Colorado, that he ought not to attempt to include this land in his list of irrigated acreage depending for irrigation upon the Little Laramie River. We merely make this statement at this time to show the inconsistency of his position in this regard.

Mr. Meeker adhered with remarkable tenacity to these tables, Exhibits B, I and T-7, as the basic data for his conclusion above referred to that the average flow of the Laramie River at Woods Landing was 200,000 acre feet per year.

Mr. Field, in his testimony, in order to arrive as nearly as possible at a normal yearly precipitation, went to the Poudre River where he had a series of records covering a period of over 30 years, on the theory that an average could be more accurately arrived at from 30 years' records than from the records of a materially less number of years upon the Laramie. He found, as will hereafter be specified, that the year, 1912, was very slightly in excess of normal. Mr. Meeker, following the same idea, went to a more remote stream, that is, more remote in so far as the point and conditions of observations were concerned, that is, to the North Platte River, and taking the records of the United States Geological Survey at Saratoga, which was admittedly below all irrigation in North Park in Colorado, a very considerable amount, for eight years between 1903 and 1913, inclusive, determines that for the North Platte River at that station, the year 1912 was 115.5 per cent of normal, Exhibit T-9, and he argues from that that the year 1912 was approximately 115.5 per cent of normal for the Big Laramie River.

The complainant introduced no measurements or records of the stream flow other than those of Mr. Meeker, although in

rebuttal, when Mr. Meeker concluded that the normal yearly run-off at Woods Landing was 200,000 acre feet, he contended that he had reviewed other records, but these were neither produced nor were we told of what they consisted.

Contending that the year 1912 was 115.5 per cent of normal, he finds 207,000 acre feet, in round numbers, passing the Pioneer Dam on the Laramie River, based upon gaugings made at that station. However, there had been diverted above, the water taken by the Sky Line and Divide Ditches in Colorado, which, as explained, will amount to 20,000 acre feet per annum as an average. As a matter of fact, they happened to be slightly above the average in the year 1912. As shown by Exhibit 124, they were 20,986 for the Sky Line and 2,157 for the Divide, or a total of 23,143 acre feet. This amount, if added to Meeker's 207,000 acre feet at the Pioneer Dam, would make a total of 230,143 acre feet. This is stated to show that Meeker's estimate of an average flow of 200,000 acre feet per annum is the net flow rather than the gross at Woods Landing.

As will be shown later, the diversions which can be made through the Greeley-Poudre tunnel, according to Mr. Field's estimate of the water supply, which is larger than Mr. Meeker's estimate, will be 56,000 acre feet per annum. This is based upon the Greeley-Poudre system as planned and partially constructed. Therefore, according to Meeker's estimated net flow, the Colorado diversion sought to be enjoined would be 56/200ths of the net amount of water in the Laramie River after the Sky Line and Divide Diversions have been supplied. There is a possibility of an enlargement of the Greeley-Poudre system by the extension of one of the collection ditches to McIntyre Creek. This, it is estimated, would give an additional 15,000 acre feet through the tunnel. While this is not planned as part of the Greeley-Poudre system, it is possible, and if ever constructed, it will enable Colorado to take 71/200ths of the net flow as Mr. Meeker finds the net flow at Woods Landing after the Sky Line and Divide Ditches are supplied.

It will be shown elsewhere that the evidence discloses that this is the ultimate possible diversion under any known engineering, permissible from the standpoint of the cost in relation to the returns therefrom that can be made from the Laramie River for use in Colorado.

The complainant offered no evidence of the total water supply of the whole Laramie River drainage area, but did criticise, in some particulars, testimony adduced by the defendants in this regard.

An analysis of Mr. Field's testimony on this point shows, first, a record of flow at a station termed Glendevey, which is about nine miles immediately below the tunnel of the Greeley-Poudre system and about fifteen miles in an air line above the

Colorado-Wyoming line. This station is below the diversions made by the Sky Line Ditch and the Divide Canal and is also below all contemplated diversion by the Greeley-Poudre system, but not below a possible extension of the system, that is, it is below all the diversions which are now planned, estimated by Mr. Field at 56,000 acre feet a year, but it is not below the extra possible and ultimate diversion of 15,000 acre feet. This record is shown by Exhibit 125, and covers partial records for the respective months in the years 1904 and 1905 and the years 1910 to 1913, inclusive. There are no records for the month of December in any one of these years, but by making an estimate for the mean December flow, the mean yearly flow at this station amounts to 65,717 acre feet. This does not include the water diverted by the Sky Line Canal and the Divide Ditch, in other words, it is the net amount of the flow of the river after these diversions are deducted and eliminating the small diversions for irrigation above that point in the valley of the Laramie River itself (3419). The table gives the total drainage area of the stream above this point as 102 square miles, and this net mean annual flow would indicate a run-off of 12 inches in depth over this watershed. If to the mean yearly flow above given the diversions by the Sky Line Canal alone were added, the total would be 83,790 acre feet, indicating a depth of run-off for the watershed of 15.4 inches, and if to this were added the diversion through Sand Creek (the Divide or Wilson Supply ditch), the total would be approximately 86,150 acre feet or run-off to the depth of 15.8 inches.

The drainage area mentioned, being the head waters of the Laramie River in Colorado, is immediately adjacent to the upper drainage area of the Poudre; in fact, the small tributaries are interlaced. Using the Poudre records before mentioned, covering a period of thirty years, for the purpose of determining the normal yearly run-off, Mr. Field concludes (3422) that the years covered by this table (Exhibit 125) in combination, give an average of 87 per cent of normal. If normal were based upon the records at Woods Landing on the Laramie River, to which reference will hereafter be made, but which cover a less number of years than the Poudre records, it would be 84.5 per cent of normal. Assuming the larger percentage, however, Mr. Field's statement is that the normal run-off at Glendevey would be 77,000 acre feet instead of 65,717 acre feet, this, again, being the net after the deduction of the Sky Line and Divide Canal waters (3422).

The witness arrives at this estimated normal by another method. 1912 is approximately normal according to the Poudre flow. The table, Exhibit 125, covers measurements made throughout the year 1912 with the exception of December. Estimating the run-off for the month of December to be 1,050 acre

feet, the run-off for that year would be 76,000 acre feet, or only 1,000 acre feet less for the year than the amount arrived at by the other method.

While it is our desire at this time to discuss the evidence relative to the flow of the Laramie River to the exclusion of other questions, it is, nevertheless, of particular interest while we have under consideration the Glendevey station, to consider the amount of water flowing in the river at that point which can be diverted by means of the inter-watershed diversions above. The records indicate that the Sky Line Canal is able to divert about 71½ per cent of the total supply furnished by the watershed above that ditch (3423), and that the Greeley-Poudre system will probably not be more efficient, although it will be able to divert the winter flow in the stream itself at the tunnel, differing in this respect from the Sky Line Ditch, which cannot, because of ice, operate during the winter months. This winter flow at the mouth of the tunnel is estimated at ten cubic feet per second. The collection ditches of the Greeley-Poudre system, based upon the experience of the Sky Line Canal, will not be able to operate during the winter, but, because of the ability to divert the ten cubic feet per second through the tunnel during the winter months, the Greeley-Poudre system will probably be able to divert 74 per cent of the net amount of water passing Glendevey, or approximately 56,000 acre feet per annum (3424). Adding now the amount which might be acquired by the possible extension of the system to the lower McIntyre, a tributary which reaches the stream below Glendevey, an additional 15,000 acre feet might be acquired (3425). This would give the total ultimate development of the Greeley-Poudre 71,000 acre feet instead of 56,000 acre feet, and by adding the 20,000 acre feet already diverted annually by the Sky Line and Divide Canals, we get the ultimate possible figure of 91,000 acre feet per annum, but a probable diversion of 76,000 acre feet per annum, which is the amount of water out of the total amount furnished by Colorado which the State of Colorado or its people can use from that stream.

Professor Carpenter estimated the total flow of the Laramie River at the state line to be in excess of 320,000 acre feet per annum. His estimate of the amount which can be diverted through the Greeley-Poudre system as planned is 70,100 acre feet, but the percentage of the total, as we will hereafter show, is identically the same as established by Mr. Field.

It is also of interest in discussing the stream measurements at Glendevey to call attention to the small amount of the drainage area which can be intercepted by the Sky Line Ditch and also by the Greeley-Poudre system. On the map attached to the answer of the corporate defendants, Exhibit 1, the drainage area which can be intercepted by the Sky Line is colored yellow

and is noted upon the exhibit as being 15½ square miles. The drainage area which can be intercepted by the Greeley-Poudre system is colored purple and is noted as 68 square miles. This was later modified slightly and was given as 63.5 square miles for the Greeley-Poudre system (1398), out of a total of 393 square miles constituting the drainage area of the Laramie River and its tributaries, including Sand Creek, within the State of Colorado.

The next station on the river at which measurements were maintained was at Decker's in Colorado, about half a mile south of the state line, and then at Boswell's in Wyoming, immediately to the north of the state line. These two stations were supposed to be the same, but a tributary stream called Stuck Creek, of considerable size, enters between the two. The court will, of course, notice that between the Glendevey station and the Decker station there are a number of tributaries into the river, among them McIntyre Creek, La Garde, Laramie Creek and Grace Creek from the west and Jimmy Creek and others not named upon the map from the east. Of all of these, the McIntyre is the largest.

Exhibit 126 gives a series of records at these two stations for part of the months of 1904, 1905, 1906 and 1908 at Decker station, and 1911, 1912 and 1913 at Boswell's station. Inasmuch as these records shown by the Exhibit 126 are published records, some being from the United States Geological Survey and some from the reports of the State Engineer of Colorado, it was thought well to refer to them in the evidence, but, as an indication of the total flow of the stream, they were deficient. This will be explained later, but the records are of interest as showing the amount of water in the stream, subject to this error, which, when known, merely confirms Mr. Field's conclusions.

The two records on Exhibit 126, that is, those for the years 1904, 5, 6 and 8 at Decker's, and 1911, 12 and 13 at Boswell's ranch (state line), are considered as one record by Mr. Field in his treatment of this exhibit, making an allowance for the inflow from Stuck Creek between the two stations, which, upon measurements made in 1912 by Prof. L. G. Carpenter and by hydrographers from the State Engineer's office of the State of Colorado in 1913, he estimates to be 9,000 acre feet per annum. It will be noticed that no measurement is complete for any one of the years mentioned.

In determining the percentage of normal for the years covered by the Decker Station, we have to go to the Poudre, inasmuch as there were no records at Woods Landing for those years. (3431) However, the percentages for the three records covered by the Boswell record, that is, 1911, 12 and 13, can be based upon either the Poudre or the Woods Landing (Laramie) records, and if a normal were estimated upon either

the Poudre or Woods Landing basis, based upon this discharge table for the limited number of months for each of the years given, the normal flow for the periods indicated would be 155,000 acre feet, exclusive of the diversions from the Laramie River into the Poudre River through the two canals mentioned, an average of 20,000 acre feet. It must be borne in mind, however, that this is not and does not purport to be a full year's record nor an estimate for a full year. On the same basis, in order to determine the amount of Colorado water at this point, there must be added the portion of the water of two tributary streams, Johnson and Beaver Creeks, which have part of their drainage areas in Colorado and part in Wyoming. From measurements made, Mr. Field estimates that the Colorado drainage alone contributes 16,000 acre feet through Johnson Creek and 6,000 acre feet through Beaver Creek, or a total of 22,000 acre feet, making a grand total of 197,000 acre feet. This does not include any water flowing into Wyoming through Sand Creek. The Decker Ranch records were very questionable; in fact, there are two sets of records, one according to the gauge heights reported by the water commissioner and the other as published by the United States Geological Survey, those shown by the water commissioner being very much higher. The station was established in 1904 by Mr. Lamb, a hydrographer for the United States Geological Survey, who furnished the water commissioner, Mr. Decker, with a rating table and Decker kept records based upon this rating table. The published record was made by the United States Geological Survey, reported in Water Supply Papers 171 and 172, and a great variance appears between the Decker reports based upon the Lamb rating table and the published reports. For illustration, in the month of July, 1904, according to the Lamb rating table, the discharge was 14,193 acre feet, whereas, according to the published figures which are adopted in Exhibit 126, the discharge was only 12,746 acre feet; August, according to the Lamb rating table, was 5,922 acre feet as against 4,667, the published record; in September, 3,453, according to the Lamb rating table as against 2,547 in the published records; again, in October, 3,493 as against 2,577; the aggregate for the months of July to October being, according to the Lamb rating table, 27,061 as against 22,537 shown by the published record. Attention is drawn to the fact that Exhibit 126 shows the published or lower record.

Another error appears in this, that in the year 1904, comparing the published record at Decker Station for July with the Glendevey Station for the same month, the inflow between the two stations was only 2,606 acre feet, whereas McIntyre Creek and other creeks mentioned augment the river between

these two points and an increase of 2,606 acre feet between the two stations is manifestly low.

Because of these obvious errors, these Decker records shown on Exhibit 126 were discarded (3431-3437).

The discrepancy between the Lamb rating table and the published records is not definitely accounted for. However, inasmuch as the records were prepared probably in Washington and published some years after they were taken, there is ground for believing that the error occurred there, particularly in view of the fact that on one of the records a statement is noted to the effect that certain gaugings were probably too high because of a defective meter. A defective meter, however, would show a discharge lower than the actual discharge, rather than one higher than the actual discharge (3436), so that the explanation is not satisfactory, but regardless of what explanation may be made, the fact remains that the published records are considerably lower than those based upon the rating table made by the hydrographer Lamb.

The Boswell records, however, are retained, but they are subject to a criticism, which will be mentioned later, that is, that the station did not measure all of the water passing at high water by reason of a peculiar topographical condition at the station.

These two tables should also be criticised in justification of discarding the Decker records from another viewpoint. The mean for the Decker Station for the months given in the respective years seems to be 116,797 and that at Boswell's 132,247 acre feet. Based upon the Poudre River standard of normal, the years covered by the Decker records would give 101 per cent of normal, while those given by the Boswell records, based upon the Poudre standard, would be 81 per cent of normal, or based upon the Woods Landing standard, 85 per cent of normal. It is therefore obvious that the Decker records are manifestly low.

The next station below Boswell's on the river is Woods Landing, some nine miles below the state line. In the analysis of the water supply question, Mr. Field proceeds to the records taken at this station and refers to Exhibit 127, which shows the discharge of the Laramie River in acre feet for the months of April to October, inclusive, during the years 1895 to 1900 and 1911 to 1913. The table, in the second column, shows, also, the amount diverted through the Sky Line Canal and Sand Creek or Divide Ditch, giving a total, with this added amount, of 216,244 acre feet. (3439.) This figure does not include the flow for the winter months, that is, November to March, inclusive, during any one of these years. Then, from the percentage of flow for each fractional year, based upon this mean as shown, and also the percentage of normal based upon

the normal flow of the Poudre, it appears on the table that the years covered by this table, in combination, are 96.1 per cent of normal, and that normal would be 225,000 acre feet, the mean for the months of April to October.

Exhibit 128 is a table showing the discharges of the Laramie River at Woods Landing for the various months upon which measurements were taken for the years 1889 to 1900, inclusive, and 1911 to 1913, inclusive. This table is based upon various records. The figures for the 1912 record are taken from Mr. Meeker and are shown on his table, Exhibits B, I and T-7. Some figures are preceded by the letter A. They were furnished in the year 1911 by a deputy State Engineer of Wyoming, Mr. Harry True, from unpublished records in the office of the State Engineer of Wyoming, at the request of the officers of the Greeley-Poudre District, in order that they might ascertain as nearly as possible the total run-off of the Laramie River. If all the records in this table are used, the flow at Wood's Landing, exclusive of the diversions of the Sky Line and Divide Ditches, is indicated at an average of 254,111 acre feet (3441) and this figure does not include the run-off in Sand Creek from Colorado. In analyzing this table, the witness discards the records prior to and including the year 1894 as being subject to question, and uses only the subsequent years, and of these subsequent years only the records between April and October as a basis for his conclusions, because the winter records were not numerous, and, in one case, subject to criticism (3441) as being much above the average for their corresponding months. This disposes of the contention of the complainant that Mr. Field took only the higher records, discarding the lower, in reaching his conclusions.

Referring again to Exhibit 127, the average discharge, excluding the amount taken through the Sky Line and Divide Canals, is 198,545 acre feet for the months of April to October, inclusive. The flow of these months being about 90 per cent of the annual flow (3442), makes the average discharge for the whole year 220,490 acre feet. (3442.) All of these years in combination, as indicated in the table, are 96 per cent of normal, based upon the Poudre standard. The normal average discharge, therefore, for the year, would be 230,000 acre feet, which, coupled with the 20,000 acre feet passing through the Sky Line and Divide Ditches, would make a total of 250,000 acre feet passing Wood's Landing, and this is exclusive of the supply furnished by Sand Creek. The total inflow between Boswell's and Wood's Landing is estimated at 35,000 acre feet of which 22,000 acre feet, as heretofore stated, is furnished by Colorado, making an inflow from Wyoming between the stations of 13,000 acre feet. If this be deducted from the 250,-

000 acre feet, it leaves 237,000 acre feet as furnished by the State of Colorado, exclusive of Sand Creek.

By another method, we get a similar result—that is, taking 216,244 acre feet as the total run-off, April to October, at Wood's Landing, according to Exhibit 127, including the Sky Line and Divide Ditches, the years in combination being 96 per cent of normal, gives a normal for these months of 225,000 acre feet. Now, estimating this as being 90 per cent of the yearly total, in other words, estimating the winter flow, November to March, inclusive, as being 10 per cent of the total amount, which is less than one-half of the amount actually shown on Exhibit 128 as the winter flow, gives a total to Wood's Landing of 250,000 acre feet. Again deducting the 13,000 acre feet supplied by Wyoming through intermediate tributaries, gives 237,000 acre feet at the state line exclusive of the amount of water contributed from Colorado to Wyoming by Sand Creek. (3443.)

By still another method the same conclusion can be reached. The Boswell Station record (Ex. 126) gives a mean for the period covered, April to November, inclusive, based upon a three years' record, of 132,247 acre feet, to which should be added 20,000 acre feet for the Sky Line and Divide ditches. These months represent about 92 per cent of the annual flow which would therefore be, including the Sky Line and Divide ditches, 165,700 acre feet. The three years covered, 1911, 1912 and 1913, represent 72, 104 and 51 per cent, respectively, of the normal flow as established by the Wood's Landing records; or, in combination, 75 per cent. On this basis the total discharge would be 220,933 acre feet, to which must be added the Colorado water in Johnson and Beaver creeks of 22,000 acre feet, making a total across the state line of 242,933 acre feet, exclusive of the Sand Creek discharge (3444).

Still another method may be employed in confirmation of these different conclusions. Considering the year 1912 approximately normal, the discharge, as shown on Exhibit 127, at Wood's Landing, for a period April to October, inclusive, 1912, is 236,550 acre feet. This period, as before stated, covered about 90 per cent of the annual discharge which would therefore be 262,830 acre feet, and if, instead of the estimate of 90 per cent for the period April to October, 1912, covered, we use the winter flow as given by the record (Ex. 128), the total discharge at Wood's Landing for 1912 would be 256,396 acre feet, and if again a deduction is made, for the reason that 1912 appears (Ex. 127) to be 104 per cent of normal based upon the Wood's Landing records alone, then 100 per cent of the normal would be 246,500 acre feet, from which again must be deducted the 13,000 acre feet of Wyoming water discharged through Beaver and Johnson creeks, leaving 233,500 acre feet as the annual

discharge at Boswell's (state line), exclusive of the Sand Creek discharge (3444).

Another method is to take the Boswell's Station records for the year 1912, April to October, inclusive, of 182,248 acre feet, adding thereto the amount actually diverted by the Sky Line and Divide ditches in that year, 23,143 acre feet (Ex. 124), making a total of 205,391 acre feet. These months represent 90 per cent of the total annual discharge which would therefore be 228,821 acre feet, to which must be added the Colorado water discharged by Johnson and Beaver creeks, or 22,000 acre feet, giving a total discharge across the state line of the Colorado watershed, exclusive of Sand Creek, of 250,821 acre feet. Again considering 1912 as 104 per cent normal, based upon the Wood's Landing records, the normal yearly flow would be 242,000 acre feet (3445).

By still other methods of calculation, the average yearly flow of the Laramie River at Boswell's, together with the Colorado water furnished below by Johnson and Beaver creeks, but exclusive of Sand Creek, is 237,000 acre feet, 233,500 acre feet, and 242,000 acre feet, the average of which is 237,500 acre feet, slightly less than the average if the methods heretofore mentioned are taken as the basis (3445).

As previously stated, the 1912 record, Exhibit 128, is taken from Mr. Meeker's table of the discharge of the river at Pioneer Dam, as is shown on complainant's Exhibits B, I, and T-7. That this record is incorrect and shows entirely too low a flow, appears from this: the record for the year is limited to the months of April to December, inclusive, and for the months of June and July he actually shows a less discharge than appears at the Boswell station for those months, notwithstanding there is a considerable run-off during these two months from the territory lying between the two stations. Exhibit 129 apparently is prepared to show the difference in the discharge. As a matter of fact, however, the table is based primarily upon the records at Boswell's, to which are added the records of the inflow, the sum being the flow at Wood's Landing. A casual inspection of the exhibit, without reference to the testimony, would indicate that certain Wood's Landing records were taken, from which the Boswell records were subtracted, to show the inflow. The evidence, however, discloses that the opposite method was employed in arriving at the amount of the flow at Wood's Landing; that is, the Wood's Landing record, as shown on Exhibit 129, was arrived at by adding to the Boswell station the inflow between Wood's Landing and Boswell's. The evidence shows that in 1911 the difference of discharge between the two stations was 5,600 acre feet for May; 10,975 for June; 1,916 for July; 2,700 for August; 664 for September; and 465 for October; or a total for the period, May to October, inclusive,

of 22,311. In other words, that was the inflow between Boswell's and Wood's Landing, and 1911 was a year of less than normal flow, probably about 72 per cent of normal (3449).

The records for 1913 show a difference between the measurements at the two stations of 4,123 acre feet for May, 1,217 for June, 936 for July, 1,210 for August, 1,616 for September, 1,044 for October, 45 for November; and, estimating the inflow for April at 1,500, makes a total for the period covered in 1913 of 11,681 acre feet. The year 1913 was about 51 per cent of normal, so that it appears from an analysis of these tables that Mr. Meeker's 1912 record for the Pioneer Dam (Exhibits B, 1, and T-7) are probably more than 10,000 acre feet too low for the month of June, and more than 20,000 acre feet too low for the full year (3449).

In 1912 the records on Exhibit 129 were largely estimated. The inflow between the stations, based upon the discharge of Johnson and Beaver Creeks and other accretions, seems to be about 40,000 acre feet, but a conservative estimate was made of 32,059 acre feet (3451). As confirming the estimates made for the respective months of the year 1912, certain measurements made by the hydrographer for the office of the State Engineer of Colorado, can be used. These measurements were made in the year 1913 and were: 6 in May, 7 in June, 5 in July, 1 in August, 1 in September, and 1 in October. Using these as a basis, the difference between the two stations would be as follows: May, 5,547 acre feet; June, 2,211; July, 381; August, 380; September, 586; and, estimating 1,500 acre feet for April and 500 acre feet in October to complete the period covered by the 1913 table, Exhibit 129, we have a total of 11,105 acre feet, thereby confirming the other measurements shown on the table for the year 1913, which total 11,636 acre feet (3451).

Now, assuming the year 1912 to be approximately normal and the year 1913 to be slightly in excess of 50 per cent of normal, and taking the measurements for the fractional part of the year, we can arrive at the conclusion that the normal difference between the two stations for the year 1912 would be between 30,000 and 40,000 acre feet, that is to say, the Wood's Landing record for the year 1912, if correct, should show between 30,000 and 40,000 acre feet more than is shown at Boswell's, thereby confirming the statement that Mr. Meeker is low in his 1912 measurements at the Pioneer dam (3453).

The drainage area of Sand Creek in Colorado is given, for this purpose, as about 50,000 acres (3445), although other witnesses place it as high as 81,000 acres. The run-off from the area should be one-third of an acre foot per acre, and if the lowest estimate of the area be accepted, that is, 50,000 acres, the run-off in Colorado through Sand Creek is 17,000 acre feet per annum, which, if added to the 237,000 acre feet, the average

for the Laramie River itself, the total amount furnished by Colorado is 254,500 acre feet. (3444.)

Let us depart for a moment from the question of water supply and consider the relative amount of this Colorado water which can be diverted. As previously stated, the average of the diversions made by the Skyline and Divide ditches is 20,000 acre feet, or 8 per cent of the Colorado water. The Greeley-Poudre District, through the tunnel, according to Field's estimate, can take 56,000 acre feet, or 22 per cent additional, and if the Lower McIntyre development should ever be added, making a total through the tunnel of 71,000 acre feet, the Greeley-Poudre diversion would be 28 per cent of the total, or a combined total through the Skyline and Divide canals, the Greeley-Poudre system as planned and all possible diversions from the river by means of the Lower McIntyre extension, of 36 per cent of the supply which the State of Colorado itself furnishes to the Big Laramie River. (3445.)

If we should eliminate entirely the supply furnished by Sand Creek of 17,000 acre feet, and, on a basis of a total diversion of 91,000 acre feet by Colorado, there would still be included in these Colorado diversions only 38.4 per cent of the Colorado water. (3446.)

In other words, eliminating Sand Creek, 38.4 per cent would then represent the extreme limit of the Colorado diversions under any and all circumstances from the Laramie River. Without the extension of the Greeley-Poudre system to the Lower McIntyre, the total diversion would be 30 per cent, or, reversing the statement, the fact is, that including the Skyline diversion, the Divide or Sand Creek diversion, and the Greeley-Poudre tunnel diversion, 70 per cent of the water of the Laramie River watershed arising within the State of Colorado must pass into the State of Wyoming, notwithstanding anything which Colorado might do in the future, with the exception of the one extension to the Lower McIntyre. (3446.)

It therefore appears that by its bill of complaint in this cause, Wyoming is seeking not only the 70 per cent of Colorado water which it must and will receive, but in addition to that, the 22 per cent which it is proposed to divert to the Greeley-Poudre tunnel.

The Little Laramie.

In taking the measurements of the flow of the Little Laramie River, no attempt has been made to charge anything to the use of the water in the Centennial Valley, which, as before stated, is similar in many respects to the Colorado area of the Laramie Valley. All water consumed by the ditches in the Centennial Valley is therefore eliminated from consideration in the tables given of the Little Laramie flow. (3469.)

Exhibit 131, produced by Mr. Field, is a table giving the discharge measurements of the Little Laramie River at Hatton, Wyoming, near the point where the river emerges from the mountains onto the Laramie Plains. The measurements were made at a place called May's Ranch for the years 1902, 1903, 1911 and 1912, and the records are from U. S. Geographical Survey publications, while the 1913 record is the flow at the Lake Hattie Inlet plus the flow in the Bellamy Canal, the figures being furnished by Mr. Meeker. (3705.) The Bellamy Canal is one of the ditches diverting water from the Little Laramie to Lake James. In addition to this one there is also another large ditch which diverts water from the north fork of the Little Laramie. It is above the station and therefore its diversions are not included in the flow of the stream. This ditch is commonly called the Loback Ditch. This table indicates an average discharge for the years given of 93,373 acre feet, but there are partial returns only for four out of the five years given. The only complete record, 1913, was one of very low flow. The average discharge of the Little Laramie, as shown by this table, for the months of April to October inclusive is 86,828 acre feet. There is no record at Wood's Landing on the Big Laramie for the years 1902 and 1903, so, going to the Poudre for the percentage of normal, we find that 1902 was 51 per cent and 1903 116 per cent of normal. 1911, based upon the Wood's Landing record, was 72 per cent; 1912, 104 per cent, and 1913, 51 per cent. These, in combination, being 80 per cent of normal, the normal discharge for the period, April to October inclusive, would therefore appear to be 108,535 acre feet, and for the entire year, 120,600 acre feet. (3470.)

Comparing the discharge of this station with that of the Big Laramie at Boswell's or Wood's Landing, we have still a further check upon what is probably the normal discharge of the Little Laramie at this station. The normal discharge of the Big Laramie at Boswell's has been given as 220,933 acre feet. With the Little Laramie calculated at 120,600 acre feet, the percentage would be 55 per cent of the Big Laramie at Boswell's, or 61 per cent if we exclude the Sky Line and Divide ditches. (3470.)

The winter discharge at Boswell's appears to be 4,185 acre feet per month. 55 per cent of this amount would probably represent the winter flow of the Little Laramie at Hatton. This would be 2,400 acre feet per month, or 12,000 acre feet for all winter months, which, added to 108,535 acre feet, the normal for the period April to October inclusive, would give a total discharge for the year of 120,535 acre feet, arriving at the same conclusion by a different method. (3471.)

By still a further analysis of figures at Boswell's and Hatton, based upon the record for months that are common to both

stations, Mr. Field arrived at the conclusion that the flow at Hatton on the Little Laramie was 55 per cent of the flow of the Big Laramie at Boswell's, and by another analysis arrives at the conclusion that the discharge of the Little Laramie at Hatton, based upon the records in these calculations, was 120,700 acre feet per annum as an average for normal. (3472.)

It next becomes of interest to consider the total amount of water available annually for the Laramie Valley as a whole. We have heretofore shown by the witness Field that the annual normal discharge at Wood's Landing on the Big Laramie River is approximately 250,500 acre feet, and on the Little Laramie at Hatton, 120,700 acre feet. Turning again to the consideration of the Big Laramie, there is a tributary that enters the stream below Wood's Landing called Fox Creek, with an estimated annual run-off of 14,400 acre feet. (3473.)

The total available water above the Wheatland Reservoir must also include the run-off from the mountain territory through Four Mile, Seven Mile, Cooper and other small streams heading in the mountains north of the Little Laramie, and on the west side of the Laramie Plains. This mountain territory is about 60 square miles in extent or 38,400 acres. A conservative estimate would place the run-off at one-third of an acre foot per acre per annum, yielding from this territory 12,800 acre feet. (3474.)

The mountain area on the east side of the Plains should also be considered. This area from a point opposite Two Rivers down to the Wheatland Reservoir is about 60 miles in length and about 5 miles in width on an average. Assuming it to be 3 miles in width, it should furnish an annual supply of 12,800 acre feet based upon one-ninth of an acre foot run-off over the area. (3474.) There is also doubtless considerable water furnished from the Laramie Plains area proper, which is very extensive, being in the neighborhood of 600,000 acres, but inasmuch as this inflow will be erratic, due almost entirely to violent storms, no charge was made by Mr. Field on that account. The total average supply from the Laramie River and its tributaries above the Wheatland Reservoir is 411,200 acre feet, the sum of the amounts just given. (3474.)

Below the Wheatland Reservoir some water enters the river in the canon from tributary streams from the mountain area lying principally to the north of the river (Duck Creek, Dodge Creek and others). This, however, has not been charged against the total supply available for the use of the Wheatland system. There is the flow of Blue Grass and Sybille Creeks. Measurements have been made of the flow of these streams from which the witness concludes that these two streams furnished 20,000 acre feet or more annually, making a total

supply above the Wheatland tract of 431,200 acre feet, the normal average flow. (3476.)

However, this must not be considered all of the water of the Laramie River, inasmuch as it does not take into consideration the water available from the North Laramie River which enters the main stream from the north, heading in the vicinity of Laramie Peak, nor the Chugwater, which enters the main stream from the south, heading on the eastern slope of the Green Mountains. As heretofore stated, these streams converge near the station called Uva and generally below the Wheatland area. There is some irrigation on both these streams and from reports published by the State Engineer of Wyoming for the years 1911 and 1912, the discharge of Chugwater near its mouth was 18,300 acre feet per annum. (3476.) The total discharge, therefore, of the stream in the Colorado and Wyoming areas would seem to be in excess of 450,000 acre feet without considering the flow of the North Laramie. Of this amount Colorado furnishes something in excess of 250,000 acre feet and in turn can use only the amount of the present diversions through the Sky Line and Divide canals, 20,000 acre feet; through the tunnels and collection ditches as planned, 56,000 acre feet, and through the other possible diversion from the river by the extension of the system to the lower McIntyre, 15,000 acre feet, making a total possible diversion of 91,000 acre feet.

Confirming Mr. Field's estimates, two other tables were also introduced. Exhibit 143 is a table showing the discharge of the Big Laramie River immediately above its junction with the Little Laramie River, the point being called Two Rivers. Record covers portions of the years 1909, 1910, 1911, 1912 and all the year 1913, the mean discharge at that point being 126,753 acre feet.

Exhibit 144 is a similar table showing the discharge of the Little Laramie River immediately above its junction with the Big Laramie River, this point also being termed Two Rivers.

The court will understand that measurements were made immediately above the junction upon both branches of the stream after all upper diversions including the Pioneer Canal, Lake Hattie and Lake James had been made. In each case the station was termed Two Rivers.

The Little Laramie station records, Exhibit 144, cover the same years as Exhibit 143. There was a mean discharge of 50,132 acre feet per annum, the mean being based upon the measurements for the respective months shown on the table.

The combined means at Two Rivers station, that is, 126,753 acre feet on the Big Laramie, and 50,132 acre feet on the Little Laramie, 176,885 acre feet, represent the total flow of the Laramie River immediately at the junction, and inasmuch, as has

been heretofore shown, as there is relatively a small amount of irrigation below this point and the Wheatland Reservoir, it therefore follows that the major portion of this water is available for the Wheatland system. If Mr. Meeker be correct in his estimate of the capacity of the Wheatland Reservoir at 83,500 acre feet, there is therefore at this point available more than twice the capacity of the reservoir, and if the reservoir capacity be 126,000 acre feet, there is a surplus above that amount of 50,000 acre feet per annum.

Lake Hattie and Lake James, the other two large reservoirs, and by far the greater portion of the irrigation in the Laramie Plains, are above Two Rivers. Referring to plaintiff's Exhibit K, we learn that Lake James was storing water from April 21 to August 3 in 1912 and from April 19 to May 25 in 1913; and that Lake Hattie, which receives water from both the Big and Little Laramie Rivers, commenced storing from the Big Laramie April 8, and ceased October 5, 1912. Apparently recommenced and ceased again December 26 and commenced storing water from the Little Laramie June 4 and ceased August 10, 1912, and in 1913 commenced storing from Big Laramie April 25 and ceased on June 13, receiving no water from the Little Laramie in 1913.

An inspection of Exhibits 143 and 144 shows that after this storage had been made by these two reservoirs, although it continued in 1912 practically through the irrigation season and in 1913 well into the irrigation season, nevertheless there was abundant water in the streams at the junction for every need below; although the court will recall that while the year 1912 was approximately normal or slightly above normal, the year 1913 was only about 55 per cent of normal.

Further supplementing his conclusions, the witness reviews the evidence given by Wyoming relative to the amount of water stored in the various reservoirs in that state diverting water from the Laramie River or its tributaries.

Referring first to Lake James, according to the testimony of Z. E. Sevison, a witness on behalf of the State of Wyoming, the capacity of this reservoir is 41,100 acre feet (631). This reservoir was constructed in 1908 or 1909, although not really completed until 1911 (633). Water was first stored for irrigation in the year 1909. In that year the storage was 18,000 acre feet, a small amount of which was used and the balance carried over. Including this amount carried over, the storage in 1910 was 10,000 acre feet, and at the end of that season the lake was practically empty. In 1911, 10,000 acre feet was stored and all used; in 1912, the storage was 22,000 acre feet, of which about 18,000 acre feet was carried over the irrigation season, in other words, not used; and up to March, 1913, 3,000 acre feet additional had been stored. According to Exhibit J, a table

produced by R. I. Meeker, a witness for the State of Wyoming, there was diverted into the Bellamy Canal and Lake James from the Little Laramie River, 24,793 acre feet in 1912, and in 1913 to November 30, 12,310 acre feet. According to Exhibit K, Mr. Meeker found that on July 17, 1912, there was 15,000 acre feet in storage in Lake James, and on November 25, 1912, 18,400 acre feet, and that storage commenced that year April 21st and ended August 3rd; on April 25, 1913, 20,400 acre feet; October 30, 1913, 19,800 acre feet, and that storage commenced that year April 19th and ceased May 25th. Sevison testified that there was no water carried over from 1911 to 1912; so by deducting the amount in storage November 25, 1912, 18,400 acre feet, from the diversions made in 1912, 24,793, we have 6,393 acre feet used or possibly lost. It appears, therefore, that in the practically normal year of 1912 there was not only an excessive amount of water available, but there was actually stored above all uses, 18,400 acre feet (3483).

Referring now to Wheatland Reservoir: according to the complainant's witness, J. A. Elliott, no water was carried over in Wheatland Reservoir from 1910 to 1911, nor from 1911 to 1912 (170). According to the Wyoming hydrographer, Mr. Meeker, the flow at Look Out, which is immediately above the Wheatland Reservoir, from May 27th to December 31st, 1912, was 119,770 acre feet, and there was in the reservoir on May 27th, 1912, 36,600 acre feet (Exhibit K). There was, of course, considerable flow into the reservoir prior to May 27th, as the high water in the river begins prior to that date. Assuming this amount to be 6,000 acre feet, which is conservative, there was into or through the reservoir in 1912, 162,370 acre feet (3483). There was withdrawn from the reservoir in 1912, as shown by the records at McGill station on the river below the reservoir, 95,653 acre feet, and it is known that there was water discharged from the reservoir at a date in 1912 earlier than that shown by the McGill station records. Assuming that to be 6,000 acre feet, the total amount drawn through the reservoir was 101,653 acre feet (3483), which subtracted from the amount into or through the reservoir, 162,370, leaves a balance of 60,717 acre feet (3484), while Meeker, according to Exhibit K, states that on November 18, 1912, there was 43,000 acre feet left in the reservoir, and from November 18th to the end of the year 1912, the inflow was 5,540 acre feet; or, according to Meeker's estimate, 48,540 acre feet at the end of the year 1912. These figures are substantially confirmed by the testimony of J. A. Elliott, the engineer having Wheatland Reservoir in charge, that there was 40,000 acre feet in the reservoir at the end of the irrigation season of 1912 (170). The inflow for October, November and December was 19,070 acre feet and the outflow only 463 acre feet, leaving the amount which should be in the reservoir at

the close of the season 58,607 acre feet (3484). Allowing for evaporation, this discrepancy between Elliott and Meeker can be accounted for by the difference in their estimates of the capacity of the reservoir, Elliott basing his figures upon a capacity of 120,000 acre feet (170), while Meeker takes a capacity of 83,500 acre feet.

Referring now to Wheatland Reservoir No. 1, which is a smaller reservoir located near the center of the Wheatland tract, capable of storing water not only from the Laramie River through the Wheatland tunnel, but also water from Sybille and Blue Grass creeks; this Reservoir has an active capacity, according to the witness Elliott, of 7,000 acre feet (166), and is used for the irrigation of lands in the Wheatland tract. Complainant's Exhibit K contains the statement that there was on storage September 10, 1912, 10,500 acre feet, estimated, and on November 1, 1913, 2,100 acre feet, showing a use above any water that may have been stored in the reservoir during the year 1913 of 8,400 acre feet.

Lake Hattie, according to the Wyoming testimony, has an active capacity of 68,500 acre feet, with a dead or unavailable capacity of 42,000 acre feet additional, and the complainant's testimony showed that water was available; in other words, the dead space had been filled and water could be withdrawn in June, 1912. Complainant's Exhibit J by Meeker, shows that there was furnished from the Little Laramie alone in 1912, 14,053 acre feet, and from the Big Laramie (Exhibit I), 69,855 acre feet; or, a total of 83,908 acre feet. Exhibit K by Meeker shows that on November 20, 1912, there was 18,700 acre feet available storage in the reservoir and that no water was run from the reservoir in 1912. It would therefore seem that the difference between the total inflow, 83,908 acre feet, and the amount on hand November 20, 1912, 18,700 acre feet; or, 65,208 acre feet, is probably the dead or inactive capacity instead of the 42,000 acre feet testified to, subject, however, to this modification, that there is, of course, considerable loss by evaporation and seepage. Allowing 3,208 acre feet for this loss, the dead capacity would then appear to be 62,000 acre feet and the total amount stored in 1912, both available and unavailable, would be, with this correction, 80,700 acre feet. On April 24, 1912, according to Exhibit K, there was 19,400 acre feet stored and available and the inflow from the Big Laramie in 1913, from April 25th to some date not mentioned, in June, was, as shown by Exhibits K and I, 28,470 acre feet. On November 5, 1913, there was 26,000 acre feet in the reservoir (Exhibit K). There was, therefore, used or lost through evaporation, seepage, etc., 21,870 acre feet. Allowing for possible loss by seepage and evaporation, 5,000 acre feet; the use of the reservoir was 16,870 acre feet for the year 1913, which is admittedly a very low year

in the amount of water supply. Nevertheless, during this low year, Lake Hattie succeeded in increasing its storage above its use and loss by evaporation, from 18,700 acre feet on November 20, 1912, to 26,000 acre feet November 5, 1913; or, 7,300 acre feet, without taking any water whatever from the Little Laramie River in that year (3487).

It therefore appears that there was stored in these reservoirs, in the year 1912, above the amount actually used for irrigation from the reservoirs, the following:

In Lake James.....	18,400 acre feet
Wheatland No. 2.....	47,000 acre feet
Wheatland No. 1.....	10,500 acre feet
Lake Hattie	80,700 acre feet
Or a total of.....	156,600 acre feet

This amount, 156,600 acre feet, is manifestly the amount stored in excess of the use and evaporation from the reservoirs in that year (3488).

Furthermore, the records at Wheeler's Bridge, which is on the Laramie River below the canon, for the year 1912, indicate that there was about 10,000 acre feet of water passed that point, which is above the mouth of Sybille Creek. 1912 was a year of larger flow than 1913, and yet the records for the year 1913 show that there was 19,000 acre feet discharged by Sybille Creek. 1912 would undoubtedly be greater and probably as much as 20,000 acre feet. Chugwater, for the year 1912, according to the records, discharged 18,300 acre feet. Adding these amounts to that left in the reservoirs, 156,600 acre feet, gives a total of 204,900 acre feet, the aggregate amount carried over in storage (above the use) and the amount wasted (3489). Estimates of seepage loss, of course, may vary. If it be contended that Field's estimates in this regard are low, then his estimate of this amount of surplus water, 204,900 acre feet, would be reduced accordingly.

The witness Field increases this amount by the addition of estimates of loss by evaporation and waste not heretofore detailed, a consideration of which is not necessary for this argument. However, this amount, 204,900 acre feet, must not be understood as being the total supply of water for irrigation for that year. It does not include the amount used, either by direct irrigation from the river through the ditches, or the use from the reservoirs themselves. It is merely the amount carried over in storage that year plus the amount passing down the river at Wheeler Bridge and the amounts discharged into the Laramie River from Sybille and Chugwater Creeks.

According to the witness Elliott for Wyoming, the amount of water furnished to the Wheatland tract in the year 1912

was 100,000 acre feet (170). The amount diverted through the Pioneer Canal in that year, according to Meeker, was 17,703 acre feet (Exhibits B, I and T-7), all other ditches between Pioneer Dam and Two Rivers (Big Laramie), 29,892 (Exhibit T-7), ditches between No. 2 Dam and Two Rivers (Little Laramie), 17,245 (Exhibit T-8). These amounts added to the sum of 204,900 acre feet, give 369,740 acre feet, and still do not account for a large amount of irrigation through numerous other ditches.

Referring again to the 1912 records, showing an inflow into Lake Hattie Reservoir from the Big Laramie River of 69,855 acre feet, as shown by Mr. Meeker on Exhibits B, I and T-7, and which were adopted by Mr. Field in his analysis of the Wyoming evidence, it is of interest at this time that, in rebuttal, Mr. Meeker criticised Mr. Field's analysis, particularly his graphs showing the flow and use of water on the Big and Little Laramie Rivers for the year 1912, Exhibit 136, and 1913, Exhibit 141, contending that he had duplicated the amount of water diverted by the Pioneer Canal, the amount being 17,703 acre feet in 1912 and approximately 12,000 acre feet in 1913, and that the error had been carried through both charts. Upon being challenged on cross-examination, he corrected this statement (4322) and revised his Exhibits B, I and T-7 from which Mr. Field had taken the data relative to the distribution to the various reservoirs, and admitted that he himself had made a duplication of the 17,703 acre feet and deducted that amount from the sum which he charged to Lake Hattie Reservoir from the Big Laramie River in 1913 and added it to the amount charged to the Wheatland Reservoir No. 2 and the ditches below Two Rivers. Therefore, in so far as Mr. Field is concerned, the corrections made by Mr. Meeker in his distribution simply reduce the amount of storage for 1912 in Lake Hattie and increase the amount in Wheatland Reservoir No. 2 proportionately. The witness further corrected his testimony and admitted that the error of 12,000 acre feet which he charged in Exhibit 141 did not, in fact, exist (4323-4).

In regard to the dead space in Lake Hattie which has to be filled before any stored water is available, and which, according to the testimony of Wyoming's witness Bishop, is 42,000 acre feet, and which the witness Field states may be as great as 62,000 acre feet, it is pertinent to say that the demand for water to fill this dead space is not constant, that is, once having been filled, it will, except for the loss occasioned by seepage and evaporation, remain in the reservoir and the initial filling of the reservoir made a greater demand on the river than subsequent fillings will do. If this reservoir had been filled prior to 1912, then, with the amount of water diverted into this reservoir in that year, the reservoir would have been entirely

filled and approximately 12,800 acre feet would have been the surplus (3494).

Moreover, without any comment upon the economy of maintaining a condition which could, by the expenditure of some labor, be remedied at least in part, that is, maintaining a reservoir with this enormous amount of dead space from which there is bound to be considerable loss in any year, nevertheless the amount of water required to fill this dead space, if applied to the lands of the defendant, The Greeley-Poudre Irrigation District, would have been sufficient to have irrigated a number of acres equal to about 75 per cent of the total number of acre feet of such water for one year (3495). However, for the purpose of future consideration of the demands upon the river, this dead space can be eliminated from consideration.

To more graphically illustrate the flow of water in the river, the witness Field produced several diagrams or hydrographs showing the flow of water in the Laramie River in the year 1912.

The first of these, Exhibit 132, represents the amount of water flowing past certain points on the Laramie River from the Sky Line Canal to Woods Landing for the different months in the year 1912, differentiating between the amounts diverted to the Sky Line and Divide Ditches, the amount which could be diverted by the tunnel and collection ditches of the Greeley-Poudre System, the inflow from Glendevey to Boswell's station and from Boswell's station to Woods Landing. The hydrograph is explained by the witness in his testimony on pages 3497 to 3499.

Exhibit 133 is a similar representation based upon the flow of the Little Laramie River for the year 1912, and is discussed at pages 3499 to 3501.

Exhibit 134 is a similar diagram representing the flow and use from Two Rivers, Wyoming, the junction of the Big and Little Laramie Rivers, to Look Out, the station immediately above the Wheatland Reservoir (3501).

Exhibit 135 shows graphically the condition of Wheatland Reservoir No. 2 for the year 1912, in so far as there are available records. The diagram is constructed almost entirely upon data furnished by witnesses for the complainant. The upper curved line represents the combined flow of the Big and Little Laramie Rivers at Two Rivers station. The second line from the top represents the flow at Look Out station, the head of the Wheatland Reservoir. Both of these lines represent the total amount discharged up to any given date, but do not represent the flow at any one period. The third curved line from the top, marked "Out-flow less intake," is obtained by subtracting the out-flow as recorded at McGill station below the reservoir from the inflow. The blank area between these two lines

represents the outflow and is indicated by the scale on the graph. The bottom line designates the quantity reported in the reservoir by R. I. Meeker for the complainant, and the cross hatched area between the first and second lines represents the loss or use between Two Rivers and Look Out, or possibly errors in measurements. This exhibit is based upon the assumed capacity of 83,500 acre feet, that being the amount testified to by Meeker. If the capacity were greater than that amount, then the lines on the graph would be, as a whole, moved upward. This exhibit is discussed at pages 3502 to 3504 of the testimony.

Exhibit 136 is a mass diagram showing in a different manner the flow of the river for the year 1912 at different points and also the use of water during the year. The upper line of the diagram represents the supply of water expressed in acre feet, commencing with the source of the river and continuing to the mouth of Chugwater Creek, including also the discharge of the Little Laramie, aggregating a total of approximately 480,000 acre feet. The lower line shows the flow at the various points indicated after deducting the use or diversions from the river, and indicates that 50,000 acre feet passed down the Big Laramie River below the mouth of Chugwater Creek in the year 1912. (3505-3510).

Exhibit 137 is a mass diagram showing the amount of water from the Sky Line Canal to Wood's Landing on the Big Laramie River in 1913, similar to Exhibit 132 for the year 1912. (3538).

Exhibit 138 is a mass diagram of the Little Laramie River from Filmore to Two Rivers, showing the flow and distribution for the year 1913, similar to Exhibit 133, which was for the year 1912. (3539-3540).

Exhibit 139 is a mass diagram showing the flow and distribution of water in the Laramie River between Two Rivers and Look Out in the year 1913, similar to Exhibit 134 for the year 1912 (3541).

Exhibit 140 is a mass diagram of the inflow and outflow of Wheatland Reservoir for the year 1913, based upon two assumed capacities, the red lines indicating the inflow and outflow based upon a capacity of 123,000 acre feet, the blue lines indicating the inflow and outflow based upon a capacity of 83,000 acre feet. This diagram is similar to Exhibit 135 for the year 1912 except that Exhibit 135 was based only upon the assumed capacity of 83,500 acre feet (3542).

Exhibit 141 is a diagram for the year 1913, similar to Exhibit 136 for the year 1912, showing the accumulations of the discharge of the Laramie River and its tributaries, together with a representation of the flow after the diversions have been made and showing 30,000 acre feet passing out of the river below the mouth of Sybille Creek. This diagram does not in-

clude any discharge from Chugwater and in that respect differs from Exhibit 136. The mouth of Chugwater is below the lowest point indicated on the exhibit. (3542-3.)

Exhibit 142 shows graphically the supply and use of the water of the Laramie River in so far as it applies to the total supply of the river and the diversions by the Sky Line and Divide Ditches, and those which will be made by the Greeley-Poudre system. In other words, it graphically shows, in five columns, the total water supply by Colorado to the Laramie River and the relative amounts which will be diverted by Colorado.

Exhibits 132 to 142 are all drawn on a scale representing acre feet, the figures being noted on the scale at the left hand margin. The height to which any column or line ascends therefore indicates the number of acre feet represented. In all of them, the scale from left to right, or the horizontal scale is prepared for the various months of the year, but only in part is this scale appropriate. This will be clearly noticed when the exhibit in question is examined. In Exhibit 142 Mr. Field shows in column five the total flow of 254,000 acre feet per annum from Colorado. Column 1 shows the relative amount diverted by the Sky Line and Divide Ditches; Column No. 2, the tunnel diversion as planned, No. 3, the tunnel diversion plus the amount which might be diverted if the Lower McIntyre extension were made, and No. 4, the total of all of the Colorado diversions including the possible Lower McIntyre extension. The exhibit merely represents in graphic form the conclusions which Mr. Field arrived at as to the relative amount of Colorado water which can be diverted and which has been heretofore referred to (3544, 3545).

The witness then reviews the testimony of the Wyoming hydrographer, Mr. Meeker, considering more specifically his exhibits, which are based upon measurements through a portion of the years 1912 and 1913, as heretofore stated, although these were afterwards supplemented on rebuttal by a continuation of records to the date upon which the rebuttal testimony was given.

On complainant's Exhibit B, I and T-7, each of which is a table produced by Mr. Meeker, showing the flow of the river at the Pioneer Dam where Meeker found, or rather, estimated a flow of 207,000 acre feet for the year 1912, there is an apparent error in this, that the records at Boswell Station for 1912, exclusive of the Sky Line and Divide Diversions, shows 205,678 acre feet. There should be added the inflow from Johnson and Beaver Creeks, about 27,500 acre feet from both the Colorado and Wyoming areas, and other miscellaneous drainage sufficient to bring the total up to 239,697 acre feet at Pioneer Dam, a discrepancy of over 32,000 acre feet. The error appears to lie

particularly in the discharge for the month of June. At Boswell's Station the gaugings by the State of Colorado show a discharge for the month of 92,912 acre feet and the inflow between Boswell's and Wood's Landing from tributary streams was 9,914 acre feet, making a total of 102,826 acre feet, while Meeker in the three exhibits last mentioned, reports 91,874 acre feet, and in data furnished at the request of defendants but not introduced in evidence, showed 86,003 acre feet for the month of June. The result is that Meeker's tables are so faulty in material points as to discredit their correctness (3547).

The United States Geological Survey, according to measurements taken in the year 1912, found 94,700 acre feet in the Big Laramie alone at Two Rivers station from April 5 to October 31, inclusive, in 1912. (Ex. 143.) This would indicate an annual discharge of 120,000 acre feet against Meeker's estimate of 89,550 (Exhibit B), or a difference of 30,450 acre feet.

On Exhibit I for the year 1913, Mr. Meeker estimates 45,709 acre feet in the Big Laramie at Two Rivers, indicated on the table as "Wheatland Reservoir No. 2 and intermediate ditches below Two Rivers," while the Geological Survey records for the same year show a discharge of 54,001 acre feet (Ex. 143), a discrepancy of 8,292 acre feet (3548).

The mean shown on Meeker's tables B and I, based upon measurements for a part of the year 1912 and part of the year 1913, is misleading unless it be definitely understood that it is merely the mean of the figures given and not the mean discharge of the river. The year 1912 was approximately normal, while 1913 was only about half of normal, so that obviously the mean of these two years would not be the mean discharge of the river (3549).

Complainant's Exhibit J is also in error. It shows a discharge, June 1st to December 31st, 1912, of 93,667 acre feet at the Lake Hattie No. 2 Dam on the Little Laramie. On tables furnished defendants by Mr. Meeker, the discharge for November and December aggregated 3,760 acre feet. Deducting this amount gives a total for the period June to October of 89,907 acre feet, whereas the United States Geological Survey records for the same period show 94,200 acre feet. On the same table Meeker credits 37,556 acre feet to the Wheatland Reservoir and intermediate ditches below Two Rivers. In other words, this is the amount which he credits to the Little Laramie River at Two Rivers, exclusive of any inflow between Two Rivers and Wheatland Reservoir, he contending that there is none, whereas the United States Geological Survey for the same period shows 42,540 acre feet at Two Rivers, a discrepancy of approximately 5,000 acre feet (3551).

Complainant's Exhibit L, which is a table produced by the hydrographer Meeker, purporting to give a summary of the storage in the years 1912 and 1913 in the reservoirs, Wheatland Nos. 1 and 2, Lake James and Lake Hattie, is criticised particularly for the reason that the amount shown by this exhibit to be in Lake Hattie on November 20, 1912, 18,700 acre feet, does not show the amount of dead water which the reservoir held and which was, of course, a demand upon the river in that year and would be available, as stated, in any other year except the year of initial filling. In other respects assuming the correctness of the table, this dead water would have to be added to the total given in the summary for the year 1912 on Exhibit L (3552). If this dead water amounts to 42,000 acre feet, according to Bishop, then the total shown on the summary of 91,100 should be increased to 133,100 acre feet, or, if as estimated by Mr. Field, this dead water amounts to 62,000 acre feet, then the total amount for the year should be increased to 153,100 acre feet. It should also be noted that this table shows the storage as of date November 20th for both the years 1912 and 1913, not the total storage at the close of either year, which would doubtless be greater than the amount on November 20th.

Complainant's Exhibit M, also produced by Meeker, is criticised. This table purports to give the relation of run-off on the Laramie River between Glendevey and Wood's Landing stations and is subject to the same criticisms as have been directed to Meeker's 1912 records at the Pioneer Dam which have been previously discussed. The mean which the table assumes to produce is based upon entirely too short records, even assuming their correctness, for the year 1913 was admittedly much below normal. 1911 was also a low year, but not as low as 1913 (3553). If the comparison between the two stations was based upon the normal flow, the relation is 77,000 acre feet for the Glendevey station and 215,500 acre feet for the Wood's Landing station, after deducting the amount diverted by the Sky Line and Divide ditches at both stations. In other words, the Glendevey flow is 35 per cent of the Wood's Landing flow (3553). The note on the bottom of the exhibit which reads "Run-off at Woods, Wyoming, for July, August and September represents substantially the entire run-off of the Laramie River, except surplus from the Little Laramie River passing in occasional years and in considerable amounts produced by summer freshets" is not true. It does not include the amount diverted by the Sky Line and Divide ditches on the Big Laramie and there is heavy discharge from the Little Laramie River in all years. (See complainant's Exhibit J and T-8, prepared by Meeker and also defendant's Exhibit 131 and 144.)

Complainant's Exhibit K is criticised in this, that the statement that on May 27, 1912, there was 36,600 acre feet

in the Wheatland No. 2 reservoir is based on the assumption that the active capacity of the reservoir is 83,500 acre feet instead of 126,000 acre feet (3556) and for the further reason that there is no record as to the amount withdrawn from the reservoir prior to May 27th, but there is information that this discharge was as high as 600 cubic feet per second.

Professor L. G. Carpenter, the second witness for the defendants on the question of the amount of water available in the Laramie River, explains at length the methods adopted by hydrographers in measuring streams, with a criticism of the various methods, showing the relative accuracy of various ones (3761-3776), and then explains how rating curves and discharge curves are erected (3776-3777). He explains his study of the question of precipitation at various points affecting the run-off of the Laramie River and on streams to be compared with it in this regard, this investigation covering a period of years (3778-3784).

Professor Carpenter, while Director of the Colorado Experiment Station at Fort Collins, encouraged measurements on the Laramie River in Colorado. These were undertaken in 1902 and subsequent years by the United States Geological Survey, the hydrographer being a Mr. Lamb, a former student in the Colorado Agricultural College under Professor Carpenter (3789-3790). After the Geological Survey ceased taking measurements, Professor Carpenter furnished an automatic gauge to Mr. Decker who has been previously referred to, who took records for some time (3791) at the station known as Decker's.

In the year 1912, Professor Carpenter, with from one to three assistants, spent considerable time on the Laramie River and its tributaries, making measurements, particularly until the high water had passed. In that year there was an automatic gauge at the Boswell station which Professor Carpenter, upon examination, found to be defective in that the pen on the record had a constant tendency to show a lower discharge than actually existed in the river. Corrections were made from time to time by the witness or his assistants whenever one of them happened to be present when the record-keeper was changing the chart. Neither the witness nor his assistants had the instrument in charge and so could not correct it at all times, but only when they were able to co-operate with the keeper, who lived some distance from the station (3792-3795). On all occasions when a check was made it was found that the instrument was recording less than the actual flow of the river (3795). This chart gave the record upon which the State Engineer of Colorado based his published report.

In addition to this error, Professor Carpenter discovered what had apparently been overlooked by all hydrographers

previous to that time. By reason of a topographical formation, the river in the valley at Boswell's station flows generally northward, makes a bend, curving for a short distance to the east, and then turns again to the northward. The station where the records were obtained was located a short distance below this second bend, and it was discovered that when the water became high it overflowed and passed down through three separate channels to the west of the station, entering the river again at some point below, the result being that all of the water which passed through these extra channels escaped measurement inasmuch as only the main channel itself was in contemplation of the hydrographers making measurements, and the records, regardless of the inaccuracy of the measurements, failed to disclose the high water discharge of the river (3798). The witness immediately made measurements of the cross sectional area of these extra channels and also the height upon the gauge rod at the station in the main channel at which the overflow would occur (3798-3799). The channels in question are rather large and capable of carrying a material quantity of water. For illustration, on June 4, there was, in addition to 2,012 cubic feet per second passing in the main channel, 500 cubic feet of water per second of time passing through these three overflow channels, the total of which would have been, if correctly measured, the reported discharge of the river. On June 11 there was 220 cubic feet per second passing through the overflow channels and 1,790 cubic feet per second in the main channel (3801). This overflow continued for something more than four weeks during the period of highest flow in the river. Measurements taken by the witness and his assistants showing the discharge at various gauge heights are given (3803).

A diagram showing graphically the water which passed through these extra culverts and which was not included in the published records of the State Engineer, was introduced, Exhibit 158. In this diagram the discharge at Boswell's station, as shown by the published report of the State Engineer of Colorado is shown in yellow and the additional and greater discharge based upon Professor Carpenter's measurements, passing through the culverts and not recorded, is indicated by the red color on the diagram. The diagram covers a period commencing about the 17th of April and ending the 30th of September, and shows that about June 4, 5 and 6 the discharge was approximately 2,512 cubic feet per second. A glance at this exhibit makes clear the relative amount of water which was not included in the measurements made by the State Engineer's office and shown by his published figures. The witness Field, in arriving at his conclusions as to the flow of the stream, used the figures given by Professor Carpenter from his

actual measurements in making his determination of the flow at the Boswell station.

Professor Carpenter made no measurements personally in 1911. The presumption is that the error in the recording instrument at the Boswell station which he found in 1912 existed in 1911, and that the published record based upon the chart of the defective instrument shows a discharge less than the true discharge. The other condition, that is, that the high water in the river passed through the culverts mentioned, would be true of any year when the river reached a height sufficient to cause the overflow. An examination of the published records of the State Engineer for the year 1912 discloses that the defects in the recording instrument were taken into consideration whenever a correction was made on the chart, otherwise no correction was made, neither does the published record include the water passing through the extra culverts (3808).

The measurements made in 1912, in addition to those on the Laramie River itself at Glendevey and Boswell's, included regular observations on Grace Creek, Bear Creek, Johnson Creek, Jimmy Creek, Forrester Creek, Fox Creek, Beaver Creek, Stubb Creek, Nunn Creek, Deadman Creek, Rawah Creek, McIntyre Creek, La Garde Creek, Stuck Creek, at the Lake Hattie inlets, that is, both on the Big and Little Laramies, and on the Little Laramie and also occasional measurements on other tributary streams as opportunity permitted (3811). The data relative to these measurements was furnished to the State Engineer, John E. Field, a witness in this case (3812).

The witness reviews the hydrography of the several tributaries of the Laramie River (3813-3816), showing the relative size of each and its discharge, and also the watersheds which they drain, supplementing his investigations through the snow measurements before referred to, correlating the discharge measurements which he had taken with the depth of the snow as determined by his investigation, and describes with considerable detail the snow measurements and the relative amount of water which the watersheds would produce (3816-3823). He found that the range to the west of the Laramie River, known as the Medicine Bow Range, was a very excellent source of water supply and better than he had anticipated. We believe we are justified in stating that Professor Carpenter's wide experience in hydrographic matters, coupled with his very exhaustive investigation of the Laramie River and its watersheds, enables him to testify with far greater accuracy than if his knowledge of the situation was limited to measurements taken at a limited number of points on the stream for a portion of the year 1911, all of the year 1912 and a portion of the year 1913, as did Mr. Mecker, the Wyoming hydrographer.

Exhibit 156 is a number of photographs showing these snow measurements, the views being taken at various points from the head of the Laramie River in Colorado northward to the Centennial Mountains at the head of the Little Laramie River in Wyoming. The number on each individual picture has no connection with the case, being merely the serial number in the filing system used by Professor Carpenter, but each picture contains a legend showing the date upon which it was taken and the location. These views are described at pages 3883-3892.

The range is much broader in Wyoming than in Colorado, and, while there are some slightly higher elevations in Colorado than in Wyoming, this higher area is not extensive and the precipitation to the northward in the Wyoming area is greater than the precipitation at corresponding elevations in Colorado and a large part of the range in Colorado, that is, the part of lower elevation lying about fifteen miles south of the state line, is not so good a source of supply as is the Wyoming area (3891-3892).

During the year 1912 Professor Carpenter, in addition to his snow measurements, made many measurements on the Little Laramie River at Filmore and kept daily records. At that point the drainage area of the Little Laramie River is about 163 square miles, or 104,000 acres. The run-off for the month of June alone was 76,632 acre feet, and in July 27,676 acre feet by actual measurement, or practically a run-off for the two months of one foot in depth for the drainage area. That is, the run-off for June and July alone amounted to approximately 104,000 acre feet (3894). Contrast this with Meeker's estimate of 93,667 acre feet for the entire year of 1912 (Exhibit T-8).

Exhibit 157 is a hydrograph showing the flow of the Little Laramie River at this station, based upon measurements from May 20th to some date in October in the year 1912. It shows the flow in cubic feet per second for each day during the period covered, the highest discharge being in the month of June when the river reached a height of approximately 1,960 cubic feet per second.

The Greeley Poudre system, by means of its tunnel and collection ditches under construction, exclusive of the possible extension to the Lower McIntyre, in other words, the Greeley-Poudre system as contemplated, will divert 23½ per cent of the run-off of the Big Laramie River and its tributaries from Colorado, that is, 23½ per cent of the Colorado water. This is based not alone upon the measurements made in the year 1912, but upon investigations conducted by Prof. Carpenter through a number of years, particularly during the years 1909 and 1910, and upon which he made a report concerning the water supply available for the Greeley-Poudre Irrigation District (3933-3957). The project, as reported on by Prof. Carpenter after

his examinations in the years 1909 and 1910, did not include a consideration of the possible extension of the system to the Lower McIntyre, but did include the system as planned and under construction. Prof Carpenter's estimate at that time, as shown by this report, was that there was 70,100 acre feet of water available for the system from the Laramie River (3936), and his conclusion as to the total flow is that at Wood's Landing, with a watershed of 404 square miles, the actual run-off for a period of eleven years averages about 14 inches after deducting the diversions by the Sky Line ditch. This means, in other words, that the Wood's Landing net flow is approximately 301,000 acre feet per annum, and therefore the diversion of 70,100 acre feet at the tunnel by the Greeley-Poudre system means 22 per cent of the total Colorado flow or approximately 23½ per cent of the net flow after deducting the Sky Line Diversions (3956-3957). It will be noticed that Professor Carpenter's figures of the amount which may be diverted by the tunnel differ from those of Mr. Field. Carpenter finds that this diversion will amount to 70,100 acre feet; Field finds 56,000 acre feet. This difference is consistent with their difference as to the total flow, Field finding that the total Colorado water is in excess of 250,000 acre feet per year and Carpenter finding it in excess of 300,000 acre feet. It is significant, however, that they agree as to the percentage of the total supply of water which can be diverted through the tunnel. Field's conclusions as to the total flow are, according to Professor Carpenter, very conservative. Lest it be suggested that the witness Field may have struck an average between Professor Carpenter and the one Wyoming witness upon this point, Mr. Meeker, we direct the attention of the court to the fact that Meeker's conclusions in this regard were never testified to until the complainant introduced evidence in rebuttal.

The complainant placed Mr. Meeker on the stand in rebuttal on May 21, 1914, to which time he had continued his measurements on the Laramie River, and some of his previous tables were enlarged accordingly. He criticises the conclusions reached by the Colorado witnesses Field and Carpenter, as a rule not specifically, but, as we understand him, for the general reason that their tables were not all based upon personal measurements and because of the possibility of error in the work of other hydrographers (4272-4278), and states that he found errors in some of the earlier records of the Laramie River at Wood's Landing, due to the presence of ice in the stream when winter measurements were taken. On cross-examination, however, he admits that Field discarded these winter records (4331). As a conclusion of his criticism, he states (4279) that he would not feel justified in modifying his own records "because they have been secured under known conditions with

hydrographic methods of much greater efficiency and accuracy than those secured in the earlier days."

He criticises Professor Carpenter's measurements taken at Boswell station, contending that the professor had taken too great a cross sectional area and too high mean velocities, while he prepared from his own measurements an area curve which he calls a standard area curve and a discharge curve which he terms a standard discharge curve. From these he prepared a discharge table which he terms a standard discharge table, Exhibits T-1, T-2 and T-3. In Exhibit T-4 he gives a comparative table of the run-off at the Colorado line for the months of April to November, inclusive, in the year 1912, based upon the published records in the 16th Biennial Report of the State Engineer of the State of Colorado, showing a discharge of 160,873 acre feet (erroneously printed in the abstract as 169,873); the figures of the witness Field showing 183,983 acre feet, and his own revision showing 165,837 acre feet for the months mentioned. It will be noticed that for the period covered by this table, that is, April to November, inclusive, Mr. Meeker is only 5,000 acre feet, in round numbers, higher than the published report of the State Engineer, although he admits that he knew that at the Boswell station the higher water passed through the three culverts which we have described and escaped measurement. The report of the State Engineer of the State of Colorado for the year 1912 was based upon the records of an automatic gauge which, as we have previously explained, was found by Prof. Carpenter to record less than the total discharge. Some corrections were made on some of the charts when this defect was noticed, but even if full correction was made, nevertheless the published record failed to include the water passing around the station. Assuming that that is the only error in the published record, nevertheless Mr. Meeker is palpably in error when he allows, on his revised figures based upon his so-called standard discharge curve, only 5,000 acre feet in addition to the 160,000 acre feet shown in the published record because, by actual measurements, Prof. Carpenter on June 4, 1912, found 500 cubic feet per second passing around the station and thereby escaping measurement; on June 11, 220 cubic feet per second, and at other dates various other amounts. Now 500 cubic feet per second is equivalent to approximately 1,000 acre feet per day, so that if the overflow of 500 cubic feet per second lasted for five days alone, it would amount to the total allowance which Mr. Meeker has given in excess of the erroneous record of the State Engineer. As a matter of fact, this overflow condition continued for more than four weeks and the total amount is indicated by the hydrograph prepared by Prof. Carpenter and previously referred to, Exhibit 158. It is approximately 28,500 acre feet.

Prof. Carpenter's measurements on the Little Laramie which were submitted to the witness are likewise criticised and two tables are put in evidence, T-5 giving a portion of the run-off for the year 1912, and T-6, a portion of the run-off for the year 1913, in connection with this criticism. We are unable to understand upon what the criticism is based, except that the witness disagrees with Prof. Carpenter.

In criticising the witness Field, Meeker states (4293) that Field, in his compilations, had used Meeker's figures when they were higher than the Colorado records and the Colorado records were higher than the Meeker records. This, however, is not borne out by Mr. Field's testimony which was to the effect that if he had used all records, his conclusion as to the flow at the state line would have been higher than he found it.

Exhibit T-7 is a continuation to the 15th of May, 1914, of the measurements made at the Pioneer Dam on the Laramie River and supersedes Exhibits B and I. This was, as will be shown later, afterwards corrected. A table, T-8, was later introduced, showing a continuation of the measurements made by the witness Meeker on the Little Laramie River, superseding Exhibit J.

In answer to a question as to his opinion as to the character of the years 1912 and 1913 with respect to the relative amount of flow of the Big and Little Laramie Rivers as a result of his measurements and observations for these two years and comparison of such records as were available for other years, the witness states:

> "Based on a review of the flow records taken only in a general way and other hydrographic information, I have concluded that the year 1912 was slightly above normal in the Laramie River basin and that roughly, the normal at Wood's Landing station or Pioneer Dam for a normal year is approximately 200,000 acre feet, and that the year 1913 was a trifle above 50 per cent of normal." (4296.)

In making this comparison, the records of the North Platte River at Saratoga, Wyoming, were considered, as heretofore stated. It will be observed that this conclusion of the witness, in so far as we have been advised of the method by which it was reached, is based entirely upon his own measurements shown by the Exhibits B, I and T-7 on the Big Laramie, coupled with a criticism, rather than a use of all other known records. Although he contended that he had reviewed other records, he failed to mention what they were or by whom made, nor how criticised. Witness admits that the automatic register maintained by the State Engineer of Colorado in the years 1911 and

1912 at the Boswell station was not registering the full amount of the discharge (4302-4303).

The estimate of Mr. Field of 12,800 acre feet per year as the normal run-off from the mountain territory along the west of the valley, discharged principally through Four Mile, Seven Mile, Cooper Creek and Mill Creek and other small streams, is criticised by Mr. Meeker with the statement that only a small portion reaches the stream, but he admits that most of this water is diverted before reaching the river and applied to lands along these creeks. The defendants contend for the purpose of this case that it makes no difference whether the water is used for irrigation along the creeks or whether the water is diverted for irrigation after it reaches the main stream. We are in no wise concerned with the location of the land under irrigation, except that it be in Wyoming (4304).

Mr. Field's estimate of 12,800 acre feet as being the normal discharge of the mountain area on the east side of the Laramie Plains is also criticised, although it is stated that Soldier Creek, Willow Creek and Five Mile Creek do contribute some water to the river. It is said, however, that from a point opposite Two Rivers northward to the Wheatland Reservoir there is practically no water from this drainage area that reaches the stream, but it is stated that this run-off is intercepted by lakes and ponds lying between the river and Black Hills and some is intercepted by the Oasis and Boughton ditches. (4306.) There is also irrigation from Soldier, Five Mile and Willow Creeks (4350). Again, we contend that if the water is intercepted either by ditches or by lakes and ponds, it in no wise negatives our argument that it is a source of supply, although it may not actually reach the Laramie River.

Mr. Field's statement, based upon the records of the State Engineer of Wyoming for 1911 and 1912, that 18,300 acre feet is discharged by Chugwater Creek, is likewise criticised because it is contended that this water does not reach the Laramie River but is used for irrigation along that stream above its mouth. Respondents likewise are in no wise concerned with the location of the irrigated area. We are the defendants in a case brought by the State of Wyoming, not by the appropriators of water on the Laramie River or on one of its tributaries. Chugwater, according to the Wyoming records, furnishes that amount of water, it is a natural tributary of the Laramie River, and we are in no wise responsible whether the water is used along Chugwater Creek or whether it is allowed to pass into the Laramie River below the Uva Station and thereby be allowed to escape (4307).

Moreover, the witness admits, on cross-examination, that a reservoir is proposed in the vicinity of Iron Mountain on

Chugwater Creek for the impounding of water from that stream (4353).

The witness then charged that Mr. Field, in his tables, had made a duplication of 17,700 acre feet in the year 1912 and 12,000 acre feet in the year 1913, but later, on cross-examination, as we have previously stated, he was compelled to correct this statement and admit that the error of 17,700 acre feet for the year 1912 was his own and also that there was no error in the 1913 record (4322).

Witness again reverts to storage and states, over the objection of defendants, that he finds the capacity of Wheatland Reservoir to be 83,400 acre feet. Based upon that capacity, that reservoir had in active storage on May 15, 1914, 58,000 acre feet; on the same date, Lake James had 21,400 acre feet and Lake Hattie 26,500 acre feet (4310). This is significant in view of the fact, as will be shown later, that at the date upon which the witness testified, the high water in the river had not yet been reached.

The witness speaks of the value of the Wheatland No. 2 Reservoir, which, because of the fact that it is built across the channel of the river, intercepts all seepage and waste waters from irrigation above (4319), and, on cross-examination, admits that, because of the topography of the country, no such reservoir is possible below irrigation on the Poudre River (4353).

On cross-examination the witness admitted that his error of 17,700 acre feet, which he first attributed to Field, ran through three tables introduced at different times, produced by himself, that is, Exhibits B, I and T-7, and that his mistake was never discovered until his criticism of Mr. Field was challenged (4324). He was also compelled to admit that an error was present in his Exhibit T-2, which he had just produced as a criticism of Professor Carpenter's measurements at Boswell station and in which he sought to give the discharge through the culverts in which the flow escaped measurement. On this table he gives the discharge at a gauge height of 3.65 as 480 cubic feet per second, whereas, according to his own discharge curve, it should have been 580 cubic feet per second, making the total discharge of the river at that gauge height 2,300 cubic feet per second instead of 2,200 cubic feet per second as indicated on the table, which, however, was corrected to meet this objection (4332).

He further admits receipt of a letter dated April 3, 1914, from Robert Follansbee, District Engineer of the United States Geological Survey, in answer to a letter of his own relative to high water measurements at the Boswell station made by the Geological Survey in the year 1911, which, inasmuch as their accuracy had been questioned, were made the subject of remeasurement on September 1 and 2, 1913, at which time Mr.

Follansbee ran levels to determine the approximate gauge height at which the overflow through the culverts would begin, and from which Mr. Follansbee found that the main overflow began approximately 1,050 feet up stream above the gauge, that the overflow would commence in the lowest overflow channel at a gauge height of 2.4, although it would not flow through the main overflow channel until it reached a gauge height of 3 (4334-4335). This measurement by the United States Geological Survey corroborates Professor Carpenter, who testified that on the night of the 30th of June, 1912, with a gauge height of 3, the overflow was imminent and that on the next morning, at a gauge height of 3.4, the overflow had occurred, so that it was apparent that the flow through the overflow channels began between the gauge height of 3 and the gauge height of 3.4 (3802). At any rate, Mr. Follansbee proves that Professor Carpenter is conservative.

Lake Hattie, according to the witness, had, on May 23, 1914, 26,500 acre feet available in storage and, although there was at that time approximately 1,400 cubic feet per second passing the Pioneer No. 2 Dam, yet no water was being stored in Lake Hattie, the reason assigned being that the superintendent had planned to finish some work on the dam which had remained unfinished in 1913, but, upon being pressed, admitted that the reservoir had sufficient water stored for use during the year 1914 (4345-4347), and that although the high water and flood stage of the river, which was late in the year 1914, had not yet been reached, in other words, was in prospect on the date upon which the witness testified, nevertheless, based upon snow reports and other information in reference to the condition of the watershed, the witness predicted that the year 1914 would be a year of very much greater flow than the year 1913 and would probably equal the year 1912 (4348). As a matter of fact, the winter of 1913 and 1914 was one of rather heavy snowfall throughout the Rocky Mountain area, although until late, the year 1913 had been a year of very low precipitation. The heavy snow came too late to be included in the measurements of the flow of the streams for 1913 concerning which Mr. Field and Professor Carpenter testified, while the witness Meeker, on rebuttal, was able to include some measurements of this flow.

THE AMOUNT OF LAND IRRIGATED.

It next becomes of interest to consider the amount of land irrigated, both in the Poudre Valley from the Poudre River and in the Laramie Plains and the so-called Wheatland area from the Laramie River. The amount of land irrigated

in the Poudre Valley is, of course, not an issue, except as it becomes so indirectly in a consideration of the necessity for water from the Laramie River, whereas, on the other hand, the amount of land irrigated in Wyoming from the Laramie River is directly in issue.

Irrigated Land, Poudre Valley.

No definite survey of the irrigated lands in the Poudre Valley was made. However, testimony of many persons familiar with the valley was taken and the figures given, it must be borne in mind, do not include the lands within the territorial limits of the Greeley-Poudre Irrigation District. The District lands amount to 125,000 acres, although there are more than that within the territorial confines of the district which are not, strictly speaking, district lands. Eliminating, then, the 125,000 acres within the district which it is proposed to irrigate but which is not now irrigated but is awaiting reclamation, we find from the evidence presented that the amount of land under irrigation in the Poudre Valley is approximately 300,000 acres. This amount, however, is what we might term the gross amount, with this explanation, that a quarter section under irrigation is called 160 acres, whereas, in truth, there may be a small portion of that quarter section devoted to buildings, barn yards, etc., which is, strictly speaking, not irrigated, if irrigation were counted by the amount of land devoted to crops under irrigation. Likewise the highways, which, of course, are not irrigated, would have to be deducted in order to get the net amount of irrigation. With deductions of this kind, the witnesses seem to agree that the actual net amount under irrigation is approximately 265,000 acres.

Mr. Wortham, the engineer of the Greeley-Poudre Irrigation District, places it at 275,000 acres (2134).

Mr. John L. Armstrong, the water commissioner for the Poudre Valley, states that the gross amount is from 305,000 to 310,000 acres; that, pursuant to the law, in 1912 he reported, by actual crop areas, 240,000 acres, but that amount did not include certain lands which were irrigated by seepage and return water nor a few very small ditches which he did not take into consideration, neither did this figure of 240,000 acres include lands covered by highways, barn yards and similar things, nor lands lying fallow; it is the net amount, determined by the actual areas devoted to actual crops irrigated by the ditches, with the exceptions mentioned, diverting water from the Poudre River. (2499.) His testimony was that at the date thereof there was an actual net amount under irrigation in the Poudre Valley of from 240,000 to 250,000 acres (2500).

Mr. J. F. McCreery, a witness for the defendants, who

had been devoting his time to the gathering of agricultural statistics and similar lines of work for the Greeley Commercial organization, testified that there were approximately 305,000 acres under irrigation in 1914 (3185).

Mr. A. A. Edwards, another witness for the defendants who had been for many years connected with irrigation enterprises in the Poudre Valley, fixed the number of acres irrigated at from 275,000 to 300,000 acres (2190).

Prof. L. G. Carpenter estimated the amount at 270,000 acres actually under irrigation (2294), and Mr. Field, the State Engineer, fixed the gross amount at approximately 300,000 acres and the net amount at from 250,000 to 275,000 acres. For the purpose of ascertaining the duty of water in the Poudre Valley, he took the figure 265,000 (3413-15, 3735).

Therefore, speaking of the irrigated area of the Poudre Valley, we believe the evidence justifies the statement that there is approximately 300,000 acres of land under irrigation, with the understanding that this includes a small portion of land in each section devoted to highways, buildings, barn yards and similar things, and in treating the question with respect to the amount irrigated from the Laramie River, the same method will be pursued, that is to say, we will speak of the gross amount of irrigation rather than the net amount as these two terms are here defined.

Irrigated Lands, Laramie Plains and Wheatland District.

For the sake of convenience, we will divide the Wyoming area irrigated by the Laramie River or its tributaries into two divisions, that lying to the east of the Black Hills, which we will term the Wheatland Tract, although, as a matter of fact, the original Wheatland tract is not all that area to be considered, and, second, lands lying within the Black Hills called the Laramie Plains.

There is no serious conflict in the testimony as to the amount of land under irrigation in the Wheatland area. The original Wheatland tract, according to the Wyoming testimony, was a desert land project, the undertaking dating from 1883 (70), and including 60,000 acres of land. In 1913, when the taking of evidence commenced, approximately fifty per cent of this was actually under cultivation (69).

M. R. Johnson, who had been for several years the superintendent of the company, placed the actual amount of irrigation at from 35,000 to 40,000 acres of land (5), whereas J. A. Elliott, another witness for the complainant who succeeded Mr. Johnson as superintendent, places the amount at 33,544 acres (168). He did, however, make an examination of a map prepared by the defendants, Exhibit 2, which showed the actual

amount of land under irrigation in this district, and testified (195) that this map "is substantially correct," and according to this map, the actual amount in the original tract under irrigation, without any deductions for roads, barn yards or similar things, and excluding the town of Wheatland, is 28,623.75 acres.

The complainant contends that as the settlement in the Wheatland tract began, they found themselves, in the absence of reservoirs, short of water during the period of low flow in the stream, that is, during the latter part of the irrigation season, and it was to supply late water that they built, first, the reservoir located upon the Wheatland tract known as Reservoir No. 1, which we have previously described, with a capacity of 7,000 acre feet, and also the large reservoir commonly called the Wheatland Reservoir and known as Wheatland Reservoir No. 2, with a capacity, according to Mr. Johnson, and Mr. Elliott, of 126,000 acre feet, and which was completed about 1900 and was supposed to have been necessary to relieve the situation occasioned by the shortage of water in the late season on the original Wheatland tract. It is significant, however, that, according to Mr. Johnson, the amount of land under irrigation at the date of the construction of the larger Wheatland Reservoir, that is, 1900, was only about 10,000 acres, and yet their reservoir capacity, in addition to the amount of water available by direct flow through the ditches, was 133,000 acre feet. It is therefore not surprising to learn that the company owning this system of works and undertaking the development of this tract of land, should later be looking about for additional areas upon which to put the vast amount of surplus water which they had available. Accordingly, two other tracts of land were filed upon, one almost immediately adjoining the original Wheatland tract on the southeast, known as the Bordeaux Tract, and another almost adjoining the original Wheatland tract on the northwest, called the Sybille or Cooney Hills tract. These last two tracts, that is, the Bordeaux and the Sybille tracts, are what is generally known as Carey Act lands. The Bordeaux tract contains 10,000 acres and the Sybille tract 30,000 acres (168-9). Although promoted by the same persons, generally speaking, as those who promoted the original Wheatland tract, they were not in contemplation at the time of the formation of the original project, nor, as a matter of fact, were they in contemplation when the Wheatland Reservoir was constructed (42). They seem to have been an afterthought, arising out of the abundant quantity of water made available by the construction of this extraordinarily large reservoir.

In the year 1913, no lands in the Sybille tract were under irrigation whatsoever. As a matter of fact, the ditch leading from the main distributing system for the Wheatland tract was

not fully completed, although the surveys had commenced in August of 1907 and construction work commenced in July, 1910, and there was under irrigation in the Bordeaux tract, according to Mr. Elliott, 1,004 acres (168), but according to defendants' survey, Exhibit 2, 451 acres. The survey for the ditch leading from the main system to this tract was commenced in February, 1904, and construction work in June, 1907.

It therefore becomes apparent that the promoters of this enterprise, in the year 1904, found themselves in a position to supply more water than the lands included within the original Wheatland tract for which the irrigation system had been constructed, needed, and they therefore, as an afterthought, began the project in 1904 called the Bordeaux tract, containing 10,000 acres and three years later, in 1907, began the surveys for the second after-project, the Sybille tract, containing 30,000 acres of land.

It therefore appears that at the date upon which the taking of evidence was commenced we have the original Wheatland tract, containing 60,000 acres of land, dating from 1883, which had in thirty years' time been developed only to the extent of fifty per cent, and while they had approximately fifty per cent yet to colonize and develop, nevertheless the same company undertakes the development of two other projects, containing, in the aggregate, 40,000 acres additional, but out of the whole 100,000 acres, dating from the three respective dates, upon which these projects were commenced, we find that they actually had under irrigation, according to Mr. Elliott, the superintendent of the company, a total amount of 34,544 acres (168), and according to the defendants' survey, 29,074.75 acres (Exhibit 2). There is no material difference in the testimony presented by the complainant or the defendants on this acreage, and it is unnecessary to indulge in any nice distinction as to whether the amount is 34,000 or 29,000. Probably the latter figure is correct, because it was based upon a definite survey, and we believe Mr. Elliott's statement to have been based upon a more general estimate.

Turning now to the Laramie Plains area, we find more difficulty in arriving at the exact acreage under irrigation. General estimates were given by various persons who testified as to the amount of land under irrigation under various ditches, but none of these are based upon a definite survey of the lands. Realizing the necessity of accuracy in this regard, the defendants, as early as possible, undertook the survey of the irrigated area in the Laramie Plains. This survey was made by a party in the field and the instrument employed was a plane table, this being an instrument of recognized merit, used by surveyors generally, including the United States Government in making both topographical and geographical surveys. The party com-

menced at Wood's Landing and worked down stream past the City of Laramie, on past the junction of the Big and Little Laramies for a distance of five miles due north, and thence back up the Little Laramie to Filmore, that being the point where the river emerges from the mountains and corresponds in a measure to Wood's Landing upon the Big Laramie River.

This survey was made of these lands in detail and an accurate map or plat was made in the field, showing every character of cultivation in the area surveyed. However, time did not permit of the completion of the plat, although the survey itself covered practically all of the irrigated lands in the Laramie plains, the only ones omitted being what might be termed the fringe on the edges of the main cultivated areas. In other words, practically all of the irrigated area in the Laramie plains was surveyed and the major portion was platted in such a way that the plat shows each tract of land, the character of cultivation, the division fences, the exterior ditches but not the interior laterals, and a classification of lands devoted to different uses. A photographic reproduction of this plat is introduced in evidence, Exhibit 114, and to this exhibit we respectfully request the consideration of the court. It will be apparent at once that this exhibit, as well as many others which were offered in evidence, could not be duplicated in the record, and we therefore pray the indulgence of the court in filing but one of each of these various exhibits.

Each page or sheet of the exhibit shows, in general, six sections. The first few sheets are the plats made of the survey near Woods Landing, and the sheets are numbered according to the numerical arrangement of the sections in their respective townships. Confusion will be avoided if the key map in the fore part of the exhibit is consulted, inasmuch as this key map will show the plat in the exhibit covering any specific section or sections desired.

For the sake of clarity, we will explain that the portion covered by the survey, but not platted, includes the irrigated area on the Little Laramie River from Filmore down to a well-known road, frequently mentioned in the testimony, called Sprague Lane. Generally speaking, the area surveyed but not platted was that portion of the territory under irrigation lying along the Little Laramie River where it runs diagonally across Township 16 North, Range 76 West, and a glance at the map attached to the answer of the corporate defendants will readily disclose to the court the area in question.

This survey was made with all possible care, although time prevented the doing of many things which defendants would have wished to do in acquiring a complete knowledge of the situation. But, with the exception of the fringes on the outside of the main irrigated area, this survey showed with the

accuracy of a survey, the total number of acres under irrigation, the total number of acres in meadow, in grain, in alfalfa, or in any other crop, and also classified the meadow lands into first, second and third class, or instead of third class, as termed by the Wyoming witnesses, irrigated pasture.

Counsel for the complainant endeavored to find inaccuracies in this plat, but, when the vast amount of land included in the detail of the survey is considered, it is significant that in only four instances was the complainant able to show even immaterial inaccuracies in this survey, none of which were at all important, and they are disclosed by a resurvey of certain specific sections as shown by the complainant's exhibits, S-1, S-2, S-3 and S-4.

This survey was made under the immediate direction of Mr. Field, the State Engineer, the party being in charge of the Deputy State Engineer, Mr. Emmett C. McAnelly, and the instrument being operated by George P. Woodhall, all of whom are witnesses for the defendants.

Upon the presentation of the evidence in chief, the complainant introduced a table, Exhibit E, purporting to show the irrigated lands on the Little Laramie River. This table was prepared by Mr. Meeker after a reconnaissance made by him and one assistant. He testifies that at times distances were measured by the speedometer upon the automobile in which he was traveling (988). Exhibit E attempts a classification of the lands in question into meadow, pasturage, oats and alfalfa, and summarizes the total as being 49,553, although Mr. Meeker in his oral testimony, placed the amount at 48,344 (983).

This table includes lands irrigated on Seven Mile and Four Mile creeks, as well as on the Little Laramie itself, and also includes 11,611 acres lying above Filmore, the point at which the stream was measured and its flow determined by the witnesses both for the complainant and the defendant. We have previously explained that this land, lying largely in what is termed the Centennial Valley, was not taken into consideration in the irrigated section for the reason that no witnesses whatsoever added the water necessary for its irrigation to the flow of the stream found at Filmore, although one large ditch, the Loback Canal, heads on the north branch of the Little Laramie River and diverts, or is capable of diverting, a large volume of water. In fact, it was used in conjunction with the Bellamy Canal as an intake into Lake James. The canal, however, along its lower course, does irrigate some lands which are included in the irrigated area by the defense, although the water taken through the canal, as previously stated, is not charged to the stream. These lands above Filmore in question are as follows, according to Exhibit E: 832 acres in Township 14 N., R. 78 W.; 178 acres in Township 14 N., R. 77 W.; 6,711

acres in Township 15 N., R. 78 W.; 2,916 acres in Township 15 N., R. 77 W., and 974 acres in Township 16 N., R. 78 W. We therefore contend that in order to be consistent, this amount of 11,611 acres must be deducted from the irrigated area contended for by complainant.

The defendants introduced a similar table, Exhibit 117, prepared by Mr. Woodhall, and based upon the plane table survey of the Little Laramie area, containing a slightly enlarged classification from that prepared by Mr. Meeker. According to the plane table survey, the total amount of land under irrigation on the Little Laramie below Filmore, the point of the measurement of the stream, is 31,341 acres. Later reference will be made to the amount devoted to the specific crops in this area.

After eliminating the 11,611 acres above Filmore and comparing Meeker's figures with Woodhall's table for the land actually in controversy, we find that Meeker shows 37,942 acres against Woodhall's figures of 31,341, but inasmuch as Mr. Meeker included in this table 2,445 acres lying on Four Mile and Seven Mile creeks, which Mr. Woodhall puts in a different classification, the actual discrepancy between the two is 4,156 acres.

Mr. Woodhall's figures of 31,341 acres irrigated land on the Little Laramie below Filmore are based upon a definite survey. Mr. Meeker's figures were, according to his own statement, based merely upon a reconnaissance.

Passing now to the Big Laramie, we find that no definite statement of the total amount of acreage irrigated was attempted by the complainant. As already stated, various witnesses attempted to give in a general way the number of acres of land under certain ditches, but no definite evidence was introduced as to the total number on the river. Mr. Meeker made a reconnaissance of the lands under the Pioneer Canal, measurements being made merely by pacing the distances. (827.) This reconnaissance occupied him and one assistant five days—August 5th and 6th and September 18th, 19th and 20th, in the year 1913. By this method he arrives at the conclusion that the total amount under irrigation under the Pioneer Canal is 11,556 acres. (824 and 844.) Furthermore, he found evidence of at least 2,000 acres having been at some previous time irrigated, but now apparently abandoned so far as irrigation is concerned.

This testimony is significant when we consider the claims made by the complainant for the irrigation of lands under this canal. The Pioneer Canal was commenced about 1879, the oldest of the larger ditches diverting water from the Big Laramie in Wyoming, and in all these years this development is represented by the irrigation, according to Wyoming testimony it-

self, of only 11,556 acres, which is more than the survey made by the defendants discloses to be the correct amount.

Before proceeding further, however, let us digress to call attention to Exhibits N and O, offered by the complainant and to which objection is made by the defendants. These exhibits purport to give the adjudicated decrees on the Laramie and Little Laramie Rivers (Exhibit N) and on Soldier and other creeks (Exhibit O). Exhibit N, being the Laramie River decree, is admittedly not a final decree. The original decree was made by the Board of Control of the State of Wyoming, from which an appeal was taken to the District Court of Laramie County and from which an appeal was taken and pending undecided at the time the exhibit was offered in evidence. The defendants object to it for further reasons which need not be discussed here except to say that we contend that it is in no wise binding upon the defendants for the very obvious reason that they were in no wise parties to it, neither could they be parties to it. However, an examination of this exhibit shows that the Wyoming authorities had decreed appropriations under the Pioneer Canal under date of April 19, 1879, for the irrigation of 49,030 acres of land, and yet their own expert is able to find only 11,556 acres.

The plane table survey included the major portion of the lands under the Pioneer system. As to the area included, we insist that our survey is definite. However, we accept without question Mr. Meeker's estimated figures where we have not measured. Taking these, added to the amount which we actually measured, we find that the total irrigated under the Pioneer Canal is 10,605.8 acres.

Mr. Z. E. Sevison, another witness for the complainant, testified to the number of acres of land under the Oasis Ditch. Inasmuch as the plane table survey did not extend to the extreme limits of the irrigation of this ditch, nor to the extreme limits of the Boughton Ditch, neither did it include the irrigation of lands under three or four smaller ditches further down the river, including the Gillespie Ditch and McGill Ditch. We have taken the Wyoming testimony, whatever it may be, for the amount of lands irrigated there. In other words, wherever we have not made a measurement, we have taken the Wyoming testimony without question, although we know that where we have measured it and compared it with the Wyoming estimate, the Wyoming evidence has always shown a higher amount than our survey proved to be correct. The result is that we find that there is in the Laramie Plains area under irrigation from the Big Laramie, the Little Laramie, Sand Creek, Soldier Creek, Four Mile, Seven Mile and Cooper Creeks, and any other sources, the total of 78,999 acres, and this figure has been arrived at by a consideration of all the testimony intro-

duced by Wyoming without question except where actual measurement disproved its correctness.

At page 2792, Mr. Woodhall, testifying in this regard for Colorado, says that the total acres of land irrigated in the State of Wyoming in the Laramie Plains from the Laramie River and its tributaries is 90,610 acres.

The abstracting of the original testimony has been possibly too brief, but it appears from the original transcript, as well as from the abstract, if analyzed, that this amount, 90,610 acres, included everything in the Laramie Plains area, even that portion irrigated on the Little Laramie above Filmore, 11,611 acres, which we insist must be eliminated from consideration. In other words, the testimony, without contradiction, shows that in the Laramie Plains area below Wood's Landing on the Big Laramie, at which point that stream was measured, and below Filmore on the Little Laramie, at which point that stream was measured, the total amount under irrigation, including the amounts under the other tributary streams such as Sand Creek, Soldier Creek, Willow Creek, Four Mile, Five Mile, Seven Mile, Cooper Creek and any other sources of supply, is 78,999 acres. Included in this are the 31,341 acres under irrigation, classified by crops, actually measured and surveyed on the Little Laramie (Ex. 117) and also 29,279.3 acres actually surveyed and measured, by plane table survey, shown according to classification of crops, under the respective ditches on the Big Laramie (Ex. 118).

The Wyoming area under irrigation in the year 1913, upon a most liberal basis for Wyoming, therefore seems to be: Wheatland area, 29,074.75 acres; Laramie Plains, 78,999 acres; total, 108,073.75 acres.

This amount of land, 108,073.75 acres, is the amount for which Mr. Field, the State Engineer of Colorado, finds that there is available for irrigation a total amount of 431,200 acre feet of water per annum as an average, less only the amount diverted from the stream by the State of Colorado. In other words, less 20,000 acre feet per annum now diverted by Colorado through the Sky Line and Divide canals and the proposed diversion of 56,000 acre feet per annum through the Greeley-Poudre tunnel. Assuming that the Greeley-Poudre system is completed, we then have Colorado diverting 76,000 acre feet per annum, leaving as a total supply of water for the lands herein designated in Wyoming, 355,200 acre feet of water as the normal yearly supply for the irrigation of 108,073.75 acres of land, or 3.28 acre feet per acre.

Later we will have occasion to discuss the question of the duty of water and will review the evidence concerning it, but it is pertinent to say here that Mr. Meeker, testifying as an expert for Wyoming, states that the duty of water on the Lara-

mie Plains is 1 acre foot per acre per annum. If Mr. Meeker be correct, all the water needed for the irrigation of the Laramie Plains area now under irrigation is 78,999 acre feet per annum, and if the same duty pertains upon the Wheatland area, then the total quantity of water needed for all the Wyoming area would be 108,073 acre feet per annum, or only approximately one-half of the total amount which Mr. Meeker, the Wyoming hydrographer, states is the normal yearly flow of the Big Laramie alone at Wood's Landing, or approximately one-third of Meeker's combined flow of the Big and Little Laramie Rivers.

Now, as will be explained elsewhere in this brief, the Wyoming law permits a maximum diversion for irrigation of one cubic foot per second of time measured at the point of diversion for the irrigation of 70 acres of land. Let it be understood that this is the maximum contemplating the most adverse conditions requiring the greatest amount of water which might be found within the state.

According to the testimony of Mr. Johnson and Mr. Elliott, ex-superintendent and superintendent of the Wyoming Development Company, the irrigation period on the Wheatland tract was approximately ninety days, but the maximum quantity of water was used for only a very short period. During the irrigation season there were times when the demand was slight. This is universally true where irrigation is practiced. No irrigator needs the maximum all of the time. There will be occasions when he will need the peak flow or the maximum quantity; at other times he may need none, and at still other times he may need less than the maximum. In other words, the demand will be variable according to the conditions of his crops and the season of the year. The irrigation season in the Laramie Plains is, by reason of the altitude, shorter than the season at Wheatland. But, for the sake of illustration, let us assume that the irrigation season in the whole Wyoming area irrigated from the Laramie River is ninety days, and let us also assume a condition which could not possibly exist—that is to say, that they required the maximum amount of water which the law gave them every minute of the irrigation season. We then would find that under the Wyoming law the 108,073 acres under irrigation will be entitled to use 2.6 acre feet per acre, or a total of approximately 290,000 acre feet per annum out of a balance of 354,700 acre feet remaining above all Colorado diversions, that is, 76,000 acre feet. As a matter of fact, according to the testimony of the Wyoming witnesses, there was actually diverted to the Wheatland lands in past years more water than the maximum amount they could legally receive under the law of the State of Wyoming.

In fixing the irrigated area at 108,073 acres and the water supply therefor, less the Colorado diversions, at 431,200 acre

feet per annum, it must be kept in mind that this water supply is the average available for all lands above and including the Wheatland tract. It does not include the flow of the North Laramie nor of Chugwater Creeks, which, if added, would make a total in excess of 450,000 acre feet per annum, as we have previously shown, but this we have not considered here for the reason that there is some irrigation along the Chugwater Creek and also some irrigation upon the North Laramie which we have not included in the irrigated area given, these two creeks reaching the main river below the Wheatland tract.

In this connection may we call attention to a colored map introduced by the complainant as Exhibit G, which purports to show by different coloring the amount of land irrigated from the Laramie River in Wyoming.

The offer of this map was objected to by the defendants, because, among other things, it is entirely at variance with all of the evidence as to the amount of land under irrigation. It is particularly noticeable that general areas are colored to indicate irrigation, whereas, as a matter of fact, such areas were not, as shown by the Wyoming evidence, irrigated. The map purports to show, according to its legend, all irrigation development prior to 1900 in green, and all irrigation development subsequent to 1900 in yellow. Not only are the areas colored green not irrigated, except in part, but the evidence introduced by the complainant shows that only a small portion was irrigated even as late as the year 1913, and the same thing may be said of that portion colored yellow, which purports to be that developed subsequent to 1900. For illustration, the whole of the Wheatland tract of 60,000 acres is colored green, intending thereby to convey the impression that it was all irrigated prior to 1900, whereas the witnesses for the complainant testified that only fifty per cent of this tract was irrigated in 1913.

We do not desire to discuss the exhibit further at this time, except to say that it is not in accordance with the evidence in any particular, and to insist upon our objection to it as shown at page 1030 of the transcript.

DUTY OF WATER.

The term "duty of water" is variable and is used frequently to designate the quantity of water which is usually applied for irrigation upon any certain tract of land or upon a certain area. Many irrigators and hydrographers use the term in this sense.

We do not so understand it and do not intend to use it in that sense here. Neither will we attempt an exact definition

of the term, except to call attention to the word "duty." Unless the word "duty" is kept in mind, confusion will arise. It implies a burden upon water in that it specifies the amount of land which a given quantity of water should adequately irrigate, rather than the amount of water which a given quantity of land receives.

Therefore, when we say that the duty of water is higher, we mean that it accomplishes a greater use. In other words, irrigates a larger acreage. The natural assumption might be that higher duty meant more water, but with the word "duty" clearly in mind, it will readily be seen that the higher the duty the less water necessary for any certain quantity of land, and the lower the duty, the more water, or, conversely, the higher duty is the greater amount of land which the water will irrigate, and the lower duty the less amount of land which the water will irrigate.

May we suggest that confusion will be avoided if the court will keep in mind a catch phrase: "Higher duty, less water."

Duty of Water in Poudre Valley.

We have previously shown that the total supply for the Poudre Valley, including the water brought into the Poudre Valley from outside sources, based upon a long series of records, is approximately 367,000 acre feet per annum (Exhibits 123 and 124) (3410, 3411), and that an average of about 110,000 acre feet per annum passes out of the mouth of the Poudre into the Platte (3411), of which probably 50 per cent is seepage water and 50 per cent original water. (Exhibit 113 and pages 2487 and 2491).

We have also shown that the irrigated area in the Poudre Valley is approximately 300,000 acres of land without making deductions for roads, barnyards, etc., but treating the 300,000 acres as the total amount under irrigation, we therefore find that about 312,000 acre feet per annum is the consumptive use in the Poudre Valley, slightly more than one acre foot per acre.

However, we do not contend that one acre foot per acre measured at the point of diversion from the river is sufficient. 312,000 acre feet of water per annum measured at the weir where the river leaves the canyon would, in the absence of use and reuse of seepage and return water, not permit of the proper irrigation of that valley, because we have the unavoidable loss of water in transit not only from the head of the ditch wherever the diversion may be, but also from the point of measurement at the mouth of the canyon to the head of the ditch.

Individual ditches have diverted and do divert very much more than that which would supply one acre foot per acre measured at the land and these have been commented on to some

extent in the brief of the complainants herein. Referring to the testimony of John L. Armstrong, water commissioner for the Poudre Valley, which shows that some small ditches diverted as much as 2.94, some as much as 3 acre feet per acre, and still others as little as .59 acre feet per acre, it is manifest that the duty of water for an area, whether that area be the Poudre Valley or the Laramie Plains, cannot be obtained by analysis of the amount diverted by any one small ditch, but must be taken either by analysis of the total amount of water with respect to the total amount under irrigation, or possibly be taken on a ditch which is typical of the whole area, using that as a criterion. Probably this last method is not as accurate as the first. However that may be, we have frequently referred to two canals in the Poudre Valley, one of them being the Eaton Ditch belonging to the Larimer and Weld Irrigation Company, the construction of which was commenced in 1879, the same year in which the Pioneer Canal was commenced, the other being the Larimer County Ditch belonging to The Water Supply and Storage Company dating from 1881. These two canals, inasmuch as they are large and in a general way run throughout the length of the irrigated area of the Poudre Valley, are, in a measure, typical.

We have definite evidence as to the duty of water, measured at the headgate, under the Larimer County Canal. Mr. A. A. Edwards, for many years the superintendent of that company, fixes this duty at one acre foot per acre for diversified crops such as are commonly raised under that ditch, measured at the headgate of the lateral leading from the ditch (2222), which would necessarily mean a higher duty at the place of application, but if fixed at the point of diversion from the river, it would be lower, because of the necessary loss in transit. The amount diverted by this canal from the river is approximately 1.2 acre feet per annum for each acre of land irrigated. (3415.) The duty under the Eaton canal, which is a canal very similar to the Larimer County Canal, is about the same. The Eaton ditch dates from 1879, the same date as the Pioneer Canal in the Laramie Plains, while the Larimer County canal is about two years junior. These two canals being among the older of the larger canals in the valley and irrigating what is, as a whole, a well developed section, are typical of the high state of development of irrigation in the Poudre Valley, and probably typical of the duty of water of the valley as an average, although some areas under other ditches require less and some more water.

The method of adjudication of priorities of right to the use of water has been explained elsewhere, but, in this connection we desire to state that the earlier decrees in the Poudre Valley are, as a rule, excessive. By that we mean that a larger

number of cubic feet per second was adjudicated to be the right of the canal than was actually needed or, at any rate, than is now actually needed for the original area irrigated. This seems to be the rule in all pioneer districts. Two causes may be assigned. In the first place, inasmuch as some of the canals in the Poudre Valley have dates earlier than 1870, at which time the science of irrigation was not as definite as it is today, it is probable that many persons making claims for these rights did not know with any degree of exactness what amount of water one cubic foot per second would produce. Doubtless the estimates given in the earlier days were very general and the natural tendency would be to over-estimate the number of cubic feet which a ditch could carry rather than to under-estimate it. But, lest we impeach too strongly the judgment of these pioneers, it is a fact that the duty of water in the Poudre Valley has been steadily and probably constantly increasing. Less water is used proportionately today than was used years ago. This tendency is very apparent. There is no conflict in the evidence concerning it, and therefore no need to refer to the specific testimony.

An examination of the evidence shows that probably every other irrigated section has undergone or is undergoing the same experience. The fact that excessive appropriations were made in Wyoming clearly appears in the testimony introduced, and there is no reason to believe that the duty of water in that area, as irrigation continues, will not increase, and in the future they will need very much less water for the irrigation of the same amount of land now under irrigation than they use today or that they need today. We use the alternative for the reason that we believe that in Wyoming they are now using more water than is necessary for proper irrigation.

Reverting again to the Poudre Valley, inasmuch as the irrigated area is susceptible of practically definite determination, and inasmuch as practically all the land under the ditches now constructed is irrigated more or less efficiently, depending upon the available water supply and the rights of the various ditches thereto, it is comparatively easy to fix the duty of water, knowing, as we do, the normal flow of the Poudre River.

As we have stated, this normal flow available for the Poudre Valley is approximately 312,000 acre feet per annum, based upon an average of thirty years' records, measured at the mouth of the canyon, and, in general, the number of acres irrigated is about 300,000 acres. Considering the use and reuse of seepage and return flow available, the amount of water used would therefore seem to be slightly more than one acre foot per acre, determined at the point of measurement on the river, and probably materially less if measured at the point of application of the water to the lands. Generally, we consider the duty of water in the Poudre Valley as one acre foot per acre, experience

showing that as an average this amount of water applied to the land will be sufficient for successful irrigation, provided, of course, the supply is so controlled as to make it available at the proper time. Therein lies one great advantage of storage reservoirs and a system of administration such as prevails in the Poudre Valley, whereby exchanges can be made between reservoirs or between reservoirs and ditches in order to get water at the proper time and at the proper place.

Great stress is made by the complainant in its brief upon the question of the time of use, the contention being that during the late summer and fall, at which time a relatively greater portion of the total flow of the Laramie River would be diverted, according to the complainant, by the Greeley-Poudre tunnel, there is a shortage of water in the Laramie River. Therefore, they contend that the diversion by the Greeley-Poudre system at that time of the season will deprive them of water which is necessary for the irrigation of their hay meadows and other crops. But, according to their own witnesses, they have been short for years at that season of the year, and we suggest that, regardless of any diversion by Colorado, they would always be short at that season of the year if they did not take advantage of the opportunity given for the storage of flood waters coming earlier in the season.

The Poudre Valley would not have been able to irrigate one-half, probably not one-third, of the amount of land now under irrigation if it depended upon the direct flow of the stream for irrigation. In the arid regions the streams always fall early in the summer and the flow, as a rule, decreases as the year advances. It is only the ditches of the earliest priorities in the Poudre Valley for which there is any available water from midsummer on, if the direct flow of the river alone is depended upon, but in all these mountain streams, in the arid area, there is a flood season, coming, as a rule, late in May and early in June, at which time water for irrigation is not needed as much as it is later in the year when the streams are lower. It is the storage of this flood water which has made the Poudre Valley what it is today. The irrigators in that section have taken advantage of every feasible opportunity for the construction of reservoirs, and practically all available water which engineering science will permit to be stored at a cost which will be justified by the returns, is now stored, or, at any rate, will be stored with the completion of the works of the Greeley-Poudre system. Are we asking anything unreasonable when we contend that Wyoming should use every reasonable means for the storage of the flood waters of the Laramie River? Have we any right to expect that the needs of mankind are to be disregarded to the extent of permitting Wyoming to deny a demand on the part of Colorado for a small frac-

tion of the Colorado water flowing in the Laramie River while Wyoming neglects to avail herself of every reasonable opportunity of conserving a supply which is available in greater quantity than her needs today and for years to come will require?

Several witnesses for Wyoming, living under some of the older ditches on the river, testified that during the summer season of 1912 they were short of water, and again in 1913 they were short of water. We have shown the very inferior quality of works by which the older ditches in the Laramie Plains divert water from the river; some had no dams at all, others had dams constructed of anything which happened to be available, rubbish, brush wood, manure, piles of loose rock, anything which came handiest, was used. Head gates in many instances, if they could be termed head gates, higher than the bed of the stream. In short, many of the older ditches in Wyoming were in no wise equipped to divert water if it was available in the stream, and it is not at all surprising that at times they may have been short of water, but this we believe to be manifest, if there had been, as a rule, a shortage of water, two things would have been apparent; in the first place, adequate diversion dams and diversion works would have been constructed, and, in the second place, there would have been a definite administration by the officers of the state whose jurisdiction it is to apportion the water according to the rights of the various ditches, and we find from the Wyoming testimony, of which we will have more to say under the head of "Administration," that all sort of regulation upon the part of the water commissioners of the various districts or other superior officers has been unnecessary, or, if not unnecessary, then it has been entirely neglected and the universal statement of Wyoming witnesses was that they took the water whenever they wanted it and as much as they wanted to the capacity of their ditches whenever it was available, without let or hindrance upon the part of any officer whatsoever and without regard to any prior appropriator.

Now, of course, the Laramie River is low from midsummer on, and it is not to be wondered at that under normal conditions some ditches depending upon the direct flow of the river might be short of water, but let us look a little farther. The complainant introduced a table, Exhibit K, purporting to give a resume of the stored water in the years 1912 and 1913, and from this statement we learn that in the year 1912 Lake Hattie commenced to store water from the Big Laramie River on the 8th day of April and from the Little Laramie River on the 4th day of June, and continued to store water from the Big Laramie River throughout not only the irrigation season, but practically throughout the year, and continued to store water from

the Little Laramie River until August 10th; that in the year 1913 Lake Hattie commenced to store water from the Big Laramie River April 25th, and continued until the 13th of June.

And from this same exhibit we find that Lake James storage commenced in 1912 upon the 21st day of April and ceased upon the 3rd day of August; that in 1913 storage commenced upon the 19th day of April and continued until the 25th day of May.

It is not surprising that ditches depending upon the direct flow of the Laramie River were short in the year 1912. As we recall it, these complaints were made by witnesses living under ditches having priorities earlier than Lake Hattie. They complained they were short of water and yet Lake Hattie continued to store without ceasing all during the irrigation season and no officer of the State of Wyoming raised so much as a protest against it. The same is true of Lake James. In the year 1913 the condition was not quite so bad, but nevertheless Lake Hattie continued to store until June 13th.

How can the complainant justify its claim that the little ditches were short of water in the face of these conditions? Either there was no shortage of water and the little ditches received their supply, regardless of Lake Hattie's storage, or there was a palpable violation of the law upon the part of the Laramie Water Company, the owners of Lake Hattie. We have previously shown that 1912 was approximately one of normal water supply. If Lake Hattie can store during the irrigation season of 1912, we can see no reason why it should not store during the irrigation season in any normal year. Let us suggest that in the Poudre Valley no such condition of affairs would have been tolerated for a single instant. In Colorado, no reservoir is allowed to store as long as any ditch, be that ditch either senior or junior to the reservoir, demands the water for direct irrigation. The reservoirs in the Poudre Valley are permitted, and this has been the custom since reservoirs were built there, to store only when there is a surplus above the amount needed for direct irrigation by all ditches, and many a Poudre Valley reservoir has been compelled to forego storage of water which was available in the Poudre River because a demand was made for that water by ditches using water for direct irrigation on the lower South Platte. We do not state this as a proposition of law, but as a question of fact, as a condition under which storage in the Poudre Valley has been accomplished, and the rule of practice to grant the junior ditch water for direct use against a senior reservoir has been the established rule of administration in Colorado, although it is possible that it may ultimately be otherwise determined as a matter of law.

Duty of Water, Wheatland Area.

The duty of water on the Wheatland area, in so far as the application to the land is concerned, should not be abnormal. So far as developed, the area is devoted to somewhat diversified farming. The average altitude is approximately 4,700 feet above sea level, and we see no reason why conditions there should not follow the general rule of irrigated districts, and we have no doubt whatsoever that experience will disclose that the duty of water will be increased from year to year. However, no shortage of water is apparent upon this area, at any rate, since the construction of their reservoirs. Rather, they have had more water than they needed.

We have stated that the original Wheatland tract was a Carey Act project, and in the early history of that project we find that the promoters actually turned water loose upon the bare naked prairie, claiming thereby that they would increase the natural growth of the prairie grass. These were not hay meadows, they were but prairie lands which are common to the area to the east of the Rocky Mountains. No further explanation was made. We do learn, however, from their own testimony, that they had considerable difficulty in securing the approval of the Government and that for a number of years their patent or patents were withheld. We are prone to wonder whether the reclamation required by the law of Congress, commonly known as the Carey Act, as a prerequisite to patent, was claimed to have been accomplished by pouring water upon prairie lands, but, dismissing that, it is apparent that they had more water than they needed for legitimate irrigation.

We learn that they have approximately 29,000 acres under irrigation, but let us take their own estimate, in round numbers, and call it 33,000 acres under irrigation, including the small amount in the Bordeaux tract. M. R. Johnson, at one time superintendent of the system, testified (91) that the irrigation season ordinarily is from 90 to 100 days, during which period the water is applied more or less constantly and in greater or less amount, depending upon the needs of the crops. This is confirmed by the testimony of Mr. Elliott, the superintendent succeeding Mr. Johnson, who also testified (170) that in the year 1912 100,000 acre feet of water was used for the irrigation of this amount of land, and, nevertheless, they had 40,000 acre feet left in the Wheatland Reservoir at the close of the season. In other words, they used three acre feet per acre that season, whereas, under the Wyoming law, if they had applied the full maximum amount which the law permits, continuously without diminution for a period of 90 consecutive days, they would have diverted only approximately 85,000 acre feet. It therefore appears from their own testimony that the

Wheatland people diverted, during the year 1912, 15,000 acre feet more than the maximum permitted by the law of Wyoming for the most extreme conditions in that state. No such demand as that permitted by the maximum amount under the Wyoming law is possible. That tract manifestly does not need the maximum quantity of water allowed throughout the whole irrigation season.

Mr. Johnson testifies (94) that since the original construction of the tunnel and the diversion of water through this system, they have never been interfered with by the authorities of the state, but have taken water when and where they would, with only one exception and that was in the year 1911, when they were directed to allow some water to pass their diversion dam for the use of persons below. Again, we learn from the testimony of Mr. Elliott (212) that the net distribution of water to the Wheatland lands in 1912, was from 2.6 to 2.7 acre feet per acre, determined by actual deliveries at the head of the laterals leading to the lands. It is therefore apparent that the Wheatland system has had available not only an excessive amount of water, part of which, in a normal year it was unable to use, but also the amount distributed, measured at the head of the lateral ditches, amounted to from 2.6 to 2.7 acre feet per acre, or more than two and one half times the amount of water correspondingly used in the Poudre Valley.

Mr. Field testifying for the defense, in reviewing the tendency heretofore mentioned, concerning the increase in the duty of water as irrigation developed, particularly where necessity required it, says (3572) that he would expect that if economy ever became necessary in the Wheatland district, the duty of water would not exceed one and one half acre feet per acre, measured at the head gate of the canals, and that there need be no increased diversion over the amount at present diverted for the ultimate irrigation of the entire unirrigated land now proposed to be irrigated.

Duty of Water, Laramie Plains.

When we consider the Laramie Plains, we again find more difficulty in arriving at the true conditions. This area seems to be abnormal from many view points. No attempt whatsoever was made in the presentation of the case in chief to establish a duty of water in this area, but from various witnesses we learn that the principal crop in the Laramie Plains consists of native hay. The average altitude of these plains is about 7,100 feet above sea level, and the history of the area shows that it has failed to become a farming region. In so far as the area is irrigated, by far the greater portion, in fact almost all, is devoted to the growth of native hay. The testimony shows

that the practice in the irrigation of these hay lands is to apply the water copiously, to flood the meadows and keep them constantly flooded until it became necessary to shut off the water in order to permit the ground to dry sufficiently to permit mowing the hay. Under this system, there are few lateral ditches, but the water is applied until the whole country devoted to hay meadows is flooded, advantage being taken of draws, depressions and so forth, for the distribution of the water. On the Little Laramie the water is spread out through a number, five or possibly seven, different channels of the river, dams of manure or any other convenient substance being placed here and there to divert the water out of the channels.

The complainant, in its brief, says that this is the only sort of irrigation possible under the circumstances; that inasmuch as hay meadows are not cultivated, they do not lend themselves to systematic irrigation as where the water is distributed through the furrows in cultivated fields. To a limited extent this may be true, yet it does not excuse the fact that the most primitive methods have always been used and still prevail for the irrigation of these hay meadows on the Laramie Plains, and it is a fact that for weeks these lands are practically swamps, saturated until a remarkable condition described by one Wyoming witness appears. This witness testified that boulders appearing upon the lands so brought under irrigation, in time sink beneath the surface of the ground and disappear. We are unable to give, from the evidence introduced by the complainant, a definite statement as to what amount of water was actually used, much less the amount of water required in the irrigation of this area, but from beginning to end of the evidence in chief, this fact appears, that water was used just as freely as the irrigator wished and the supply permitted. It was a copious flooding, and that practically at no time in the history of the Laramie Plains had there ever been any administration of the water by the water commissioner or any other official. The few exceptions will be noted later.

However, Mr. Meeker, in his Exhibit J, followed in rebuttal by Exhibit T-8, estimates the amount of water distributed to the ditches between the No. 2 Dam and Two Rivers on the Little Laramie, at 17,245 acre feet in the year 1912. Inasmuch as there is, according to the defendants' plane table survey, 31,341 acres in this area, Mr. Meeker's figures, if correct, would mean a duty of water of approximately .55 of an acre foot per acre, which, upon its face, is absurd. The evaporation from the surface of the soil would even approach this amount. Moreover, it is absolutely inconsistent with his amount distributed to the Pioneer Canal, for the same year, which he gives as 17,703 acre feet for the year 1912, Exhibit B. The Pioneer Canal, in large measure, irrigates native hay lands, similar to the irri-

gation upon the Little Laramie, and yet Mr. Meeker was able to find by his reconnaissance only 11,556 acres under the Pioneer, and this is reduced by our plane table survey to 10,605 acres. It would therefore appear that his duty of water on the Pioneer, if his estimate of the flow of the river is correct, is approximately 1.6 acre feet per acre. His Little Laramie figures and his Pioneer figures cannot be harmonized, but that is not to be expected, because we know his estimate of the flow of the stream is entirely too low, and that 1.6 acre feet per acre is only a fraction of the amount of water actually used under the Pioneer Canal and other ditches in the Laramie Plains area, but let us take Mr. Meeker at his own figures for a moment. He testifies on rebuttal that the normal flow of the Big Laramie at Wood's Landing is 200,000 acre feet per annum, that the Little Laramie is approximately fifty per cent of this amount, measured at Filmore. In other words, he estimates the total in the two streams to be 300,000 acre feet per annum, without allowing anything whatsoever for any other sources of supply, although we know there are such. Let us for a moment consider only the 300,000 acre feet. Now let us deduct 100,000 acre feet for the excessive amount which the Wheatland people contend they have used. That leaves 200,000 acre feet net for the use of the Laramie Plains. Now, if Mr. Meeker's figures be correct, in his Exhibits J and T-8, that 17,245 acre feet of water was distributed in the normal year 1912, for the irrigation of 31,341 acres of land on the Little Laramie between the Lake Hattie No. 2 Dam and Two Rivers, thereby establishing a duty of water at .55 acre feet per acre, he has water enough, according to his own estimate of the total flow, after deducting 100,000 acre feet for Wheatland, to irrigate 363,000 acres of land. Or, on a like basis, if the duty of water as established under the Pioneer Canal by Exhibit B and others following it of 1.6 acre feet per acre is correct, he has water enough for the irrigation of 125,000 acres of land, yet all the land now under irrigation in the Laramie Plains, is, as we have shown, 78,999 acres below the points of measurement on the two streams. Assuredly Mr. Meeker is wrong either in the total amount of water available in the two streams, or in his duty of water, or, what is probable, he is wrong in both.

Other analyses of Mr. Meeker's figures show additional inconsistencies.

As heretofore mentioned, the defendant showed that the amount of water in the Big Laramie at the state line is, according to Mr. Field, approximately 250,000 acre feet per annum; according to Mr. Hedke, approximately 300,000 acre feet, and according to Prof. Carpenter, in excess of 320,000 acre feet per annum. We also showed the exact number of acres under irrigation as heretofore explained, and we showed the

lack of administration, the go-as-you-please system of the distribution of water in Wyoming, the absence of adequate diversion works, in short, primitive methods, arguing an abundant supply of water.

On rebuttal, Mr. Meeker, the Wyoming expert, took the stand again and of necessity was compelled to modify the conclusions deducible from his tables previously introduced in evidence. Let us see what he did.

In the face of his own tables showing .55 of an acre foot per acre as the duty of water on the Little Laramie and 1.6 acre feet per acre under the Pioneer Canal and various other amounts in different locations on the Laramie Plains, and in the face of the fact that all of the evidence showed wasteful conditions in the use of water, he testified (4317):

> "From my records and experience, the duty of water diverted from the Laramie River between Pioneer Dam and Two Rivers station is approximately one acre foot per acre. This includes copious flooding of the meadow lands and irrigation of the pasture land adjacent to the river. If all the lands irrigated between these stations were included, the duty of water would be higher."

Moreover, with respect to the lands on the Little Laramie River he placed the duty of water also at one acre foot per acre. This particular testimony seems to have been omitted in the abstracting, and we therefore take the liberty of quoting the original transcript, page 4320:

> "Q. I neglected to ask you if you could state approximately the duty of water realized between Lake Hattie No. 2 Dam on the Little Laramie and Two Rivers. A. That is also approximately one acre foot per acre per annum.
>
> Q. Is the general character of the irrigated crops grown there similar to that in the Big Laramie Valley? A. Yes, sir.
>
> Q. Including meadow lands and irrigated pasture? A. Yes sir, and on account of the copious application and large return waters, there is also a large re-use of water between the two points, which accounts for the high duty.
>
> Q. What can you say of the relative rapidity of the return flow in that portion of the stream? A. That is also very rapid."

From this it appears that Mr. Meeker, possibly in order to make his estimated total flow in the river coincide with the number of acres which he claimed to be irrigated, places the

duty of water at this amount, one acre foot per acre, for practically all of the irrigated area of the Laramie Plains.

Now, on this basis, Mr. Meeker finds water enough in the Little Laramie and Big Laramie, without considering smaller tributaries, for the irrigation of 300,000 acres of land after the amount at present diverted by Colorado is eliminated, or enough water for the irrigation of 244,000 acres after Colorado has diverted the additional 56,000 acre feet which we expect to take through the Greeley-Poudre tunnel. Wyoming has, according to the testimony, a total of 108,073.75 acres now under irrigation in the Laramie Plains and in the Wheatland area. Apparently the expert testifying in this regard in behalf of the State of Wyoming, and, as a matter of fact, the only witness in behalf of the State of Wyoming who attempted to testify as an expert on the question of water supply and the duty of water, finds that according to his established duty of water, he has, after Colorado will have made its additional diversion herein sought to be enjoined through the Greeley-Poudre tunnel, water for the irrigation of 135,926.25 additional acres of land above the amount now irrigated. It is true that Mr. Meeker did not testify to the duty of water on the Wheatland area, neither has any other witness except as we have heretofore reviewed it. If it be contended that the duty of water on the Wheatland area is lower, this acreage would, of course, have to be reduced accordingly.

Mr. Field, State Engineer of Colorado, found that from the total supply of water available for all lands above and including the Wheatland tract, after deducting all Colorado diversions, including the 56,000 proposed through the tunnel, that there remains for the Wyoming lands 373,500 acre feet of water as a normal yearly supply. If Mr. Meeker's duty of water be correct, then, after Colorado had done everything which physically can be done toward the diversion of water from the Laramie River, there remains, with the Wyoming supply added, enough water above the Wheatland tract to irrigate 373,500 acres, and if Prof. Carpenter be correct then there will remain water sufficient to irrigate in Wyoming 400,000 acres or more.

ADMINISTRATION OF WATER.

Fundamentally the laws of Colorado and Wyoming, with respect to irrigation, are the same. As a matter of fact, the Wyoming laws were patterned largely after the laws of Colorado, and probably the chief difference lies in this: that in Wyoming the water is appurtenant to the land; as we understand, it is adjudicated for the irrigation of a certain piece of land. In Colorado, the water is not appurtenant to the land.

In Wyoming the prospective appropriator applies to the executive officers for a permit, which is granted him if there is, in the judgment of the State Engineer, sufficient unappropriated water in the stream to supply his demand. The appropriation or the priority of appropriation dates from the time this application is filed, and later on the adjudication or decree is made by the Board of Control, consisting of the State Engineer and the Division Superintendents of the state. From this board an appeal lies to the courts.

In Colorado no permission is necessary to initiate a right, but the appropriator files his map and statement with the State Engineer, formerly with the county clerk and recorder of his county, and proceeds with his construction regardless of the amount of unappropriated water in the stream. If he proceeds with diligence, depending upon the circumstances, he is entitled to a decree, but this decree is rendered by the District Court having jurisdiction.

In both states the chief executive officer having jurisdiction of the administration of water is the State Engineer. The states are then divided into divisions, over each division there is a division engineer, or, as termed in Wyoming, division superintendent, and again divided into water districts, each water district being under a water commissioner.

In Colorado every ditch diverting from the stream is required to maintain an adequate headgate by which the water may be shut out of the ditch, and a definite measuring weir in which the water flowing in the ditch can be measured, and each reservoir is required to maintain a gauge indicating the depth of available water in storage.

Poudre Valley.

In considering the administrative methods employed in the Poudre Valley, we wish to refer generally to the testimony of John L. Armstrong, appearing at pages 2454 to 2548, inclusive, and of A. A. Edwards, a man of wide experience in irrigation matters, pages 2180-2258. Mr. Armstrong had been for twenty-four years out of thirty-one, water commissioner or acting water commissioner of Water District No. 3 of the State of Colorado, which includes the Poudre Valley, and he gives in detail the system under which his duties are performed. The inflow from other watersheds into the Poudre River is observed and measured constantly by deputies, and the flow of the stream constantly observed. Each of the larger canals maintains an employe whose duty it is to regulate the gates of the canal, and the commissioner is in constant touch with these headgate keepers by telephone. In fact, before public telephone lines became general in the Poudre Valley, private lines were built in part for this purpose. The commissioner makes it a

practice to notify each headgate keeper of the water available for each respective ditch twice a day, and oftener if there is a radical change in the stream flow. Ditches are watched with minute care in order to secure the proper distribution of water and the prevention of waste.

Counsel for the complainant refer to the methods employed by the water commissioner in this regard as being those of a fugitive from justice, because of his surreptitious visits to headgates, etc.

Methods of exchange between upper and lower ditches or ditches and reservoirs have been systematized. For illustration, an upper ditch of junior priority may have a reservoir located at some place which renders it unavailable for the irrigation of the lands under that ditch. This reservoir is filled when water is available for it. During the irrigation season this ditch may take the water from the river to which an earlier but lower ditch is entitled and from its reservoir supply a sufficient amount of water for the needs of the earlier but lower ditch. Many other illustrations of the exchange of water might be given, but it is unnecessary to say more than that by reason of this general system the highest possible use of water is accomplished and the irrigation of far more land is made possible than if such a plan were lacking.

Comment has been made that some ditches in the Poudre Valley were not thus regulated and scrutinized, but these, as described by Mr. Armstrong, are small ditches having early priorities, lying close to the river and these, or at least some of these, the witness states it is not necessary to regulate for the reason that they can use only so much regardless of the amount they divert, and that the surplus returns immediately to the stream. It must be borne in mind that these ditches under these peculiar conditions are the exception to the general rule, and when we state that the larger ditches in the Poudre Valley are many miles in length, the court will at once understand the difference and the reason for the difference. For illustration, the Poudre Valley canal as extended to irrigate the lands of the Greeley-Poudre Irrigation District is more than one hundred miles in length. The Larimer County canal, frequently referred to in the testimony, is something over eighty miles in length; the Eaton canal about the same length, and others also of great length. Practically all of the canals in the Poudre Valley have modern, efficient diversion works, those of later construction being mostly of concrete or masonry, older ones being timber construction. There are a few exceptions to this rule.

This administrative system in the Poudre Valley is not the accomplishment of one day, but it is the development of possibly forty years experience in irrigation, during which

period there were several times at which it was thought that the limit of irrigation had been reached in the Poudre Valley, but successive years have shown that the duty of water constantly increased, that the necessity for water produced more efficient methods both in distribution and in application, and that possibly the Poudre Valley has not yet attained its ultimate development in this regard.

Administrative Methods in Wyoming.

Let us contrast the Poudre Valley in this regard with the Wyoming area under consideration. The Wheatland system is relatively new, and the diversion works modern. The same thing may be said of the Lake Hattie System and the Lake James System, possibly some others. But these are the exception to the rule in Wyoming, where we find that the most primitive conditions still prevail and ditches are largely without dams, without adequate head gates and no definite system of administration has ever been employed. To definitely show this lack of development, or rather, to show these primitive conditions, the defendants caused to have taken a photograph of the head gate of every ditch diverting water from the Big and Little Laramie Rivers on the Laramie Plains area. These photographs are introduced in evidence as Exhibit 115, and speak more forcibly than any verbal description which we could make.

Let us see what the Wyoming evidence discloses as to the administration of water by the officers of the state having jurisdiction of the subject-matter.

Mr. Elliott, superintendent of the Wheatland system, testified that neither the Board of Control, the State Engineer, the Division Engineer or the Water Superintendent or any other water official had ever required them to release water held in storage in either of their reservoirs, nor had in any way interfered with either the storing or the diversion of water in that system (194).

His predecessor, Mr. Johnson, however, testified, as we have previously stated, that in 1911 they were required to allow some water to pass the diversion dam. In other words, they were not permitted to take it all.

Another witness, Mr. Mortimer N. Grant, was produced by the complainant. It seems that Mr. Grant, a civil engineer, was water commissioner on the Big and Little Laramie Rivers and their tributaries in Wyoming in the year 1913, and his testimony is so pertinent to the subject now being discussed that we feel justified in quoting at length from the abstract. This testimony appears at transcript pages 1276 to 1289:

"I am a civil engineer. In 1913 I was Water Commissioner for that district in Wyoming covering the Big and Little Laramie Rivers and their tributaries from the state line down to a point about a mile below the junction of those two rivers.

On the Big Laramie complaints about water were made that year, the latter part of May or first of June, by the Wyoming Development Company, and complaints were made about July and August by four or five ranchmen. On the Little Laramie more complaints were made, mostly down towards the mouth.

The complaints on the Little Laramie were chiefly in July and August.

I encountered quite a bit of trouble in distributing water among the users from the Little Laramie in 1913 because of the low stage of water in the Little Laramie River. It practically disappeared before it got down to its mouth. I took a vacation and ended my duties that year about Sept. 1st."

Cross-examination by Mr. Fred Farrar:

"During the period mentioned, my headquarters were at Laramie. During July and August I was in the field the major portion of the time. My trips generally consisted of the following: I went up to the head of the Little Laramie, down the Big Laramie and back up the Little Laramie. I think I made seven complete round trips, aside from side trips. That is only approximately, I don't know the exact number of trips. The Wyoming Development Company, mentioned, which made complaint, is the Wheatland Company. No complaint was made against Lake James, there was one complaint made against Lake Hattie. I don't remember the exact date, it was about June 8, I imagine. In the year 1912 I think there was a man named Wilson acting as water commissioner on the Little Laramie, I don't know who was on the Big Laramie, I understand there was a commissioner. Previous to that year there had been water commissioners appointed, but they have never been out in the field to amount to anything. The water commissioner, as a rule, only goes out in the field when called. Otherwise he does no actual work."

Cross-examination by Mr. Charles F. Tew:

"I was called on to measure water. I usually did all my work with a current meter. I was not making reports for the state engineer's office. The current meter

was employed because there were no measuring devices in the Big Laramie ditches that were adequate. The practice prior to 1913 on both the Big and Little Laramie Rivers, so far as I know, has been to employ the water flow of the stream without the assistance of any measuring devices in the ditches. The only time the water commissioner had been employed on the Big and Little Laramie Rivers to my knowledge was when there was complaint by water users. I think that was the practice all over the state. I think in 1912 the water commissioners on the Big Laramie were put on a salary and supposed to be in the field all the time.

There have been differences prior to 1912. In 1912 there was no complaint that I know of. There was a man employed as commissioner but I have forgotten his name. I never heard it mentioned. With the exception of the Pioneer dam on the Big Laramie River and the Lake Hattie Supply No. 2 dam on the Big Laramie River, the dams all up and down the river are what you would ordinarily call ranch ditch or beaver dams, consisting of brush and the like. Each freshet modifies the dams somewhat. There were no set or fixed conditions at the head of any ditch whereby former measurements would be a proper guide as to the inflow into the ditches. It would be impossible for a person on either river in the year 1913 to state, without a current meter or measuring device, what amount of water was being taken into any ditch at any time. All that could be reached without the use of instruments would be a poor approximation. From conditions I saw on the ground, I imagine that those conditions had existed and prevailed always. With the exception of the Bellamy canal diversion and the Lake Hattie No. 2 diversion on the Little Laramie, the remainder of the dams were of brush and the measuring devices lacking the same as on the Big Laramie. The Bellamy Ditch is the intake for James Lake. From what I have seen on the Big Laramie, it is as I have described. When I made these trips I generally went to the several headgates. I established rating stations and put in gauges on several of the ditches. I traveled up and down the river with a team and went up as far as Wrights and stayed there and then went around the country and crossed over to Lake Hattie and Sodergreen's. I measured pretty near all of the ditches from time to time. I put in staff gauges to see what was flowing in. On the Little Laramie River there were quite a number of complaints made in July and August. Rating stations were placed in only the biggest ditches. There

were no particular clashes that I had any trouble over. I either shut them down a little bit or opened them up accordingly. There were some cases where there were no headgates. The only place I had any trouble was on the Big Laramie, and there I sometimes shut down the gate or throw manure in it, probably old gates were in, but they would leak.

Most of the ditches on the Big Laramie River are what you might call two-story ditches; that is, they were above the bottom of the creek so they would have to have a dam to divert at low stages. At high water they got all the water they needed. They start to drawing water for these meadows in the higher states in June. The whole territory along both streams is used as a hay ranch country. The irrigation season is close onto ten weeks for hay. They generally use their water right up to the time they cut their hay, which is about the middle of July. Some may start in later than the first of May to irrigate, but they generally irrigate from the first part of May to the middle of July. There was clamor of shortage of water but they gave us no trouble; the flow could be regulated by using manure as described. The Big Laramie River got down pretty low in the latter part of July and August, with a manure and rock dam you could divert all the water.

There were a number of what I called two-story ditches. The average ditch does not cut the bottom of the river. A great many of the ditches are two-story. With a two-story ditch the irrigator obtains all the water he wants when the river is high, but at low stages it requires a dam. At such times the user goes to the head and throws some obstruction in the stream to suit his desires. The change of elevation of water of course makes a change of intake capacity in these two-story ditches. The irrigators settled their questions themselves; they probably would be disgruntled, but didn't bring complaints to my office. From the conditions I noted there on the channel of the river, it looked to me that the same conditions prevailed as they had in the past. It is also true that each high water flow modifies these dams to some extent, washes them out and they have to be re-installed. While the dams have been changed from time to time, the ditches have remained unchanged."

Cross-examination by Mr. Delph E. Carpenter.

"Lake Hattie evidently had been receiving water after the ice had passed out of the river in the spring. I cannot tell you the amount of water in Lake Hattie,

I haven't the data with me. They had diverted only from the Big Laramie River in 1913, but I did not keep a record of the flow. I read the gauge every time I was there. They ceased running water into Lake Hattie on about June 8, 1913, and I think that Lake Hattie was about half full in addition to all the dead water space in the lake. I would say that they had approximately 20,000 to 30,000 acre feet of water available for irrigation in Lake Hattie.

I did not know that they were running water out of Lake Hattie and wasting it into Big Basin until about the first of September. The only time I knew of their running water down into Alkali Lake or Alkali Basin was when they tried out the canal once or twice. It only ran for a day or so at that time. I heard that at a later time when Mr. Goldsborough had some prospective land buyers out there he ran water for several days and wasted it into Big Basin. I did not go to look it up. I think there was considerable water left in Lake Hattie when I resigned, about September 15. My active duties as water commissioner ceased September 1st, after that date I was only subject to call.

Water was diverted through a ditch known as Sodergreen's high line ditch in the summer of 1913. That is a recent ditch; a recent appropriation. The Sodergreen high line was shut off in June some time, with the exception of one or two days' run.

I cannot say how much water was diverted into Lake James during the summer of 1913. I kept no record.

I had the record of flow and gauge height of Lake Hattie from Mr. Meeker; the only gauge heights I took from time to time were those I had to take when I was there to check his.

The first complaint I received was from the Wyoming Development Company, directed against Lake Hattie enterprise. There was, I imagine, about a week I didn't get any records on the steel bridge at Lookout. I think Mr. Elliott went up and measured the water at the steel bridge and made complaint at that time. His complaint was that there was insufficient amount of water coming down to the Wheatland Reservoir to satisfy their rights. I turned the water down from the Lake Hattie diversion because Lake Hattie was what was called a flood water right to fill Lake Hattie, and Wheatland was prior to Lake Hattie. In other words, the Lake Hattie enterprise was a very recent one, more recent than the one below.

On both the Big and Little Laramie Rivers it is practically physically impossible for any water commissioner to properly apportion the waters with the appliances that exist at the present time. The Little Laramie is better as to headgates than the Big Laramie. Everything is so crude on both rivers that an apportionment according to the legal rights of the parties is practically out of the question, unless one has a current meter to measure it, and then it is a matter of a good deal of labor to try to regulate the water. Each rating consumes considerable time and expense. So that, for the orderly administration of that water supply the conditions are not there. The accuracy of the ratings depends on the percentage of errors you expect to allow. You can't get them down to any fraction of a foot or so, on any of those ditches, without cleaning out the channel, but it is almost as good as a measuring flume ordinarily. The Big Laramie is passing through the same history that all streams have passed through until a certain pressure is brought to bear on them, when they have to put in certain devices to regulate the water.

The James Lake enterprise is a comparatively recent one."

This testimony from a Wyoming witness clearly proves every contention which defendants have made to the effect that primitive methods still pertain in the Laramie Plains area; that there has been practically no distribution of water by the officers of the state, but, on the other hand, that go-as-you-please methods have and still do prevail.

Methods of administration, distribution and application of water between the Poudre Valley and the Wyoming area are further contrasted in the testimony of Mr. Field, the State Engineer of Colorado, more particularly at pages 3562 and 3576, inclusive.

Exhibit 115 is a series of photographs showing the diversion works of practically all ditches on the Laramie Plains. A key map in the front of the album shows the location of each scene.

COMPARISON OF AREAS.

The defendants approached the trial of this cause with the feeling that the court would desire the fullest knowledge of all questions pertinent to the direct issues, and to this end they have undertaken the production of much evidence tending to show the difference in the two areas—both the difference in develop-

ment and the difference in possibilities, and, in reviewing the evidence, we are going to adopt a statement made by Dr. L. H. Bailey, a witness produced by the defendants, to the effect that the two areas are to be contrasted rather than compared.

When we speak of the two areas, it is possibly best that we define our meaning. We have heretofore admitted that the Wheatland area, lying to the east of the mountains, with an elevation of approximately 4,700 feet above sea level, should be a normal agricultural district, that is, normal based upon conditions pertaining throughout the arid west, eliminating any exceptional areas.

The growing season at Wheatland should be comparable with the growing season in the Poudre Valley, and, inasmuch as during the thirty years which have elapsed since the inception of the project, various crops have been grown, we expect that the future will demonstrate that the major portion of the Wheatland tract is a fair agricultural district capable of producing hay, cereals, garden truck, and, possibly, sugar beets and potatoes, although the evidence discloses that the culture of sugar beets heretofore has been not highly successful, but we have no particular criticism to direct to this area from an agricultural standpoint, and the contrast which we wish to draw will be, therefore, limited to the Poudre Valley and the Laramie Plains. At the outset we wish to explain that the lands included within the Greeley-Poudre District are nothing more nor less than an extension of the already reclaimed lands of the Poudre Valley, differing in no material respect from the developed lands immediately adjoining on the west, and the history of the Poudre Valley under irrigation gives a very fair indication of the development to be expected in the 125,000 acres constituting the Greeley-Poudre District, if water is available for its irrigation.

The distance between the Poudre Valley and the Laramie Plains, at their nearest points of approach, is not to exceed fifty miles in an air line. However, the trend of the valleys is, generally speaking, at right angles to each other. Nevertheless, while only these few miles intervene, we find the greatest divergence in practically everything except distance. The average elevation of the Poudre Valley is between 4,500 and 5,000 feet above sea level. The city of Fort Collins, lying about six miles immediately outside the foothills, is 5,000 feet, while the city of Greeley, some 25 miles further down the Poudre River, is about 4,500 feet. Between the Poudre Valley and the Laramie Plains lies a range of mountains heretofore described as the Green Mountains in Colorado and known as the Black Hills or the Laramie Mountains in Wyoming. This is a relatively low range and the Laramie Plains, lying within or to the west of this range, constitutes but one of a number of high mountainous plateaus enclosed by the different parallel ranges constitut-

ing the Rocky Mountains. A similar area in Northern Colorado is called North Park. Passing southward through Colorado we find three more of these so-called parks or high mountain plateaus, they being, in turn, Middle Park, South Park and the San Luis Valley, and each one is comparable in many respects to the Laramie Plains, in that, as a rule, the altitude is so great as to forbid agriculture in the accepted sense of the word, but, on the other hand, native hay is rather abundantly grown and the areas have always, since their earliest settlement, been devoted to livestock raising. There is some difference due to latitude and the evidence shows the San Luis Valley, in the south central part of the State of Colorado, with an altitude of about 7,500 feet above sea level, has the advantage of lying approximately 400 miles to the south of the Laramie Plains, and on that account enjoys a somewhat warmer climate than does the Laramie Plains, but that, nevertheless, in this San Luis Valley, agriculture has largely been confined to the hardier plants, owing to the brevity of the growing season and the prevalence of late frosts in the spring and early frosts in the fall.

The Laramie Plains has an average elevation of approximately 7,100 feet above sea level, the city of Laramie, lying about the center of the valley, being 7,187 feet above the sea. This difference in altitude, that is, 7,100 for the Laramie Plains and approximately 4,700 for the Poudre Valley, is the principal reason for the agricultural contrast in the two areas.

The complainant, in its brief, with some irony, comments upon the amount of evidence devoted by the defense to the beauties of the Poudre Valley and admits that it is an area of high agricultural development, and also admits, in so far as we can expect admission on this point, that the Laramie Plains is handicapped by a cold climate and that its agriculture must be of a very limited sort. We believe that the history of these areas and their development, or lack of development, is a very clear indication of their possibilities. While it is true that, generally speaking, the areas included within Colorado and Wyoming began developing about the same time, nevetheless Wyoming had the advantage of the earlier settlements and the earlier transcontinental highways, the only possible exception being some Spanish settlement in the extreme southern portion of the State of Colorado, but the very early wagon routes across the continent passed across what is now the State of Wyoming, and Fort Laramie (distinguished from Laramie City), at the junction of the Laramie and North Platte Rivers, has been a point of settlement of marked historical interest from the earliest days in the settlement of the West. This point was established, probably as early as 1844, as a fur trading station and was later occupied as a garrison for U. S. troops. From here fur traders operated probably throughout all of the surrounding Rocky Mountain region, going as far south as the

Poudre Valley in Colorado. In the 60's the Union Pacific Railroad, building from Council Bluffs, Iowa, to Ogden, Utah, followed rather closely the old Overland Trail across the range of mountains to the east of the Laramie Plains at a point known as Sherman Hill, reaching the city of Laramie, where a military post had been maintained for some time previous, in May, 1868, building thence on westward to Ogden, where its rails were connected with the Central Pacific, which built west from Sacramento, in May, 1869. Previous to the construction of the Union Pacific road, the overland stage route had crossed this area and for a brief space of time an alternative or southern route had been followed up the South Platte River to the junction of the Poudre, thence up the Poudre to a point immediately outside of the mountains called La Porte, and thence in a northwesterly direction to the Laramie Plains. This was probably the latest of the various stage routes to be established. The first railroad facilities given to the Poudre Valley area came with the construction of the Denver-Pacific, which built from Cheyenne, where it made connection with the Union Pacific road, southward to Denver, a distance of approximately 100 miles. This road reached the City of Denver in the year 1870. It crossed the Poudre Valley at Greeley and for many years was the only railroad in northern Colorado. In 1877, however, a road was built from Cheyenne southward, crossing the Poudre Valley at Fort Collins and connecting at Longmont with a road which had been built out from Denver. This was known as the Colorado Central and is now known as the Colorado & Southern. About 1883 a road was built traversing the Poudre Valley from Greeley to Fort Collins, and at that time, both of the systems having fallen into the hands of the Union Pacific, the railroad described as the Colorado Central was abandoned from Fort Collins to Cheyenne and the rails removed. Later, however, the old system known as the Colorado Central having passed into the hands of the Colorado & Southern Railroad, this line was re-established, or, rather, a new road was constructed, from Fort Collins through Wellington in the Poudre Valley and on northward to Cheyenne, forming a connecting link in the north and south system of the Colorado & Southern Railway, giving a connection from Galveston, Texas, to Billings, Montana, where junction is made with the Great Northern and the Northern Pacific transcontinental routes.

It thus becomes apparent that the Laramie Plains area, with its early transcontinental railroad facilities, had no disadvantage in the matter of transportation in the early history of its development, and these facilities, were, if anything, earlier, and as good as, if not better than, the facilities afforded to the Poudre Valley.

Today, however, we find that in the Laramie Plains there is not a single feeder line, with the one exception of a road

known as the Laramie, Hahn's Peak & Pacific, which built westward from Laramie across the Medicine Bow Mountains and thence southward into North Park in Colorado, whereas the Poudre Valley is today almost a network of feeder railroads. One road, commonly known as the Sugar Road, is owned and operated entirely by The Great Western Sugar Company, built for the express purpose of transporting beets from the farms to the sugar factories. This road originates at Loveland, some 14 miles south of Fort Collins. From thence it runs eastward, dividing, one branch proceeding to the southward, the other branch running northward across the Poudre Valley at the town of Windsor, at which point it crosses the branch of the Colorado & Southern between Greeley and Fort Collins, thence running eastward to a junction with the Union Pacific at Eaton. It is so constructed as to serve as a feeder for both the Union Pacific and the Colorado & Southern, as well as to serve sugar factories at Eaton and at Windsor in the Poudre Valley and at Loveland and Longmont to the south of the Poudre Valley. Furthermore, a branch of the Union Pacific runs in a southeasterly direction from Fort Collins, traversing a very rich section of the Poudre Valley and thence in a southerly direction to the City of Denver. Another road, known as the Denver, Laramie & Northwestern, in a general way, parallels the Union Pacific between Denver and Greeley. Numerous spurs of the Colorado & Southern radiate from Fort Collins, one to the westward up the Poudre River, and one to the eastward to a farming district commonly known as the Black Hollow. Two spurs have been built by the Union Pacific into the Greeley-Poudre District. These leave the main line near Greeley, the longer spur being something like 25 miles in length. These two spurs were constructed in anticipation of the development of the lands within the Greeley-Poudre Irrigation District from reclamation by irrigation.

It is therefore apparent that the Poudre Valley is furnished with remarkable facilities for transportation, whereas, in this regard, with the exception of the one road mentioned, the Laramie Plains remains today with the one transcontinental road passing directly through it which it had in the year 1868.

We are not able to enter into a discussion of any theory as to whether or not railroads are the cause or the effect of industrial development, but it is obvious that the various branches or feeders constructed in the Poudre Valley are the result of a demand for railroad facilities, with the exception of the two spurs from the Union Pacific into the Greeley-Poudre District, which are in anticipation of the development which is expected in that area, consistent with the development in the portion of the valley already reclaimed. These railroads can

be nothing less than the effect of a wonderful agricultural production.

The earliest irrigating ditch on the Laramie Plains seems to have been commenced in 1868, the second one in 1875, the third and fourth in 1877, and the fifth in 1878. These, as is natural, were all very small ditches. Then in 1879 the Pioneer Canal was constructed, at first a comparatively small ditch, but later enlarged to a ditch of considerable size with a length of something like 40 miles. In the Poudre Valley the oldest ditches are somewhat earlier, the first one dating in 1860, followed by a number of small ditches, until the establishment of the Greeley Colony, commonly known as the Union Colony, when two ditches of considerable size were built, one on the south of the river known as Union Colony Canal No. 3 was built in 1870, and was about 15 miles in length, and a larger one known as Union Colony Canal No. 2 was built on the north side of the river in 1871 and was originally about 35 miles in length.

We will not attempt to give the complete history of the construction of the various canals in the Poudre Valley, but two, heretofore referred to, are of particular interest in any comparison with the Laramie Plains. These are: the canal of the Larimer & Weld Irrigation Company, commonly known as the Eaton Ditch, which was commenced in the year 1879, the same date as the Pioneer Canal in Wyoming. This ditch heads on the north side of the Poudre River a few miles above the City of Fort Collins and traverses the Poudre Valley, crossing the Union Pacific Railroad near the City of Eaton and extending, by laterals, to the boundaries of the Greeley-Poudre District. The other one, the canal of The Water Supply & Storage Company, known as the Larimer County Canal, was commenced in the year 1881, heads upon the north side of the Poudre River some 12 miles above the City of Fort Collins and also traverses the length of the Poudre Valley, its extensions running slightly into the area of the Greeley-Poudre Irrigation District. These two canals are of particular interest because of the comparative date of their construction with the Pioneer Canal in Wyoming, and further, because, as we have explained, they are of about an average in age and show the remarkable development in irrigation and agriculture under irrigation in the Poudre Valley.

We have felt that where it was practical photographs showing the development or lack of development of these areas would be, to a reasonable degree, suitable evidence. Accordingly, we have introduced in evidence two large albums containing photographs showing the agricultural development under these two canals.

Exhibit 119 is a series of photographs taken along the general course of the Larimer County Canal. The first photograph

was taken at a point about two and one-half miles north of Fort Collins, from which point photographs were taken in an effort to show each quarter section subdivision along a highway running through the territory irrigated by this canal.

The other, Exhibit 120, is a similar set of photographs taken under the Eaton Ditch, commencing at the sugar factory immediately adjoining the City of Fort Collins and running in the same way.

Photographs were taken upon each quarter section along a highway traversing the area irrigated by this canal. This line passes through the City of Eaton some 18 miles to the east and on into the newly developed area adjoining the Greeley-Poudre District immediately to the east of Eaton. In each of these exhibits a key map will be found. For this purpose the map prepared by the United States Geological Survey was used and the location of each photograph in the album is indicated by number. The photographs correspond in number and each has a legend showing the date upon which the photograph was taken, the location and a very brief description of the scene.

We most earnestly request the consideration of the court to these photographs as being the best visual evidence which we could produce to show the conditions of development in these areas. No attempt whatever has been made to show the good and eliminate the bad. The pictures have been taken indiscriminately along the courses mentioned.

We endeavored to treat the Laramie Plains in the same way, but conditions are so radically different that we found it impossible to do this, so, instead, we had the engineers in charge of the plane table survey take a photograph of every set of farm or ranch improvements on the Laramie Plains within the area covered by the plane table survey. The only exceptions are the few instances in which, for some reason, the photograph was a failure. These are contained in an album introduced as Exhibit 116 which has a key map and number similar to that described for exhibits 119 and 120. We have but one apology to offer and that is that it was within our means to have the pictures shown in Exhibits 119 and 120 taken by a professional photographer, whereas we found this to be beyond our means in dealing with the Wyoming situation, and the photographs were taken by two of the engineers in the plane table party, so while they are not as large nor as good from an artistic sense as the Colorado pictures, nevertheless they give a fair representation, so far as pictures can show it, of the lack of development in the Laramie Plains area.

To supplement these smaller views, we had a number of large panoramic photographs taken, Exhibit 122. If there be any criticism as to the difference in photographic skill displayed in the former pictures, it is absent here, for the reason that these

panoramas were taken by the same photographer and upon successive days. In this album, the first picture is a scene taken on the Wheatland tract. The panorama covers a complete circle, and a better understanding can be had if the picture is bent into a circle with the observer in the center. A description is given immediately preceding the picture, so that it will not be necessary to describe these scenes in this brief.

The second picture is also taken in the Wheatland district.

The third and fourth were taken on the Laramie Plains and show with true accuracy the typical conditions prevailing there.

The fifth is taken on the Little Laramie River and shows how this area is devoted largely to the culture of native hay.

The sixth is a picture taken near Ault, some twelve miles north of Greeley. The area shown has but recently been brought under irrigation. It practically adjoins the Greeley-Poudre district lands. It clearly shows what development can be expected in the Poudre Valley under irrigation, even in a short length of time.

Numbers seven and eight are pictures taken at or adjoining the town of Ault.

Number nine is a picture taken near the town of Pierce, which lies within the boundaries of the Greeley-Poudre District, the cultivated lands shown are, however, irrigated by a recent extension of the Larimer County Canal, known as the Pierce Lateral, and had been irrigated for only about four years.

Number ten is a picture taken from the top of the sugar factory at Eaton and shows the surrounding farming country irrigated largely by the Eaton Canal, of which the original date of construction was the same as the Pioneer Canal in Wyoming.

Notice the contrast between this area and the Laramie Plains along the Pioneer Canal, shown in pictures three and four.

Number eleven is a scene taken nine miles east of the City of Fort Collins.

Numbers twelve, thirteen and fourteen are scenes at or near the village of Lucerne, about midway between Greeley and Eaton.

These panoramic photographs were taken August 5th to 8th, 1913, and a description of the various scenes will be found at transcript pages 3047 to 3070, inclusive. An attempt was made to get typical pictures of the various areas affected by this cause.

To show further the contrast in development, we went to the census reports and had analysis made of the various census reports for the decades 1870 to 1910, inclusive. This analysis was made by E. B. House, Professor of Civil and Irrigation Engineering at the State Agricultural College of Colorado.

He also testified to things other than that contained in these census reports, but from the census reports he made a series of diagrams comparing generally the counties of Larimer and Weld in Colorado with Albany and Laramie in Wyoming. These census reports are of relative value only. The County of Weld has been divided since the earlier reports were published and re-divisions have been made several times. In 1909 Larimer County, Colorado, was divided and that portion known as North Park, a country somewhat similar to the Laramie Plains area, was taken off. This is not shown by the census reports, except upon analysis of the area of the county. Moreover, the County of Laramie, Wyoming, has been divided and two new counties Goshen and Platte, created out of the northern half. The Wheatland District, which is involved in this controversy, is located in the new County of Platte. This division was made after the data was compiled for the census report, consequently everything contained in Professor House's analysis referring to Laramie County, Wyoming, is inclusive of the present area of Laramie County, Platte County and Goshen County. We do not know whether there has been any similar division of Albany County, Wyoming, or not, but we wish to make this point clear, that in the comparison made by Professor House we are including the area of the present counties of Platte and Goshen as part of Laramie County, Wyoming. This fact makes the comparison more favorable to Wyoming than would be true if the limits of the present counties alone be considered. The comparison, of course, should be made between the two Colorado counties and Albany County, which includes the Laramie Plains, and Platte County, which includes the Wheatland area in Wyoming, but inasmuch as the census report did not have Platte County, it had to be included within the area of the greater boundary, that is, the undivided Laramie County.

Exhibit 86 is a blue print drawn to scale showing the areas of the four counties.

Exhibit 87 is a diagram drawn to scale, showing the development according to population, comparing the combined Colorado counties with the combined Wyoming counties. In 1870 the total population of the Colorado counties was 2,474 as against 4,978 in the two Wyoming counties. The increase in population for the various decades is shown, and in 1910 it appears that the Wyoming counties (undivided) had a total of 37,701, whereas the Colorado counties, after the deductions had been made by the divisions of Weld County, was 64,447, or, if the original Weld County is considered, then the total would have been 88,499. This chart clearly shows the great increase in Weld and Larimer Counties as compared to that of Albany and Laramie Counties in Wyoming.

Exhibit 88 is a like comparison of population, except that Weld County alone is compared with Albany County, Wyoming, and it is remarkable that in the decade from 1900 to 1910, Weld County increased from 16,808 to 39,177, while Albany County, Wyoming, decreased from 13,084 in 1900 to 11,574 in 1910.

Exhibit 89 is a chart showing the comparison in rural population. In 1870 the two Colorado counties had 1,994 persons in their rural population, whereas the Wyoming counties had 2,700; in 1910 the Wyoming counties (undivided) had 18,144, while the Colorado counties (Weld County divided) had 43,649.

Exhibit 90 is a chart showing the development in the number of acres in improved farm lands. Each one of the four counties is shown separately. In 1870 Weld County had 9,715 acres of improved farm land; Larimer County, Colorado, 5,135 acres; Albany County, Wyoming, 184 acres; Laramie County, Wyoming, 125 acres. In 1910 Weld County (divided) had 410,346 acres; Larimer County, 252,262 acres, or, with North Park separated in 1909, 177,525 acres. On the other hand, Albany County, Wyoming, had decreased from 144,075 acres in 1900 to 107,315 in 1910, but Laramie County, probably due largely to the development at Wheatland, Wyoming, had increased from 93,304 in 1900 to 210,992 in 1910.

Exhibit 91 is a chart showing development in the number of farms, each county being shown separately.

Exhibit 92 shows value of improved farms.

Exhibit 93, the number of acres irrigated.

Exhibit 94, the value of farm crops.

Exhibit 95, bushels of wheat produced.

Exhibit 96, average yield of wheat per acre.

Exhibit 97, oats produced.

Exhibit 98, average yield of oats per acre.

Exhibit 99, barley produced.

Exhibit 100, average yield of barley per acre.

Exhibit 101, potatoes produced.

Exhibit 102, average yield of potatoes per acre.

Exhibits 95 to 102, inclusive, deal with ordinary farm crops. We find from them that in 1910 Albany County, Wyoming, produced only 4,068 bushels of wheat; Laramie County, 107,800 bushels; Larimer County, Colorado, 580,250 bushels, and Weld County, Colorado, 1,628,022 bushels, and even then a decrease in the wheat production in the Colorado counties is apparent with the advent of the sugar beet industry.

Likewise we find that in 1910 Albany County, Wyoming, produced 120,449 bushels of oats, Laramie County, Wyoming, 632,949; Larimer County, Colorado, 514,553, and Weld County, 856,544.

The 1910 barley production seems to be as follows: Albany County, Wyoming, 10,361; Laramie County, Wyoming, 21,946; Larimer County, Colorado, 179,847; Weld County, Colorado, 577,637.

Potatoes in 1910: Weld County, Colorado, 5,867,691 bushels; Larimer County, Colorado, 198,506 bushels; Laramie County, Wyoming, 203,016; Albany County, Wyoming, 43,729.

As we stated, these figures are relative only. Doubtless there are at times inaccuracies in statistics obtained for the Census Bureau, and we do not insist that they represent exactly the correct data in any one county, but the system was undoubtedly uniform, and the errors, if any exist, should be compensating.

Moreover, it must be borne in mind that these figures are for the four counties, taking each county as a whole, and, of course, in this case, we are comparing not counties but only portions of counties. Nevertheless, they clearly show the relative value of the areas here in controversy as agricultural districts.

Exhibit 103 in like manner shows the hay production, in 1910 Albany County, Wyoming, producing 52,748; Laramie County, Wyoming, 116,700; Larimer County, Colorado, with North Park, a hay district, taken off, 109,792, and Weld County (divided) 168,214 tons. This classification of hay includes not only native grasses but alfalfa.

Exhibit 104 shows live-stock, and here the contention of the defense that the Laramie Plains, which is in Albany County, Wyoming, is essentially a live-stock area, becomes apparent. In 1910 the total number of live-stock in Larimer County, Colorado, was 49,753; Weld County, Colorado, 84,850; Albany County, Wyoming, 199,103, and Laramie County, Wyoming, 552,153. Laramie County, Wyoming, is a heavy producer of sheep. We understand that these figures do not include sheep and cattle held temporarily for fattening. The Poudre Valley imports several hundred thousand head of sheep and cattle each year. These are fed for the market, usually during the winter months.

These exhibits, 86 to 104, inclusive, are prepared from data contained in the United States Census Reports.

An analysis was also made by Professor House of the Government meteorological reports for the stations at Laramie, Wyoming, and Greeley, Colorado. The station at Laramie is connected with the Experiment Station at that point.

Exhibit 105 is two plots showing the minimum monthly temperatures throughout each year for the decade 1893-1902, inclusive, and the decade 1903-1912, inclusive. Minimum monthly temperatures are selected instead of maximum temperatures in order to show the relative length of the season above

frost at each station. The solid irregular lines on the plots indicate the minimum monthly temperatures at Greeley; the dotted line at Laramie. The chart is graded to show temperatures from 30 degrees below zero to 60 degrees above zero, Farenheit. At a point on the plots representing 32 degrees above zero, a heavy line runs transversely across the sheet and the temperature lines above this heavy line therefore indicate the portions of the year during which no temperature as low as 32 degrees, or freezing, occurs.

The number of days in the season above frost at the two stations for each year from 1892 to 1912, inclusive, is shown on the plots and also in the abstract (2424-2428). The average for the twenty year period is 126.5 days at Greeley and 57.6 days at Laramie.

The records from which this data was taken are beyond dispute. The same methods of taking and recording temperature were pursued at the two stations, and it is conclusive testimony to the fact that for a period of twenty years the average season between frosts at Greeley was approximately two and one-half times as long as at Laramie. It must be borne in mind that the temperature lines plotted on Exhibit 105 show only the minimum monthly temperature. The exhibit in no wise is intended to indicate daily temperatures.

As an illustration of one of the extremes, it is to be noticed that in the year 1904 there were 128 days at Greeley when the temperature was above freezing, whereas it frosted every month in the year 1904 at Laramie City, Wyoming.

Within the scope of this brief it is impossible to review in detail all of the evidence showing the development and the present status of the Poudre Valley. Much evidence was introduced for this purpose, but so diversified are the interests of this valley that it was impossible to show the conditions prevailing there without the production of a number of witnesses. Suffice it to say that we have traced the history of the valley from its pioneer days when the earliest crops consisted of the production of a small amount of native hay along the river bottoms, with a very small amount of garden truck, through the expansion of the irrigated area, and the production of small grains, to the present day development, the evidence showing that probably the Poudre Valley is as advanced a region for diversified farming as can be found in the whole country. We have shown that the production of grains has relatively decreased with the introduction of other crops, notably potatoes and sugar beets, and that development has progressed until a more thoroughly modernized farming area would be hard to find. In the valley there are two small cities, modern in every respect, Fort Collins at the upper end and Greeley at the lower end of the valley, each of these having a population, according

to the 1910 census, in excess of 8,000 people; each with a large educational institution, the State Agricultural College and the Colorado Experiment Station being at Fort Collins, and the Colorado Teachers' College, commonly known as the Normal School, at Greeley. In addition to these, there are numerous other towns varying in size, the largest of which is the town of Eaton, some eight miles north of Greeley, and Windsor, midway between Fort Collins and Greeley; also towns such as Ault, Pierce, Wellington, Severance, Timnath, LaPorte, and many others which we need not give in detail; that even in the Greeley-Poudre district several small towns, more particularly Hungerford, Camfield and Briggsdale, were built in anticipation of the development of that tract.

We have shown the substantial nature of the improvements and the presence of modern conveniences, such as telephone and electricity for power and light, not only in the towns and cities, but also throughout the rural communities.

We have shown that to the west of Fort Collins, in the area which is known as the LaPorte district, intensified farming has become the rule, and that the area is devoted to a large extent to the production of fruit, such as berries, cherries and apples, and the production of garden truck, and that in this district the farms are frequently 10 and 20 acre tracts, producing, in some instances, several hundred dollars per acre per annum; that probably this sort of production was encouraged in the LaPorte district rather than other portions of the valley for the reason that this was the point at which one of the overland stage routes beforementioned left the Poudre Valley for the Laramie Plains and the settlers at LaPorte, at an early date, found a ready market for garden produce in Wyoming, particularly in the Laramie Plains area, and that this market is still availed of and great quantities of fruit and vegetables are hauled by wagons into the Laramie Plains area, as well as shipped by rail.

We have shown that there are numerous flouring mills throughout the valley, particularly at Fort Collins, where there are two, Windsor, Greeley and at Eaton, with elevators at other locations, and that the product of these mills is, to a very large extent, exported to various portions of the United States. It is significant, however, that one miller, Mr. B. F. Hottel, who testified for the defense, stated that he always had had a large market for his flour at Laramie, Wyoming (3300).

We have shown that at Greeley there is a large canning plant, at which vegetables grown in the surrounding country are canned; that cabbage, onions, celery and other garden products are raised extensively for exportation surrounding Greeley.

To the northward of Greeley, in the territory surrounding Eaton and Ault, vast crops of potatoes have been and are grown. These are known as the "Greeley potatoes," and their

fame has extended throughout the whole United States, exports being made even to Cuba, the average amount exported being 4,500,000 bushels per annum (3095-3109, 3198-3212).

We have also shown that with the year 1901 there began the development of the sugar beet industry, with the result that there are beet sugar factories located at four different places in the Poudre Valley; Fort Collins, Windsor, Greeley and Eaton; that these factories are of enormous size, modern in every way, but it would hardly be fair to permit the inference to go that these four factories in the Poudre Valley constitute all in northern Colorado. Within a radius of probably fifty miles from Greeley there are in all nine sugar factories, all belonging to one company, the Great Western Sugar Company. This is the largest sugar producing area in the State of Colorado, and it is a matter of public knowledge that Colorado leads all other states in the production of beet sugar.

With the advent of the sugar beet, modernized methods of cultivation became necessary, and throughout the Poudre Valley where diversified farming is practiced, we learn that a scientific system of rotation of crops has been adopted with alfalfa as the basic crop. Briefly stated, the system is this: ground devoted to the production of alfalfa, which is a perennial growth, yielding in the Poudre Valley about three crops a year, with an average production per annum of about four tons to the acre, is, in the course of time, plowed up and devoted to the production of beets or potatoes for possibly two years and then to the production of grain for possibly two or three years. Possibly the last crop of grain is sowed with alfalfa seed and the farmer, after cutting his grain, finds his land in a new crop of alfalfa which will yield substantially the following season. After the land has been devoted to alfalfa for a few years, the rotation is again made. In this way the nitrogen-bearing alfalfa fertilizes the soil for the other crops.

The production of sugar beets is so great as to be astounding. See Exhibit 146, page 3580. The factory at Fort Collins is capable of working up into sugar 2,200 tons of beets per day. The cultivation of beets requires a relatively large amount of hand labor, and, for this purpose, there have been brought into the Poudre Valley many persons. The matter is of interest in this, that the crop is one which furnishes a means of livelihood for more persons than practically any other ordinary farm crop. The farmer, after removing the beets from the ground, cuts off the tops and delivers the beets to the nearest railway station, where they are loaded over a contrivance known as a dump, receiving for them a price determined by the sugar content of the beets, the average price for beets, however, being about $6.00 per ton (2346) and the average yield approximating 13 tons per acre (2349). The tops which he has removed are used for feeding either cattle or sheep, and instances of

the sale of beet tops are shown in the record where as high as $3, $4 and even $7 per acre was procured by the farmer. After the sugar has been extracted from the beets at the factory, there remains a by-product ordinarily called pulp, which is run out from the factory into immense silos and from there it is sold for the feeding of cattle and a large number of cattle are finished for market in the Poudre Valley on beet pulp, with other feeds, largely alfalfa. Another by-product in the manufacture of beet sugar is a thick molasses from which a small amount of saccharine matter cannot profitably be extracted. This also is used for the finishing of cattle for market.

Moreover, the production of enormous quantities of alfalfa led, years ago, to the development of another industry which has become of vast importance to the valley, that is, the feeding of lambs for the market, and it is a matter of common knowledge that the "Fort Collins lamb," so called, is famous in the large packing centers of the United States. These lambs are not grown in the Poudre Valley. As a matter of fact, few of them come from Colorado, but southern Wyoming and northern New Mexico are the principal sources of supply. The spring lambs are purchased, for illustration, in southern Wyoming by Poudre Valley farmers in the fall, shipped into the valley, fed on alfalfa and corn for usually a period of from three to five or six months, and then shipped to the packing centers, such as Omaha, Kansas City or Chicago. The corn fed to these lambs is imported, for the reason that corn is not a successful crop in this area.

We have already mentioned that cattle are fed, but to leave the impression that the beet pulp alone was used for this purpose would be erroneous. Cattle, like the sheep, are not raised in the Poudre Valley, but are imported from live stock producing centers, and with the modification of the feed, the methods are largely the same as those followed for sheep. In this way the Poudre Valley farmer found an advantageous market for his alfalfa and also for those things which may be termed by-products from sugar beets, that is, beet tops, beet pulp and the refuse molasses. The average market price of alfalfa is usually about $6 per ton in the stack. It would be far less, however, if the feeding industry had not developed the market.

Counsel for the complainant seem to complain at the length to which we have gone in showing the development of the Poudre Valley, but we have a pardonable pride in this development and we believe that we are justified in showing these conditions, because the fact is apparent that the Poudre Valley, acre for acre, will furnish a means of livelihood for many times the number of people that can be supported by the Laramie Plains area, even under the best methods which can be brought into practice there.

The complainant contends that they can raise practically anything in the Laramie Plains. We deny this, and it is conclusively shown that from an agricultural standpoint, as the term is ordinarily used, the country is limited to the production of hay and possibly a very slight production of the hardier grains. Where we get three crops of alfalfa per year in the Poudre Valley, the Laramie Plains gets two, and its vast area now devoted to the production of native hay, which we think is the only practical crop to be relied upon, produces an average of one half of one ton per acre, and, according to the Wyoming testimony, is worth $8 per ton in the stack. In other words, we find that the only sure crop which the Laramie Plains so far has produced is native hay, yielding an income at the rate of $4 per acre. If the Laramie Plains can produce wheat, why has it not done so? They have had a flouring mill at Laramie for many years. During a larger portion of the time, according to Wyoming testimony, it has been idle. When it does run, it has run largely upon imported wheat. One witness for the complainant testifies that during 27 years, a large portion of the grain consumed in the Wyoming area has been imported (4063). Experiments in feeding live-stock, carried on at the Wyoming Experiment Station at Laramie, required the importation of alfalfa because it could not be obtained locally (4028). They have not produced sufficient garden truck to supply the local needs, and as a matter of fact, the evidence of witness after witness produced by the State of Wyoming showed that the only garden truck the ranchmen attempted was to supply their own individual needs. They contend that they can raise oats. Why have they not done so? The fact remains that the production is lacking.

Certain persons interested in the subject, induced the representatives of the Great Western Sugar Company to send representatives to investigate the possibilities of raising sugar beets. Representatives of this company, as shown by the evidence, visited the Laramie Plains and discouraged the idea that sugar beets could be produced there. However, after looking over the situation and upon the urgent demands of various persons, a quantity of sugar beet seed was sent to persons living near the junction of the Big and Little Laramies, with directions for the cultivation of the crop upon the agreement that the beets when grown would be received at one of the factories in the Poudre Valley at a fixed price per ton. Nothing was ever heard from the venture (see testimony of Hiram Timothy, 2354-2355, and Silas H. Turner, 3133).

We have heretofore discussed, under the subject of the amount of land irrigated, three exhibits, to which we wish to refer again. The first of these is Complainant's Exhibit E, the same being a tabulation of Mr. Meeker's reconnaissance of the

lands under irrigation on the Little Laramie, the total amount of which we have criticised because of the inclusion of the Centennial Valley lands. However, for the purpose of a discussion of the areas devoted to various crops, it may be considered as it stands. In this table, Mr. Meeker classifies the lands into meadow, pasturage, oats and alfalfa. Considerable evidence had been introduced by various witnesses as to the oats which had been produced in the Little Laramie region, particularly upon what is probably the best ranch in that region, known as the Blackburn ranch, the area of which is included in the total given on this Exhibit E.

In this table, Mr. Meeker has a grand total of 49,553 acres, and of this, he classifies 26,842 acres as being meadow land, 20,077 acres as pasture, 2,314 acres as oats, and 300 acres as alfalfa land. This meadow land is native hay; the pasture land is probably land which is irrigated but which does not produce a sufficient amount of grass to justify cutting as hay and is therefore used as a pasture. Our brother Corthell for the complainant in the examination of witnesses, frequently refers to it as irrigated pasturage.

It therefore appears that out of this total amount of acreage, Mr. Meeker was able to find as devoted to agricultural crops in the accepted sense of the word, only 2,314 acres upon which oats were grown, and 300 acres devoted to alfalfa.

Keeping in mind the difference in the number of acres shown by Mr. Meeker's reconnaissance and the survey made by the defendants of this area, let us consider Exhibit 117, which is a similar tabulation, somewhat more in detail, based upon that survey of the Little Laramie area. This survey disclosed, as we have heretofore shown, 31,341 acres in this area, of which 22,081 acres was meadow land, producing native hay; 5,801 irrigated pasturage, 219 acres alfalfa, 1,319 acres oats, 933 acres plowed ground, upon which no crops were grown in the year 1913, but which had been plowed either that year or some preceding year. In addition, the survey disclosed 88 acres devoted to various other crops, including a total of 10 acres of potatoes, 43 acres of wheat or other grain except oats, 19 acres of flax, 14 acres of barley and 2 acres of turnips.

A similar tabulation to Exhibit 117 was made of the lands on the Big Laramie River, covered by the survey, Exhibit 118, except that in Exhibit 118 the lands are given under the respective ditches, whereas the individual ditches are not considered in Exhibit 117.

Exhibit 118 discloses a total of 29,279.3 acres of which 24,588.7 is meadow land, classified as first, second and third class meadow, but inasmuch as after the plane table survey had progressed, we adopted the Wyoming nomenclature for what we were theretofore terming third class meadow and call-

it irrigated pasture, which in fact it is, this total of meadow lands should really be 17,651.9 acres of meadow lands and 6,936.8 acres irrigated pasture. The survey showed a total of 1,440 acres of alfalfa, 831.6 acres of oats, 211.9 acres of other grain, 27.4 acres of potatoes, 17.6 acres devoted to gardens and 2,162.1 acres plowed ground upon which no crops were grown in the year 1913. It will be recalled that Exhibits 117 and 118 are based upon absolute survey of these lands. The two combined may be tabulated as follows:

Meadow	39,732.9
Pasture	12,737.8
Alfalfa	1,659.0
Oats	2,150.6
Other grain	268.9
Potatoes	37.4
Garden	19.6
Flax	19.0
Plowed ground	3,095.1

Attempts were made to secure, by actual measurement, the production of native hay and alfalfa per acre. The witnesses for the complainant had frequently referred to alfalfa on what is known as the Hart ranch. Accordingly, the engineers in charge of the plane table survey made measurements for the purpose of ascertaining the number of tons per acre which this farm produced. In the year 1913, the first cutting of alfalfa on the Laramie Plains commenced July 7th (2631) and the second cutting about September 18th (2752). In the Poudre Valley the first cutting usually commences in the fore part of June, the second cutting about the middle of July, and the third in September, the second cutting coming at approximately the same date in July as the first cutting on the Laramie Plains. The first cutting on the Hart Ranch, a short distance above Laramie City, produced 320 tons from 481 acres; the second cutting 252½ tons, or a total for the two cuttings of 572½ tons, an average of 1.2 tons per acre (2633). The witnesses were, of course, not able to state that alfalfa might not have been hauled from the field and not stacked, and so admitted. The amount was determined by measuring the stacks, but if any hay was hauled away, the fact was not shown by the complainant on rebuttal. This tract of alfalfa land on the Hart ranch is supposed to be the best, or one of the best, on the Laramie Plains.

Other measurements were made of the first cutting alone at other places. For illustration, the first cutting on the Hoge ranch yielded 1.1 tons per acre (2634), and the first cutting on the Buntin ranch yielded approximately one ton per acre (2635).

The native hay grown upon the Bath ranch on the Little Laramie River was likewise measured. There is, of course, only one crop of native hay per year. The Bath ranch was described by witnesses for the complainant as being one of the best meadows on the Laramie Plains. The yield from 423 acres was, by actual measurement, 253.2 tons, or approximately six-tenths of a ton per acre (2635). (We note that in the abstract the decimal point has been omitted, so that it erroneously reads 6 tons per acre.)

Similarly, efforts were made to ascertain the yield of grain per acre. Oats on the Blackburn ranch on the Little Laramie River (the show ranch of the Laramie Plains) yielded 24 bushels per acre; wheat, 11 bushels, and 19 acres of flax, 8 bushels per acre. Crops on this ranch are above the average in the Laramie Plains area. Another field of 63 acres of oats on this same ranch yielded 12.6 bushels per acre (2757).

The defendants felt that the testimony of some impartial expert on the merits as agricultural districts of the Laramie Plains and the Poudre Valley was advisable. Accordingly we procured the services of Dr. L. H. Bailey of Ithaca, New York, one of the highest authorities on agriculture in the United States. Dr. Bailey was, for many years, director of the agricultural experiment station at Cornell, and is probably best known as chairman of the Country Life Commission, appointed by President Roosevelt in 1909. His testimony is found in the abstract at transcript pages 2575 to 2615, inclusive. He testifies that he had once made a very brief visit to Laramie, Wyoming, but had never been in the Poudre Valley in Colorado prior to the year 1913; that on September 16th, 17th, 18th and 19th, he made a trip of inspection over the Poudre Valley, including the Greeley-Poudre Irrigation District, and over the Laramie Plains. This trip was made in an automobile under these conditions, that he should reach his own conclusions, free from any suggestion or argument from any person representing the defendants, directly or indirectly, but every facility was given in order to enable the witness to see everything necessary.

At Laramie, Dr. Bailey met some of the persons connected with the Agricultural College and Experiment Station, and on his reconnaissance saw what was said to be the best, from an agricultural standpoint, on the Laramie Plains.

After this trip of inspection, Dr. Bailey testifies that he made an investigation of various reports, such as census reports, soil surveys, meteorological reports, bulletins and other printed matter. Some three months after his visit, he made a report to the State of Colorado which resulted in his being called as a witness by the defendants.

He says that the two areas are not to be compared, but contrasted (2584); that he was greatly impressed with the

development of the Poudre Valley; in the industry he saw everywhere, the great number of people, the teams met on the roads hauling produce, the well-developed road systems, the character and number of the dwellings, from four to seven and sometimes more per section, established homes with good yards, small orchards, vegetable gardens; the shade trees along the highways; the frequent school houses and the thriving towns and villages; the excellent character of the soil and the crops such as alfalfa, sugar beets, potatoes, garden stuff, with storage cellars and sugar factories. "Altogether it seemed that in that region there was a highly developed rural section, founded directly on agriculture."

He then went directly into the Laramie Plains "and found a very different state of conditions." The country was more open, with a relatively small number of houses and few teams on the roads, which were excellent but with not so many of them laid out along the rectangular section lines. There were fewer shade trees, with the natural vegetation less vigorous; no rural towns outside of Laramie founded on agriculture. Saw some very attractive places, although these were not so numerous as in the Poudre Valley. Impressed with the gravel in the soil, saw some good crops of certain things, but not nearly so many as in the Poudre Valley and growing only in places here and there; very little garden truck and no fruit trees, with one exception, those at the Lund place at the head of the valley. The witness says that he saw a good number of special crops on trial, largely at the Experiment Station, which he did not enter because the frost had killed a good part of the experimental work for the year.

The witness testifies further that he had a definite impression that so far as new crops were concerned, practically everything was on trial on the Laramie Plains and that high development would be limited to special places where there is some peculiarity in soil and particularly where there is protection from climate. He says:

> "The Laramie Plains struck me as being primarily a region of live stock adaptability and in general the Greeley District is already a highly developed cropping region.
>
> It struck me that the Greeley District, acre for acre, is capable of maintaining a more intensive and more diversified cropping business, yielding as a whole more crop products and sustaining a denser population from agricultural products of the land. All these conclusions appealed to me as being self-evident.
>
> I arrived at these conclusions from my general observation of the two regions. Of course, when I came

to analyze the observations, I found that they rest on two general classes of facts, so far as I have been able to analyze them.

In the first place, the fact of actual relative lack of development of the Wyoming district as compared with the Colorado district, and second, the very considerable natural differences in elevation, configuration, latitude, soils and climate."

"If one goes into a new or developing country as a stranger, he thinks he is able to judge very well of it by observing what has already taken place in older or developed parts near-by. It is approximately the only method one has to apply. Although these two regions were open to settlement at approximately the same time, there is a very marked difference in the state of development of them."

Dr. Bailey then refers to the established reputation of the Poudre Valley area for its potatoes, sugar beets, canning crops and other products, stating that it is no longer a doubtful or experimental region, that its agricultural success seems to be assured, and that the lands within the new area, that is, the Greeley-Poudre District, have apparently as good natural adaptabilities as the adjacent lands in the vicinity of Eaton.

On the other hand, he testifies the Laramie Plains to be sparsely settled, comparatively low values, relatively little land under the plow, although there are some apparently profitable ranches.

In the Poudre Valley, the farms are small, indicating relatively intensive cultivation. In the Laramie Plains they are large, indicating less production per acre.

Dr. Bailey then reviews at considerable length various official reports and bulletins showing the character of the development in the two areas which were cited "not for the purpose of giving statistics, but in confirmation of the judgment at which I had arrived independently."

The witness then states:

"The Laramie Plains had the advantage of a transcontinental railroad. Both regions have had the possibility of developing a good water supply for irrigation. As far as I am able to judge, the Colorado region under discussion has developed continuously, or nearly so, with practically all of its irrigable lands under good or even high state of cultivation. The Laramie region has developed here and there in large ranches with some smaller establishments with very much other space that is merely

fenced and used for grazing. Of course, it is evident upon the face of it that settlers have desired the Greeley region more than the Laramie region. Of course, I am stating this not in any discouragement to development of the Laramie Plains, that must be understood, but as an assertion as to how the two areas struck me, and also as indicating that the two regions are of different character. I think this fact must be recognized when Plains Region is fully developed. It seems to me that that region will undoubtedly further develop approximately as a grazing, and to some extent as a feeding, region with such accompanying forage as can be grown with profit, and for the most part, this probably will mean its development in relatively large areas. Taking that country as a whole, as I saw it, it struck me as a region of relatively low crop production, both in totals and per acre, and also a fluctuating production, not overlooking the fact, however, of exceptions in particular places."

Witness then reviews the census figures, commenting upon the difference in rural populations, stating that:

"What has been done indicates in a general way what may be expected."

He reviews the capabilities of the two areas in crop productions, showing the comprehensive nature of the adaptability of the Colorado area for crops and the limited character of the Wyoming area. He reviews the Government soil survey reports, the soil indicating that the agricultural development of the Poudre Valley, as surveyed, far surpasses that of the Laramie region. He reviews the climatic conditions, stating that the Laramie Plains is one of the most elevated agricultural regions in North America and is therefore one of the most interesting. He states that elevation can be projected into latitude and that if this be done, the Laramie Plains area might be equivalent, other things being equal, to a point in general latitude of Edmonton, Alberta, except that the Laramie Plains lacks the greater length of day which prevails in the northern latitude.

The witness then reviews the meteorological records, taking into consideration temperature and rainfall, comparing the records at Fort Collins with those at Laramie, whereas the previous witness, Professor House, compared the Greeley records with those at Laramie. He states:

"So far as meteorological records are valuable for determining the fitness of these regions for agriculture, one would have no hesitancy in saying that the region

measured by the Fort Collins records offers very decided advantages over that measured by the Laramie records."

and concludes:

"To briefly sum up the principal reasons why the Poudre Valley area is, in my judgment, so much superior to the Laramie Plains area, as an agricultural region, I think I cannot do more than practically repeat the statement I have already made in my testimony. I feel that the development that is in the general Greeley District is one that is destined to produce more value per acre and greater diversity in cropping, to maintain a bigger rural population and more rural industries founded on agriculture. The general fundamental reasons for these differences, as I have already indicated, I think chiefly are soil and climate, particularly the latter, for the reason it is difficult to overcome climate, but it is possible to overcome some difficulties in soil conditions. In other words, I should regard the climate to be a more important controlling factor than soil, other things being equal, if the soil is such that crops can grow in it at all."

PRIORITY OF DIVERSIONS.

The defendants feel that priority of right as between users in different states has no place in a suit between sovereign states affecting the water of interstate streams, except possibly, that the relative priorities might be one of many factors from which the court would determine the reasonableness of the use in one state as against another, or, in other words, might be one factor in determining the equities between the states.

We believe the decision of this court in the case of Kansas vs. Colorado, 206 U. S., 46, is decisive of this contention.

However that may be, we have felt that we cannot neglect a complete review of the evidence showing the respective priorities of diversion from the Laramie River in Colorado and Wyoming, more particularly the later diversions in both states, which are more directly affected in this cause.

An extended review of the evidence upon this question, together with a discussion of the law on the subject is set forth in Part II, Volume 2 of this brief.

We believe that it will be more convenient to divide the brief in this manner, because of the great length to which we have already gone in a discussion of the more general features of the case. However, at this point, we desire to call attention to the fact that the Greeley-Poudre diversion from the Laramie

River dates from August 25, 1902, and, under the law of the State of Colorado, the priority is established by judicial decree as of that date as against all other Colorado priorities on the River. On the other hand, the evidence discloses that all of the larger diversions in Wyoming, with the exception of the Pioneer Canal and the system of works designed for the irrigation of the original Wheatland tract, are junior in point of time to the Greeley-Poudre system. The evidence discloses that the surveys for the Lake James system were begun upon March 22, 190 (638); for the Lake Hattie system, April 16, 1908 (646, 774); for the Sodergreen High Line, November, 1907 (445); for the extension of the Wheatland system to the Bordeaux tract, in February, 1904, and to the Sybille tract in August, 1907. (108.) These dates are all shown by the evidence and are further confirmed by the permits issued by the State Engineer and the Board of Control of Wyoming, which constitute the official findings of the date of priorities, subject, of course, to review as we have heretofore mentioned.

We have shown that Lake Hattie has a capacity of 110,500 acre feet, of which 68,500 acre feet is active or available capacity; Lake James has a capacity of 41,100 acre feet. We do not recall that the capacity of the Sodergreen High Line ditch is fixed, but the extension of the Wheatland canals to the Bordeaux and Sybille tracts, so far as they are constructed, are designed for the irrigation of 10,000 and 30,000 acres, respectively. It therefore appears that permits have been issued for works which are now constructed, in whole or in part, for the storage in these two reservoirs, counting active storage only, of 109,600 acre feet per annum, and in addition to these reservoirs, the irrigation of land in excess of 40,000 acres.

This statement is not intended, however, to include many other proposed projects, nor the proposed irrigation of other lands, but is limited to the five projects mentioned, all of which are junior in point of time to the Greeley-Poudre system.

The total extent of the acreage proposed to be irrigated in Wyoming by projects junior to the Greeley-Poudre system is set forth in tabulated form in the portion of the brief referred to devoted to the question of priority of diversions.

INTER-WATERSHED DIVERSIONS.

The defendants have shown that inter-watershed diversions are in existence where necessity requires throughout the world wherever irrigation is practiced. We have shown the existence of such diversions in India, some ancient and some modern works; in Italy, in France, Spain, Turkestan, in British Co-

lumbia, Alberta, Hawaiian Islands, Ceylon, and in every state in the Union where irrigation is practiced, these last projects being not only private projects, but also in some instances projects undertaken by the United States Reclamation Service, and the remarkable thing is that while the complainant denies the right of the defendants to divert water from the Laramie River into the Poudre River, nevertheless, under permits issued by the State Engineer of the State of Wyoming, which culminated in decrees by its Board of Control, affirmed on appeal by the courts of the state, Wyoming is itself at this time, and has been for many years, actively engaged in the practice of diverting water from one watershed to another. (1445-1600, Exs. 22-50.)

A monograph upon this subject, together with an exhaustive discussion of the law, is set forth in Part I, Volume 2 of this brief.

CONCLUSIONS OF FACT.

From the foregoing, it appears that the evidence discloses:

That the total flow of the Laramie River and its tributaries in both Colorado and Wyoming is something in excess of 470,000 acre feet per annum, and of that amount, 431,200 acre feet is the normal average flow of the river available above and including the Wheatland tract.

Of this total flow, Colorado furnishes at least 250,000 acre feet per annum, the evidence varying from 220,000 acre feet according to one Wyoming witness, to 250,000, 300,000 and 320,000 acre feet according to the Colorado witnesses.

Of the 250,000 acre feet furnished by the State of Colorado, we are now diverting for irrigation 20,000 acre feet per annum, and seek to divert 56,000 acre feet in addition, with a probability that at some time this 56,000 acre feet may be enlarged to 71,000 acre feet. Assuming this contingency, Colorado seeks to divert 91/250ths of its own water, and this amount marks the limit to which Colorado can go in the diversion of water from the Laramie River. The rest of the water must for all time remain in the stream for the benefit of Wyoming if she needs it.

That irrigation methods and irrigation systems in Wyoming have been and still are primitive; that necessity has never required the officers of that state to make any definite attempt at the division of the water of the stream according to the respective rights of the appropriators; that wasteful methods have prevailed and still do prevail over a large portion of the Laramie Plains area, and that the amount of water used has been far in excess of the amount actually needed, and that

Wyoming has most excellent natural storage facilities which have been, to a certain extent, utilized at a remarkably low cost.

That the only expert testifying for the State of Wyoming says that the duty of water on the Laramie Plains area is one acre foot per acre.

That the total amount of land under irrigation from the Laramie River and its tributaries in Wyoming is 108,073 acres, including 29,074 acres in the Wheatland tracts and 78,999 acres on the Laramie Plains.

That while the Wheatland area is a relatively fair agricultural district, it has an ample water supply for many times the amount of land now under irrigation, and has, in fact, diverted more water than the law of the State of Wyoming permitted or necessity required; that the Laramie Plains is an area where climatic conditions are so adverse that its agricultural development has been and will be limited to the production of hay and a few other hardy crops, capable of resisting the severity of the climate.

That the lands of the Greeley-Poudre District are dependent for reclamation upon water from the Laramie River, which, when supplied, will bring about a development within the district equal to the development in the adjacent lands in the Poudre Valley; that the development already reached in the Poudre Valley is one wherein the highest agricultural production obtains, with a possibility of still further development in the future, supporting many times the number of people per unit of area as can be or have been supported by the Laramie Plains; that the same quantity of water, applied for irrigation upon the Poudre Valley will produce from five to ten times the amount that could be produced by the application of the same amount of water upon the Laramie Plains.

That even for the sake of argument, assuming a shortage of water in the Wyoming territory effected because of the diversion to the Greeley-Poudre District, nevertheless a far greater benefit to mankind will result from the application of that water in the Poudre Valley rather than upon the Laramie Plains.

That after the diversions have been made by Colorado, there will remain available for irrigation in the State of Wyoming in the watershed of the Laramie River, far more than sufficient for its present needs, and even a surplus amount for vast increase in the amount of land under irrigation.

That the prior diversions from the stream, under the laws of the respective states, are in Colorado, and

That the diversion by Colorado from the watershed is consistent with the highest economic use permitted the world over where irrigation is a necessity.

Therefore, the defendants contend that their diversion from the Laramie River into the Poudre by means of the Greeley-

Poudre system, will in no wise injure the State of Wyoming, and that the equities between the two states are such that this use is in no wise an unreasonable exercise of the rights of the State of Colorado as a sovereignty.

ESTOPPEL.

As a portion of their third defense, the corporate defendants allege:

> "Defendants aver that the plaintiff and its citizens, long prior to the institution of this suit and at all times, were fully advised of the said diversions and proposed diversions of these defendants and their predecessors in title, and have been advised of the formation of said district, of the voting of the bonds thereof, of the sale of said bonds to innocent purchasers for value, of the said construction for the purpose of effecting said diversion, and of the steps taken by citizens in said district in reliance thereon.
>
> Defendants aver that plaintiff and its citizens are equitably estopped from questioning the diversions sought to be enjoined herein." (Pages 17-18.)

We have already observed that, commencing with August 25, 1902, work was continually prosecuted, first in engineering, then in necessary road construction, and, lastly, in canal, reservoir and tunnel construction in the high mountain regions in Colorado surrounding the Greeley-Poudre system; that road construction began in 1903 and proceeded during the working season, and that excavation on canals commenced in 1904 and was prosecuted with great diligence thereafter; that between August 25, 1902 and March, 1908, less than six years, more than $292,000 had been expended upon the Greeley-Poudre project, in addition to moneys expended for properties necessary to the successful operation thereof; and that at the time of the trial of this cause, the Greeley-Poudre tunnel, 2½ miles in length, and rivaling in magnitude the works of the Government of the United States, had been completed through the mountain chain between the two rivers at a cost of $600,000.00, and concrete lining had been installed wherever necessary at an additional cost of over $20,000. More than $250,000 had been expended on the collection ditches in the Laramie River drainage and more than $1,825,000 in cash on construction on the general system prior to the filing of the bill of complaint herein on May 29, 1911.

In carrying on this gigantic work, supplies, machinery and labor were freighted by wagon train from Laramie and other Wyoming shipping points across the Laramie Plains and up the Laramie River Valley in both Colorado and Wyoming. From 1902 until after the filing of this suit, these activities in Colorado were well known to the officials of Wyoming and to her citizens along the Laramie River Valley in that state (2064), and no action was taken to prevent construction of the Greeley-Poudre enterprise during the years 1902-11 inclusive, during all of which time open and notorious ditch and tunnel construction was proceeding with large forces of men, teams and machinery, while Wyoming and her citizens stood idly by without protest, while Colorado and her citizens proceeded to construct the enterprise and to make the enormous expenditure above mentioned.

Notwithstanding that Wyoming and her citizens well knew of the opening of the Colorado project in the early years of 1902-3, plaintiff took no action to utilize or divert the enormous quantity of unappropriated water still remaining available in the Laramie River, until about the close of the year 1907, and March and April in 1908, at which time the new and theretofore uninitiated Lake James, Lake Hattie and Wheatland projects were first commenced. These new projects were authorized by plaintiff State when she well knew that the State of Colorado and her citizens had, almost six years prior thereto, appropriated a portion of the remaining waters of the Big Laramie River, and well knew that the Colorado appropriators were proceeding in good faith to complete their enterprise with diligence.

In view of the entire record, and particularly those facts above mentioned concerning which there is little, if any, contradiction, it would seem needless to further urge that plaintiff State and its citizens are guilty of laches and remained silent when they should have spoken and that they are now estopped to here deny the State of Colorado the right to divert and beneficially use a portion of the waters of the Laramie River so rising and flowing within her borders, and which, were it not for her Greeley-Poudre diversion, must flow out across neighboring states and into the Gulf of Mexico while her otherwise fertile lands remain forever arid and non-productive.

New York City vs. Pine, 185 U. S. 93, 98.

If it be asserted that certain letters of September, 1909, purporting to have been sent to certain interested individuals by an official of Wyoming, constitute even the semblance of protest, let it be remembered that these letters were first written and sent more than seven years after the Greeley-Poudre project in Colorado had been initiated, and during all of which

time construction had been proceeding upon the entire system both in the Laramie and Cache la Poudre valleys, and that over $800,000.00 (2159) had already been expended upon the same and identical system now in process of completion for the Greeley-Poudre Irrigation District which stands simply in the relation of a purchaser of the project definitely planned and in a large measure constructed long before the formation of the defendant district and the writing of the aforesaid letters.

Let it be further remembered that the same official who uttered this tardy communication continued thereafter to find that still unappropriated waters existed in the Laramie River and to issue new permits to still other new and junior projects in Wyoming, thereby solemnly proclaiming to all the world that unappropriated water remained after supplying all prior and other diversions from the Laramie River, and in effect finding that the statements contained in his communication were ill-advised and unfounded. It would be unreasonable to argue at that late hour that the fortunes so invested and all the many obligations assumed and undertaken on faith of the Greeley-Poudre enterprise could or would be lightly cast aside and utterly abandoned upon so tardy a murmur of protest.

The official acts, permits and decrees of plaintiff State, adjudicating in advance a water supply for irrigation of more than 278,000 acres of land to new projects first initiated and undertaken six years and more subsequent to the initiation of the Greeley-Poudre project in Colorado, estop her to now say that the small diversion to be made by the Greeley-Poudre project can in any wise injure any prior or other projects in Wyoming, for so to do is to admit that each of the new permits (1907-8 and subsequent) is, upon its face, false and untrue, and the promulgation of a fraud by and under the sanction of plaintiff State upon every investor in any newly permitted enterprise and every land owner thereunder.

Wyoming, by her own statute of limitations, is precluded and estopped to assert any claim other than that set forth in her quasi-judicial decrees and permits, by all of which she asserts that after all Colorado diversions there must still ever remain ample water in the Laramie River to justify the construction, operation and use in other new and junior Wyoming enterprises without injury to other appropriators.

The entire record furnishes ample ground to assert that Wyoming and her citizens are estopped to here deny Colorado and her citizens the right to divert a portion of the water rising and flowing within her own borders for the irrigation and reclamation of her lands, and the development and use of her own resources in the manner and to the degree permitted by the Greeley-Poudre system.

THE LAW OF THE CASE.

We have now discussed the facts of this case and to them, as summed up, we will endeavor to apply the law of the case.

When Colorado became a state in 1876, she became sovereign within the limits of her territory except as to the limited and enumerated powers given to the national government. She became the owner, in her sovereign capacity, independent of and behind her people as to all her great natural resources such as air, light and water, with equal rights as the original thirteen states.

> "One cardinal rule, underlying all the relations of the States to each other, is that of equality of right. Each State stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none."
>
> Kansas vs. Colorado, 206 U. S., 97.

The State of Colorado and the State of Wyoming respectively have the same equal rights as any one of the thirteen original states, and as to the waters of their interstate streams, their respective rights are the same as to the waters thereof within their limits as though they were one of the original thirteen states, except as to the factors of the waters being of an interstate stream and in an arid country. The controversy is not one between private parties, as in Bean vs. Morris, 221 U. S. 485; Rickey vs. Miller & Lux, 218 U. S. 258, which cases will be hereinafter discussed, but is a case between two sovereign commonwealths insisting respectively upon the waters here in controversy, Colorado insisting upon making the diversion in her right as a sovereign commonwealth and Wyoming insisting in the same capacity on the right being denied.

Mannville Co. vs. Worcester, 138 Mass., 89, decided in 1884, opinion by Mr. Justice Holmes, then of the Supreme Court of Massachusetts and now and for many years last past a Justice of the Supreme Court of the United States, was an action of tort for diverting the waters of a natural stream in the Commonwealth of Massachusetts and preventing the same from coming to plaintiff's mill in the adjoining state of Rhode Island. The action was treated as an action between private parties. It was held that it would lie upon the ground that the servitude was being exercised with the presumed consent of the Commonwealth of Massachusetts. It is clear, however, throughout the opinion that if the Commonwealth of Massachusetts were objecting, the objection would be effective and that it was compe-

tent for Massachusetts to control the great natural resources within her limits. *Inter alia the* court said:

> "A concurrence of the laws of both States is as necessary in that case as in the one at bar, to create a liability which can be enforced in either State consistently with principle. * * *
>
> Of course, the laws of Rhode Island cannot subject Massachusetts land to a servitude, and, apart from any constitutional considerations, if there are any, which we do not mean to intimate, Massachusetts might prohibit the creation of such servitudes. So it might authorize any acts to be done within its limits, however injurious to lands or persons outside them. But it does not do either. It has no more objection to a citizen of Rhode Island owning an easement, as incident to his ownership of land in that State, than it has to his owning it in gross, or to his purchasing lands here in fee. * * * So far as their creation is concerned, the law of Massachusetts governs, whether the mode of creation be by deed or prescription, or whether the right be one which is regarded as naturally arising out of the relation between the two estates; being created, the law of Rhode Island, by permission of that of Massachusetts, lays hold of them and attaches them in such way as it sees fit to land there, Massachusetts being secured against anything contrary to its views of policy by the common traditions of the two States, and by the power over its own territory which *it holds in reserve.*"

The language contained in this opinion becomes more significant as we read the opinions of the Supreme Court of the United States as to the questions there involved, wherein that court speaks through the same jurist, Mr. Justice Holmes.

Hudson Water Co. vs. McCarter, 209 U. S., 353, opinion by Mr. Justice Holmes, decided in 1907. Here the question was between a private party and the State of New Jersey, the state being represented by its Attorney General, McCarter. The defendant, the Hudson Water Company, under a contract with the City of Bayonne, in New Jersey, had laid mains for the purpose of carrying water to Staten Island in the State of New York. By other contracts it was to get the water from the Passaic River at Little Falls, where the East Jersey Water Company has a large plant by which the water is withdrawn. The State of New Jersey, reciting the need of preserving the fresh water of the state for the health and prosperity of the citizens, enacted that it should be unlawful to transport the waters of any river of the state into any other state for use therein. Action

was brought by the State of New Jersey to enjoin carrying the waters of the Passaic River out of the state. The action was sustained. *Inter alia* the court said:

> "But we prefer to put the authority which cannot be denied to the state upon a broader ground than that which was emphasized below, since in our opinion it is independent of the more or less attenuated residuum of title that the State may be said to possess. * * *
>
> It sometimes is difficult to fix boundary stones between the private right of property and the police power when, as in the case at bar, we know of few decisions that are very much in point. But it is recognized that the State as quasi-sovereign and representative of the interests of the public has a standing in court to protect the atmosphere, the water and the forests within its territory, *irrespective of the assent or dissent of the private owners of the land most immediately concerned.* Kansas v. Colorado, 185 U. S. 125, 141, 142; Id. 206 U. S. 46, 99; Georgia v. Tennessee Copper Co., 206 U. S. 230, 238. What it may protect by suit in this court from interference in the name of property outside of the State's jurisdiction, one would think that it could protect by statute from interference in the same name within. On this principle of public interest and the police power, and not merely as the inheritor of a royal prerogative, the State may make laws for the preservation of game, which seems a stronger case. Geer vs. Connecticut, 161 U. S. 519, 534."
>
> "It appears to us that few public interests are more obvious, indisputable and independent of particular theory than the interest of the public of a State to maintain the rivers that are wholly within it substantially undiminished, except by such drafts upon them as the guardian of the public welfare may permit for the purpose of turning them to a more perfect use."
>
> "But we agree with the New Jersey courts, and think it quite beyond any rational view of riparian rights that an agreement, *of no matter what private owners*, could sanction the diversion of an important stream outside the boundaries of the State in which it flows. *The private right to appropriate* is subject not only to the rights of lower owners but to the initial limitation that it *may not substantially diminish one of the great foundations of public welfare and health.*
>
> We are of opinion, further, that the constitutional power of the State to insist that its natural advantages

shall remain unimpaired by its citizens is not dependent upon any nice estimate of the extent of present use or speculation as to future needs. The legal conception of the necessary is apt to be confined to somewhat rudimentary wants, and there are benefits from a great river that might escape a lawyer's view. But the State is not required to submit even to an aesthetic analysis. Any analysis may be inadequate. It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will. * * *

It constantly is necessary to reconcile and to adjust different constitutional principles, each of which would be entitled to possession of the disputed ground but for the presence of the others, as we already have said that it is necessary to reconcile and to adjust different principles of the common law. * * * The right to receive water from a river through pipes is subject to territorial limits by nature, and those limits may be fixed by the State within which the river flows, even if they are made to coincide with the state line."

The court, in the course of the opinion, says:

"Problems of irrigation have no place here."

The opinion shows, however, the rights of a sovereign state in the streams of the state, when such right is unaffected by and is not required to be reconciled with the problem of irrigation.

Walbridge vs. Robinson, 22 Idaho 240, decided in 1912, was an appeal from an order granting a writ of mandate resulting in a reversal of the lower court. Respondent made an application to the state engineer for a permit to appropriate water from Bear Creek, a branch of Clear Water River, situate in Idaho County. This application was for the diversion of waters to be carried and applied to irrigation in the state of Montana. The permit was issued. Prior to its issuance, a similar permit had been granted for the diversion of waters from Bear Creek to be carried and used in the State of Montana. Subsequent to the issuance of these permits, a contest was filed by the respondents and after a hearing, the state engineer refused to take any action on the matter or grant any relief to either of the parties upon the ground that in issuing the permits he had exceeded his lawful authority in attempting to grant a right for the diversion of waters of that state to be applied to a beneficial use in another state. Thereafter respondents asked that they be given certificate of the completion of their works. The engineer

refused to take action on the ground that he had no authority to grant such certificate. A suit was thereupon instituted. Bear Creek was not an interstate stream, but located wholly within the State of Idaho. There was a declaration of the constitution as to the ownership of waters similar in legal effect to our own. Commenting thereon the court said:

> "It is further contended that this latter declaration of the statute is only a written expression of what the law has always been with reference to the public waters of a state.
>
> Freund, in his work on the Police Power of the state, at sec. 417, seems to entertain this view, and in discussing similar statutes in other states, says: 'Such declaration is expressive of what is believed to be the law, and does not intend to make new law.'
>
> We think it is clear that the title to the public waters of the state is vested in the state for the use and benefit of all the citizens of the state under such rules and regulations as may be prescribed from time to time by the law-making power of the state. This is not, however, an interest or title in the proprietary sense, but rather in the sovereign capacity as representative of all the people for the purpose of guaranteeing that the common rights of all shall be equally protected and that no one shall be denied his proper use and benefit of this common necessity. * * *
>
> There is no doubt in our minds but that the state in its sovereign capacity is the owner of the waters flowin the streams thereof and may exercise its authority over the same. If the foregoing propositions be correct, the state has the right to prohibit the diversion of the waters of its stream for use outside of and beyond the boundaries of the state. In other words, as said by the supreme court in Geer v. Connecticut, supra, 'The common ownership imports the right to keep the property, if the sovereign so chooses, always within its jurisdiction for every purpose.' "

The sovereign right of each one of the states of this Union of states to own and protect its great natural resources and its privilege to come into this court and ask legal protection of the right to such great natural resources appears through these cases.

In Missouri vs. Illinois, 180 U. S., 208, and 200 U. S. 496, the latter decided in 1905, opinion by Mr. Justice Holmes; Kansas vs. Colorado, 185 U. S. 125, and 206 U. S. 46, decided

in 1906; Georgia vs. Tennessee Copper Co., 206 U. S., 230, 237 U. S. 474, opinion by Mr. Justice Holmes.

It is clear that there is a sovereign right in the state independent of and behind the title of its citizens in its great natural resources, and that this court has jurisdiction of the legal contest to protect and enforce such rights. Further, that the extent to which a sovereign state may insist on this right largely rests with her. In Hudson Water Co. vs. McCarter, supra, it is said:

> "It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will."

In Missouri vs. Illinois, the court recognized the right of Missouri to come by original suit into this court and protect its citizens against any contamination that might arise through sewage of the city of Chicago being turned into a tributary of the Missouri River.

In Georgia vs. Tennessee Copper Company, a bill in equity was filed in pursuance of a resolution of the legislature and by direction of the Governor of Georgia, to enjoin defendant copper company from discharging noxious gas from their works in Tennessee over the plaintiff's territory. *Inter alia*, the court said:

> "The case has been argued largely as if it were one between *two private parties;* but it is not. The very elements that would be relied upon in a suit between fellow-citizens as a ground for equitable relief are wanting here. The State owns very little of the territory alleged to be affected, and the damage to it capable of estimate in money, possibly, at least, is small. This is a suit by a State for an injury to it in its capacity of quasi-sovereign. In that capacity the State has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air. It might have to pay individuals before it could utter that word, but with it remains the final power. The alleged damage to the State as a private owner is merely a makeweight, and we may lay on one side the dispute as to whether the destruction of forests has led to the gullying of its roads. * * *
>
> They (states) did not renounce the possibility of making reasonable demands on the ground of their still remaining quasi-sovereign interests; and the alternative to force is a suit in this court. * * *

> The States by entering the Union did not sink to the position of *private owners subject to one system of private law.* * * * Without excluding the considerations that equity always takes into account, we cannot give the weight that was given them in argument to a comparison between the damage threatened to the plaintiff and the calamity of a possible stop to the defendants' business, the question of health, the character of the forests as a first or second growth, the commercial possibility or impossibility of reducing the fumes to sulphuric acid, the special adaptation of the business to the place.
>
> It is a fair and reasonable demand on the part of a sovereign that the air over its territory should not be polluted on a great scale by sulphurous acid gas, that the forests on its mountains, be they better or worse, * * * should not be further destroyed or threatened by the act of persons beyond its control, that the crops and orchards on its hills should not be endangered from the same source. If any such demand is to be enforced this must be, notwithstanding the hesitation that we might feel if the suit were *between private parties*, and the doubt whether for the injuries which they might be suffering to their property they should not be left to an action at law. * * *
>
> Whether Georgia by insisting upon this claim is doing more harm than good to her own citizens is for her to determine. The possible disaster to those outside the State must be accepted as a consequence of her standing upon her extreme rights."

The cause of the suit was an insistence upon the right of Georgia to be protected in the reasonable enjoyment of her rights of sovereignty. The plaintiff prevailed. The case did not proceed upon the theory of the litigation being between private parties, but upon the fact of peculiar rights inhering in litigants with sovereign powers.

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S., 258, decided in 1910, opinion by Mr. Justice Holmes, was an action between private parties in reference to the waters of an interstate stream and the character of that action is carefully distinguished from a case wherein the sovereignty itself is insisting upon its right to the waters of a stream. Miller & Lux, the corporation using the water of Walker River in Nevada, claimed rights therein. Two branches of the river rise in California and unite in Nevada above Miller & Lux. Rickey used water of both branches in California and claimed rights superior to parties lower down. In 1902 Miller & Lux brought suit in the

circuit court for the district of Nevada against Rickey and certain other defendants to enjoin interference with its use of water. Rickey pleaded that the diversion by him was in California and later answered. After appearing, he organized the petitioning corporation and conveyed his rights in California to it. In 1904 this corporation began two actions in the state court of California against Miller & Lux, and others, to quiet its title to certain water rights on the west fork and east fork, supra. In December, after they were served with process in the last mentioned suit, other defendants in the bill brought by Miller & Lux brought a cross bill against Rickey to establish their priorities. In 1906 the bills in these present cases were brought by Miller & Lux to restrain proceedings in the California actions on the ground that the Federal Court had acquired jurisdiction before the California actions were begun. Injunctions were granted. *Inter alia* the court said:

> "The petitioner contends that there is no conflict of jurisdiction, and that the proceedings in the California court should go on. Its argument is this: When a right is asserted in favor of land in one jurisdiction over land in another, different principles are involved from those that suffice when both parcels are subject to the same law. When such rights have been recognized, it has been on the ground of an assumed 'concurrence between the two states, the one, so to speak, offering the right, the other permitting it to be accepted. Mannville Co. vs. Worcester, 138 Mass., 89.' Missouri vs. Illinois, 200 U. S., 496, 521. But still there are two parcels of land subject to different systems of law; and although the rights and liabilities in respect of each may require a consideration of the other if they are to be dealt with completely, the fact remains that each may be regulated by the state where the land lies according to its sovereign will. Kansas vs. Colorado, 206 U. S. 46, 93. If, then, the courts of one state are about to deal with one parcel they should not be indirectly interfered with by a foreign court that has no power to control the use of the *res*. It is said to be a general principle that apart from some privity, such as is created by contract, trust, or fraud, courts of equity recognize the impropriety of using their power over the person to achieve such a result. (Citing cases.) It is conceivable, to be sure, that the decisions of this court may determine that the States have rights as against each other *in invitum* in streams that flow through the land of both. Kansas vs. Colorado, 206 U. S. 46, 84; Missouri vs. Illinois, 200 U. S. 496, 519-20. These rights may vary according to the

system of law required by natural conditions. They may be more or less analogous to common law rights between upper and lower proprietors, where irrigation is not necessary, as in most of the older states. See New York vs. Pine, 185 U. S. 93, 96. There may be some, perhaps limited, right of appropriation in the upper state, at least in the watershed of the stream, where irrigation is the condition of using the land. See Kansas vs. Colorado, 206 U. S., 46, 100-104, 117. *But whatever this court may decide, if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his state*, and those rights, the petitioner insists, can, or at least should be, determined only in a suit brought by the state itself. * * * To affect a purchaser with a suit against his vendor, it is said that at least the *res* must be within the territorial jurisdiction of the court in which the suit is brought. See Fall vs. Eastin, 215 U. S. 1.

We are of the opinion that the petitioner fails to establish the conclusion for which it contends. The alleged rights of Miller and Lux involve a relation between parcels of land that cannot be brought within the same jurisdiction. This relation depends as well upon the permission of the laws of Nevada as upon the compulsion of the laws of California. It is true that the acts necessary to enforce it must be done in California, and require the assent of that state so far as this court does not decide that they may be demanded as a consequence of whatever right, if any, it may attribute to Nevada. But, leaving the latter possibility on one side, if California recognizes private rights that cross the border line, the analogies are in favor of allowing them to be enforced within the jurisdiction of either party to the joint arrangement."

The decree below was approved. The court, however, makes it clear that the suit was between private parties and that the right of land owned by a private party in Nevada to claim a servitude upon the California lands was based upon the assumed consent of California. Particularly worthy of note is the contention of petitioner, the reasons assigned in which the court does not apparently differ from but only differs in the conclusion. In this argument it is recognized that the rights of individuals in waters of an interstate stream are subordinate and inferior to the rights that the sovereign may claim when it asserts its own.

Bean vs. Morris, 221 U. S., 485, decided in 1910, opinion by Mr. Justice Holmes, is again a suit between private parties over the waters of an interstate stream, and the learned justice keeps in bold relief that there is a distinction between such a contention when the litigants are sovereign states. The suit was by respondent Morris to prevent petitioners from so diverting the water of Sage Creek in Montana as to interfere with an alleged prior right of Morris by appropriation in Wyoming. Afterwards Howell was allowed to intervene and make similar claim. Sage Creek, non-navigable, joins Stinking Water in Wyoming, the latter flows into Big Horn and then back into Montana and unites with the Yellowstone. Decree went for Morris and for Howell subject to the claim of Morris, both parties being prior in time and right to the petitioners. It was admitted in argument that but for the fact that the prior appropriation was in Wyoming and the interference in Montana, the decree would be right. The court, *inter alia*, said:

> "So we pass at once to the question of private water rights as between users in different states.
>
> We know no reason to doubt, and we assume, that, subject *to such rights as the lower state might be decided by this court to have*, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that state. Kansas vs. Colo., 206 U. S., 46, 93-95. Therefore, *subject to the same qualifications*, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. Missouri vs. Illinois, 200 U. S. 496, 521; Rickey Land and Cattle Company vs. Miller and Lux, 218 U. S., 258, 260. But with regard to such rights as came into question in the older States, *we believe that it always was assumed, in the absence of legislation to the contrary*, that the States were willing to ignore boundaries, and allowed the same rights to be acquired from outside the state that could be acquired from within." (Mannville Co. vs. Worcester, 138 Mass., 89, and other cases cited.) "There is even stronger reason for the same assumption here. Montana cannot be presumed to be intent on suicide, and there are as many if not more cases in which it would lose as there are in which it would gain, if it invoked a trial of strength with its neighbors. * * * The doctrine of appropriation has prevailed in these regions probably from the first moment that they knew

any law, and has continued since they became territory of the United States.

It was recognized by the statutes of the United States, while Montana and Wyoming were such territory * * * and is recognized by both States now. Before the state lines were drawn, of course, the principle prevailed between the lands that were destined to be thus artificially divided. Indeed, Morris had made his appropriation before either state was admitted to the Union. The only reasonable presumption is that the States, upon their incorporation, continued the system that had prevailed theretofore, *and made no changes other than those necessarily implied or expressed.* * * * It follows from what we have said that it is unnecessary to consider what limits there may be to the powers of an upper State, if it should seek to do all that it could. The grounds upon which such limits would stand are referred to in Rickey Land and Cattle Company vs. Miller and Lux, 218 U. S., 258, 261."

The decree below is affirmed, the court finding that the Wyoming lands held a servitude upon the Montana lands upon the theory that as between private parties, the State of Montana was presumed to have consented, but is strongly suggestive that the right to appropriate at the expense of Montana was subject to the will of Montana as a state and such limits as might be put upon her sovereignty by the doctrine of interstate waters.

The great case in which the rights of sovereign states in the waters of an interstate stream, where the problems of irrigation had place, are presented, discussed and decided in Kansas vs. Colorado, 206 U. S., 46, decided in 1906, opinion by Mr. Justice Brewer. Of this case a great lawyer and an eloquent senator from this commonwealth recently said in the Senate of the United States:

> "The decision in the case of Kansas vs. Colorado is one of the great opinions of the Supreme Court of the United States. To my mind it easily ranks with the most notable judicial pronouncements of that great tribunal and, as time passes, I believe that fact will be more and more recognized; perhaps I should say particularly with reference to its definition of the powers of the government and the distinction it so clearly draws between those powers and the reserved powers of the states."

Kansas brought suit against the State of Colorado and a number of private ditch companies for the purpose of enjoining

them from diverting waters from the Arkansas River. The State of Colorado appeared insisting upon her rights in the stream as one of her sovereign rights. The ditch companies answered, setting up their priorities. Proof was adduced as to the priorities of certain ditches in Kansas earlier in point of time than Colorado ditches and which Kansas ditches, the evidence showed, were deprived of water by the Colorado diversions. The Government of the United States intervened. Its bill of intervention was dismissed upon the ground that it did not own the waters of the Arkansas River, that it had no rights therein as the question of navigation did not arise, and it was dismissed from the suit. It is difficult to understand, after the ruling in this great and luminous case, that the Government of the United States still insists, through some of its departments, on being interested in non-navigable streams. It may be said, however, that when waters are sought to be appropriated from the streams of any state for any national government project, the National Government deems it to be the safe course to comply with the state laws as any other consumer would in his efforts to acquire rights by prior appropriation in the waters of a stream.

The careful reasoning of the court in approaching its ruling in this case, that it was keeping constantly before its mind in deciding the grave question it was ruling between two sovereign commonwealths, the principle laid down by the court in the sewage case, Missouri vs. Illinois, 200 U. S., 521, wherein it is said:

> "Before this court ought to intervene the case should be of serious magnitude, clearly and fully proved, and the principle to be applied should be one which the court is prepared deliberately to maintain against all considerations on the other side."

In perhaps no case in the history of this great court has there been shown greater and more thoughtful care in guarding the rights of the states than in this case of Kansas vs. Colorado. An unjust decision might have destroyed the agricultural resources of a state which, resting upon the crest of the continent where the waters begin which flow to the east, to the west, to the north and the south, and where a declaration of the applicability of the riparian rights would have visited with destruction not only the development of the Arkansas valley, but the other great valleys of Colorado, the court, conforming to the principles of common law, international law and state law, rendered a decision which fully protected the rights of the litigants and declared no precedent that would be destructive to the rights of the states in future litigation.

The pith of this ruling, when fully considered, is that the common law adjusted itself to conditions as it found them, aiming to administer the highest justice between man and man; that applying its principles and all other principles of jurisprudence in the relations between the states, it was the controlling purpose of the court to work out justice; that as to this interstate stream in the reasonable exercise of their respective sovereign rights, each of the states was entitled to a reasonable part of the waters; that the court would not consider the question of private rights among the ditch companies; that the disposition of the rights of the two states would be a disposition of the rights of the private parties, for the reason that the rights of the private parties were subordinate to the rights of the states; that if the court found, as it did find, that Colorado was not diverting from this stream any more than a reasonable part of the waters of the stream and for that reason the bill must be dismissed, that the rights of the private ditch companies and their priorities were immaterial.

In conclusion, the court held that Colorado was not taking more than a reasonable part of the waters of this interstate stream; that she was entitled to take a reasonable part in the exercise of her rights of sovereignty; that even though this exercise of a right of sovereignty worked some prejudice to Kansas, no legal wrong was done; that if, at any time it might appear that Colorado was taking more than a reasonable part of the waters of this stream, Kansas could justly come again. The bill was dismissed.

Excerpts from this decision pertaining to the question before us are:

> "But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that each State has full jurisdiction over the lands within its borders, including the beds of streams and other waters." 93.
>
> "But when the States of Kansas and Colorado were admitted into the Union they were admitted with the full powers of local sovereignty which belonged to other States, * * * and Colorado by its legislation has recognized the right of appropriating the flowing waters to the purposes of irrigation." 95.
>
> "'Can it be that the great multitude of interstate commercial transactions are freed from the burdens created by the common law as so defined, and are subject to no rule except that to be found in the statutes of Congress? We are clearly of opinion that this cannot be so, and that the principles of the common law are oper-

ative upon all interstate commercial transactions except so far as they are modified by Congressional enactment.'" 96.

"For after all, the common law is but the accumulated expressions of the various judicial tribunals in their efforts to ascertain what is right and just between individuals in respect to private disputes." 97.

"Nor is our jurisdiction ousted, even if, because Kansas and Colorado are States sovereign and independent in local matters, the relations between them depend in any respect upon principles of international law. International law is no alien in this tribunal." 97.

"'Sitting, as it were, as an international, as well as a domestic tribunal, we apply Federal law, state law, and international law, as the exigencies of the particular case may demand.'

One cardinal rule, underlying all the relations of the States to each other, is that of equality of right. Each State stands on the same level with all the rest." 97.

"Yet, whenever, as in the case of Missouri v. Illinois, 180 U. S. 208, the action of one State reaches through the agency of natural laws into the territory of another State, the question of the extent and the limitations of the rights of the two States becomes a matter of justiciable dispute between them, and this court is called upon to settle that dispute in such a way as will recognize the equal rights of both and at the same time establish justice between them. In other words, through these successive disputes and decisions this court is practically building up what may not improperly be called interstate common law." 97, 98.

"It will be perceived that Kansas asserts a pecuniary interest as the owner of certain tracts along the banks of the Arkansas and as the owner of the bed of the stream. We need not stop to consider what rights such private ownership of property might give." 98.

"The action complained of is state action."

"The controversy arises, therefore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint." 99.

"May we not consider some appropriation by Colorado of the waters of the Arkansas to the irrigation and reclamation of its arid lands as a reasonable exercise of its sovereignty and as not unreasonably trespassing upon any rights of Kansas?" 102.

"What is such a just and reasonable use, may often be a difficult question, depending on various circumstances. To take a quantity of water from a large running stream for agricultural or manufacturing purposes, would cause no sensible or practicable diminution of the benefit, to the prejudice of a lower proprietor; whereas, taking the same quantity from a small running brook passing through many farms, would be of great and manifest injury to those below, who need it for domestic supply or watering cattle; and therefore it would be an unreasonable use of the water, and an action would lie in the latter case and not in the former. It is, therefore, to a considerable extent a question of degree; still, the rule is the same, that each proprietor has a right to a reasonable use of it, for his own benefit, for domestic use, and for manufacturing and agricultural purposes." 103-4.

"At one time there were some irrigating ditches in these western (Kansas) counties, which promised to be valuable in supplying water and thus increasing the productiveness of the lands in the vicinity of the stream, and it is true that those ditches have ceased to be of much value, the flow in them having largely diminished.

It cannot be denied in view of all the testimony * * * that the diminution of the flow of water in the river by the irrigation of Colorado has worked some detriment to the southwestern part of Kansas, and yet when we compare the amount of this detriment with the great benefit which has obviously resulted to the counties in Colorado, it would seem that equality of right and equity between the two States forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation." 113-114.

"Summing up our conclusions, we are of the opinion * * * that the appropriation of the waters of the Arkansas by Colorado, for purposes of irrigation, has diminished the flow of water into the State of Kansas; that the result of that appropriation has been the reclamation of large areas in Colorado, transforming thousands of acres into fertile fields and rendering possible their occupation and cultivation when otherwise they would have continued barren and unoccupied; that while the influence of such diminution has been of perceptible injury to portions of the Arkansas Valley in Kansas, particularly those portions closest to the Colorado line, yet to the great body of the valley it has worked little, if any, detriment, and regarding the interests of both States and the right of each to receive benefit through irrigation

and in any other manner from the waters of this stream, we are not satisfied that Kansas has made out a case entitling it to a decree. At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes.

The decree which, therefore, will be entered will be one dismissing the petition of the intervener, without prejudice to the rights of the United States to take such action as it shall deem necessary to preserve or improve the navigability of the Arkansas River. The decree will also dismiss the bill of the State of Kansas as against all the defendants, without prejudice to the right of the plaintiff to institute new proceedings whenever it shall appear that through a material increase in the depletion of the waters of the Arkansas by Colorado, its corporations or citizens, the substantial interests of Kansas are being injured to the extent of destroying the equitable apportionment of benefits between the two States resulting from the flow of the river." 117-118.

The ruling was that each state was entitled to an equitable apportionment of benefits between the two states resulting from the flow of the river, which equitable apportionment of benefits could only be secured through an equitable apportionment of the waters of this interstate stream.

The doctrine of prior appropiation has at all times obtained in Colorado and Wyoming.

> "The doctrine of appropriation has prevailed in this region probably from the first moment that they knew of any law, and has continued since they became territory of the United States."
>
> Bean vs. Morris, 221 U. S. 485.

It was recognized by the statutes of the United States while Colorado and Wyoming were territories.

> United States vs. Rio Grande, 174 U. S., 690.
>
> Gutierres vs. Albuquerque, 188 U. S., 545.

When Colorado became a state in 1876, in its sovereign capacity it became the owner, for the benefit of its people in common, of all the waters of the streams of the state.

See—

Walbridge vs. Robinson, 22 Ida., 240.

Also—

Colorado Enabling Act, Colorado Constitution, and Proclamation of President, supra.

Colorado, in this suit, insists upon her claim to divert 91,000 acre feet of water of this interstate stream. This is a reasonable exercise of her rights of sovereignty as to this interstate stream. She requires the water for necessary public uses. It will produce larger results within her boundaries than elsewhere. She is not unreasonably trespassing upon Wyoming in thus reasonably exercising her rights. The only reasonable way in which this right can be availed of is to apply the waters to lands lying within another watershed. The right to carry water to another watershed is necessary for its beneficial use within the State of Colorado.

In Coffin et al. vs. Left Hand Ditch Co., 6 Colo., 443, it is said:

> "The doctrine of priority of right by priority of appropriation for agriculture is evoked, as we have seen, by the imperative necessity for artificial irrigation of the soil. And it would be an ungenerous and inequitable rule that would deprive one of its benefit simply because he has, by large expenditure of time and money, carried the water from one stream over an intervening watershed and cultivated land in the valley of another. It might be utterly impossible, owing to the topography of the country, to get water upon his farm from the adjacent stream; or if possible, it might be impracticable on account of the distance from the point where the diversion must take place and the attendant expense; or the quantity of water in such stream might be entirely insufficient to supply his wants. It sometimes happens that the most fertile soil is found along the margin or in the neighborhood of the small rivulet, and sandy and barren land beside the larger stream. To apply the rule contended for would prevent the useful and profitable cultivation of the productive soil, and sanction the waste of water upon the more sterile lands. It would have enabled a party to locate upon a stream in 1875, and destroy the value of thousands of acres, and the improvements thereon, in adjoining valleys, possessed and cultivated for the preceding decade. Under the principle contended for, a party owning land ten miles from the stream, but

in the valley thereof, might deprive a prior appropriator of the water diverted therefrom whose lands are within a thousand yards, but just beyond an intervening divide." 449-450.

In the syllabus of the same case and supported by the opinion, it appears:

"The right to water acquired by prior appropriation is not in any way dependent upon the *locus* of its application to the beneficial use designed."

Other cases in Colorado announcing the same doctrine are:

Thomas vs. Guiraud et al., 6 Colo., 530-532.

Hammond vs. Rose et al., 11 Colo., 524-526.

Openlander vs. Left Hand Ditch Co., 18 Colo., 142-144.

Coffin vs. Left Hand Ditch Co. is cited with approval in Moyer vs. Preston, 6 Wyo., 308, 313, 321; Willey et al. vs. Decker, 11 Wyo., 496, 516, 528, 530.

The Left Hand Ditch case is cited with approval in support of the doctrine that water may be diverted to non-riparian lands

in Boquillas Cattle Co. vs. Curtis Co., 213 U. S., 339, 345; also 181 Fed., 1014, 1015.

An exhaustive discussion of the practise and the law of inter-watershed diversions is set forth in Vol. 2 of this brief.

We respectfully submit that when the law is applied to the facts in this case, it appears that the appropriations by Colorado to the irrigation and reclamation of its arid lands of 91,000 acre feet of the run-off of the Laramie River is but a reasonable exercise of its sovereignty and does not constitute an unreasonable trespass upon the rights of Wyoming, and further, that she is simply availing herself of her own great natural resources in making this proposed diversion. The action should be dismissed at the cost of complainant.

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APPENDIX

LIST OF DEFENDANTS' EXHIBITS.

The complainant's exhibits are designated by the letters of the alphabet. The defendants' exhibits are numbered.

Exhibits:

1. Map of the Laramie and Cache la Poudre Rivers, attached to the answer of the corporate defendants.
2. Map showing irrigated lands, Wheatland, Bordeaux and Sybille tracts.
21. Sketch Map, drainage area of Western States.
22. Sketch Map, Jumna Western and Eastern Canals, India.
23. Map, Punjab Project, India.
24. Map, United Provinces of Agra and Oudh, India.
25. Map, Periyar Project, India.
26. Map, Madras Presidency, India.
27. Map, Bouches du Rhone, France.
28. Map, Carpentras Canal, France.
29. Map, Gap Canal, France.
30. Photograph, Aqueduct, Pont du Gard, France.
31. Photograph, Tunnel, Aqueduct Pont de Gard, France.
32. Photograph, Masonry Aqueduct Craponne Canal, France.
33. Photograph, Aqueduct Carpentras Canal, France.
34. Photograph, Aqueduct Carpentras Canal, France.
35. Sketch Map, Cavour Canal, Italy.
36. Sketch Map, Villoresi Canal, Italy.
37. Sketch Map, White Mud River Project, Canada.
38. Sketch Map, Elbow River Project, Canada.
39. Sketch Map, Red Deer Project, Canada.
40. Photograph, Head-works Cavour Canal, Italy.
41. Photograph, Intake, Cavour Canal.
42. Photograph, Naviglio Grande, Italy.
43. Sketch Map, Strawberry Valley Project, U. S. Reclamation Service, Utah.
44. Map, Milk River Project, Montana.
45. Sketch Map, Los Angeles Aqueduct.
46. Sketch Map, drainage areas, Colorado, Montana, Wyoming.
47. Map, Powder River Project, Wyoming.
48. Map, irrigated land, Powder River Project.
49. Three Sketch Maps, Inter-watershed diversions, Wyoming.
50. Sketch Map, Inter-watershed diversion, Wyoming.
51. Copy of map and statement, Laramie-Poudre Tunnel and collection ditches, filed in office State Engineer, Colo., October 6, 1904.

52-72. Photographs of early work on Greeley-Poudre System on the Laramie River, 1902-1904.

73. Photograph, Skyline Canal.
74. Copy of map and statement, Link Lake Ditch and feeders, filed in State Engineer's office, Colo., Oct. 15, 1902.
75. Copy of map, East Fork Ditch and Reservoir, filed in State Engineer's office, Colo., May 9, 1904.

76-85. Photographs of upper works of Greeley-Poudre System on Laramie River, 1907-1912.

86-104 Blue print diagrams, based on Census Reports, decades 1870 to 1910, inclusive, comparing Larimer and Weld counties, Colorado, with Laramie and Albany counties, Wyoming,—size, population, rural population, agricultural production and live stock.

105. Plat showing minimum temperatures, 1893 to 1912, inclusive, Greeley, Colo., and Laramie, Wyo.

106-112. Photographs showing crop and soil conditions, Laramie Plains, Wyoming.

113. Tabulation, flow of water from Cache la Poudre River to South Platte River, 1909-1913.

Exhibits:

114. Plane table survey plats, Laramie Plains.
115. Album of Photographs of diversion works on Big and Little Laramie Rivers, Laramie Plains, Wyoming.
116. Album of Photographs, farm and ranch improvements, Laramie Plains, Wyoming.
117. Tabulation, irrigated area classified, Little Laramie Valley, Wyoming.
118. Tabulation, irrigated area classified, Big Laramie Valley, Laramie Plains, Wyoming.
119. Album of Photographs. Improvements under Larimer County Canal, Colorado.
120. Album of Photographs, Improvements under Larimer and Weld Canal, Colorado.
121. Album of Photographs, Agricultural Industries, Poudre Valley.
122. Album of Panoramic Photographs, Wheatland and Laramie Plains areas in Wyoming, and Poudre Valley area in Colorado.
123. Table, discharge, Cache la Poudre River at mouth of canon, 1881-1913.
124. Table, discharge, Cache la Poudre at mouth of canon, showing additions and diversions above gauging station.
125. Table, discharge Laramie River at Glendevey, Colo.
126. Table, discharge Laramie River at Decker's and Boswell's (State line).
127. Table, run-off, Laramie River at Wood's Landing, Wyo., and Skyline and Divide Canal diversions.
128. Table, discharge, Laramie River, Wood's Landing, Wyo., 1889-1913.
129. Table, discharge, Laramie River at Boswell's (State line) and Wood's Landing, showing inflow between stations.
130. Maps of irrigated area, Laramie River Valley in Colorado.
131. Table, discharge, Little Laramie River at Hatton, Wyo.
132. Diagram, Laramie River, Skyline Ditch to Wood's Landing, 1912.
133. Diagram showing flow and use, Little Laramie River, Hatton to Two Rivers, Wyo., 1912.
134. Diagram showing flow and use, Laramie River from Two Rivers to Look Out, Wyo., 1912.
135. Mass diagrams, Wheatland Reservoir, Wyoming, 1912.
136. Mass diagram, supply and use, Big and Little Laramie Rivers, 1912.
137. Mass diagram, supply and diversions, Laramie River, Skyline Canal to Wood's Landing, Wyo., 1913.
138. Diagram, supply and use, Little Laramie River, from Fillmore to Two Rivers, 1913.
139. Diagram, Laramie river, supply and use, Two Rivers to Look Out, Wyo., 1913.
140. Mass diagram, Wheatland Reservoir, Wyoming, 1913.
141. Mass diagram, Big and Little Laramie Rivers, supply and use, 1913.
142. Diagram, flow and diversions, Laramie River to State line.
143. Table, discharge, Big Laramie River at Two Rivers, Wyo., 1909-1913.
144. Table, discharge, Little Laramie River at Two Rivers, 1909-1913.
145. Table, discharge, Laramie River at Uva, Wyoming.
146. Tabulation showing sugar beet industry in Colorado.
147-153. Letters to and replies from State Engineers of various Western States, inter-watershed diversions.
154-155. Soil Maps, U. S. Soil Survey, Laramie Plains, Wyo.
156. Photographs showing snow-fall, Medicine Bow Range, Colorado and Wyoming.
157. Chart, discharge, Little Laramie River at Fillmore, Wyo., 1912.
158. Chart, discharge, Laramie River at Boswell's (State line), 1912.
159-178. Certified copies applications and permits for irrigation projects diverting water from the Laramie River in Wyoming, 1908 and subsequent.
179. Copy, Decree adjudicating priorities, Water District No. 43 (Laramie River, Colorado).

NOTE.—Exhibits 3 to 20, inclusive, consist of various data produced on cross-examination by witnesses for the complainant. These were identified but not introduced.

Exhibits 22 to 50, inclusive, show inter-watershed diversions in India, Italy, France, Canada and United States.

NUMBER [redacted] ORIGINAL.

JAN 5 1918

JAMES D. MAHER

In the Supreme Court of the United States

October Term, 1917

In Equity

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COMPLAINANT,

vs.

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DEFENDANTS.

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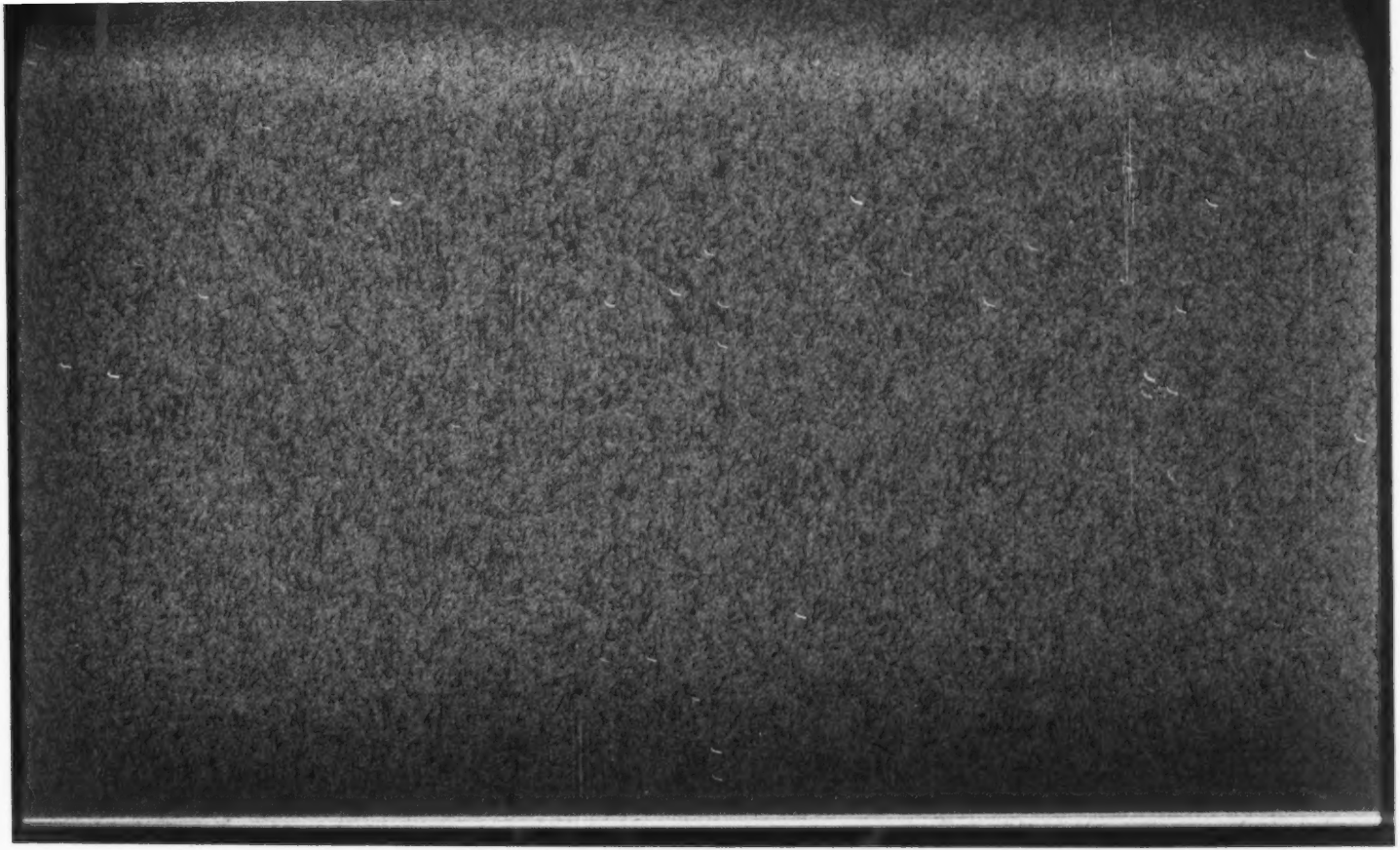

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BRIEF IN ANSWER TO THE BRIEF OF THE UNITED STATES.

A DISCUSSION OF THE CONTENTION OF COUNSEL FOR THE UNITED STATES THAT THE WATERS OF THE LARAMIE RIVER ARE THE PROPERTY OF THE UNITED STATES AND WHOLLY REMOVED FROM STATE CONTROL OR THE EFFECT OF LITIGATION BETWEEN WYOMING AND COLORADO.

As we understand the brief of the counsel for the Government, they concede that if the controversy here were between States in which the United States

never owned any property, as, for example, Massachusetts and Connecticut, private rights in an interstate stream would be limited by the division made between the States and either stand or fall with the larger right of the State, upon the theory that the States have rights against each other *in invitum*. To this extent, at least, they agree with the Colorado contention, but they say that the Colorado contention falls to the ground when once it is conceded that the water rights involved come from the United States and are protected by its sovereign power, and the main object of their brief is to prove that water rights in Wyoming and Colorado come from the United States and are protected by its sovereign power, and that the States have no right in or jurisdiction over the waters flowing within their boundaries except to the extent that they may exercise over them and the appropriators the police power which belongs to them as States. If this be true, then if police power is to be given the restricted meaning implied by the argument, counsel are doubtless right in saying that Wyoming has no proprietary or sovereign interests to assert, and Colorado has no proprietary or sovereign interests to defend. Using their own language, "the ungranted waters of the Laramie River, if there are any, are the property of the superior sovereign, the United States, and so are wholly removed from State control or the effect of litigation between the States." Wyoming, therefore, presents no justiciable controversy to this Court. If the appropriators in Wyoming and Colorado derived their rights respectively from the United States and the States have no proprietary or

sovereign interests to protect, it follows that the claims of appropriators in Wyoming against appropriators in Colorado must be settled by separate private controversies and cannot be settled in the mass by any State action.

It is a peculiar quality of rights by appropriation that each right has its own individual history and that there is no common tie between appropriators so far as the initiation and maintenance of their rights are concerned. The State, therefore, could do no more, as *parens patriae,* acting in behalf of appropriators within their limits, than make precisely the proof that they would severally be required to make in their own behalf in private litigation. In other words, any action by the State would be in behalf of a purely private right, and thus in violation of the prohibition applied in such cases.

New Hampshire vs. Louisiana and Others, 108 U. S. 76, 89.
Louisiana vs. Texas, 176 U. S. 1, 16.

Counsel say that by virtue of its acquisition of lands west of the Mississippi the United States has the right to give to individuals a vested interest in waters flowing in innavigable streams, with the right to use and protect it as granted unless and until it is condemned and paid for and that Congress intends that waters thus granted shall be effective regardless of state lines. They make no attempt to solve the problem which the Court desires to have solved if their contention should not be granted. They seek to give a practical as well as a legalistic foundation for their contention by the claim that

otherwise the reclamation projects of the Government cannot be carried out and that the interest of the Government in its lands cannot be preserved unless it has the right to control the disposition of the streams coursing through them.

It is admitted by counsel that Colorado's theory has not as yet offered any obstacle in either case, and it seems also to be admitted that it has been the policy of the Government heretofore to allign itself with other appropriators of water, taking its proper place as an appropriator, and not as a sovereign or proprietary owner, with all other appropriators, senior and junior, just as though it were in every respect bound to conform to the laws of the State, the same as other appropriators. That in respect to the reclamation of its lands, the Government acts in a proprietary and not sovereign way is decided in Twin Falls Land Co. vs. Foote, 192 Fed. 583, Standfield vs. Umatilla River Water Users' Assn., 192 Fed. 596, and in the very recent case of In re Waters of Umatilla River, 168 Pac. 922.

If the Government intends in the carrying out of its reclamation projects or in the use of water on its lands to respect the rights of prior appropriators, it is a matter of no practical importance to it whether the source of title to water by appropriation is the general Government or the State in which the Government plans are carried out or the Government lands may lie. Nor does the existence of the state line have any influence except the possibility of a controversy if water should be stored in one State, to be used in another. But such a contro-

versy is just as possible between the Government and individual appropriators as between the Government and the State. In fact, so far as the Government is concerned in this or in any other controversy concerning the use of the waters of innavigable streams, the contention of counsel is without practical value. It is no more hampered by the laws of the States created out of the public domain in which the doctrine of appropriation prevails than it is in the original States, in which the doctrine of riparian rights prevails, nor is it inconsistent with the interests of the General Government in such streams that the State should have the primary right to make them conserve the general welfare of the State. It seems to us that, so far as the United States is concerned, Mr. Long is quite right in saying that the question of what is the foundation of the right to appropriate is of little practical importance and the discussion thereof largely academic.

But as it is the purpose of this Court to obtain all light possible upon the subject and to formulate some definite rule for the disposition of controversies between States concerning their respective rights in interstate streams, and as Colorado claims that it possesses the sovereign right in its streams, as against the contention of counsel, it becomes our duty to give due consideration to what is advanced upon behalf of the Government.

Is it true that in the States created out of the public domain where irrigation is practiced and where the doctrine of appropriation as opposed to the doctrine of riparian rights prevails, the United States is still the sovereign or proprietary owner

of the natural streams, that all titles by appropriation are derived from it, and that it retains and may exercise plenary control and administration of such streams to the exclusion, if need be, of the particular States in which the streams lie? Is it true that all that has been done by the several States in the enactment of laws concerning the acquisition and use of water and the administration and distribution of the same has been done not in virtue of any inherent sovereign right of the States, but merely by force of the acquiescence of the United States? Is it true that the only inherent power of States in declaring that the waters must be beneficially used and supervising the same to effectuate that purpose, is that power which is denominated the police power? In other words, do the States maintain with respect to their natural streams the relation of mere agents of the General Government, who by the acquiescence of the Government are permitted to provide the machinery for the initiation and maintenance of rights by appropriation and the regulation and control thereof?

As a preface to the discussion of the subject that is to follow, we call attention to the statement of counsel, page 105, that "The question whether the United States or the States own the waters of innavigable streams in the West has never been directly passed upon by this Court." If this be true, the Court will be at liberty to make such disposition of the subject as the present stage of irrigation development and the material interests of the States demand, free from the embarrassment of primitive or obsolete practices or legal conceptions and with-

in the maxim *salus populi suprema lex,* and it will be from that standpoint that we shall finally present our views.

For the present, however, we shall contest the correctness of the statement. We first refer to the case of *Kansas vs. Colorado,* 206 U. S. 46, because that presented a controversy in which it was necessary to say whether the States possessed any sovereign interest in their waters. If the present Government counsel are correct, the waters of the Arkansas River belong to the United States and "are wholly removed from State control or the effect of litigation between the States." It must not be overlooked that the Government was represented by counsel in that case as well as in this, and that the special ground of the Government's interest in that controversy was the protection of its reclamation projects. The Government's contention did not fail because it was not presented or because it was overlooked. The logical conclusion from the argument of the present counsel, which they draw for themselves and which seems correct, is that if the waters belong to the United States the States have no justiciable interest in them as such, but the Court in *Kansas vs. Colorado* found that there was such justiciable controversy, which would imply that they rejected the present contention and that the basis of their decision was the recognition of some rights in the States greater than counsel are now willing to concede. In the opinion in that case the Court inquires whether the question is one simply between States or is a matter subject to National legislative regulation

and is the flow of the stream subject to the superior authority and supervisory control of the United States. The Court puts it thus:

> "In other words, is the determination of the right of the two States *inter sese* in regard to the flow of the waters of the Arkansas River subordinate to a superior right on the part of the National Government to control the whole system of the reclamation of arid lands?"

As to the claims made in behalf of the reclamation projects generally the Court answers that as no power has been granted to engage in such enterprise, none can be exercised. It, however, concedes the authority to reclaim proportioned to the lands still in Government ownership by virtue of the power conferred by the Constitution upon Congress, "to dispose of and make all needful rules and regulations respecting its property." But this is at once qualified by the following statement:

> "We do not mean that its legislation can override State laws in respect to the general subject of reclamation. While arid lands are to be found mainly, if not only, in western and newer States, yet the powers of the National Government within the limits of those States are the same (no greater and no less) than those within the limits of the original thirteen, and it would be strange if in the absence of a definite grant of power the National Government could enter the territory of the States along the Atlantic

and legislate in respect to improving by irrigation or otherwise the lands within their borders."

It then notices the provisions of Section 8 of the Act of June 7, 1902, as indicating the purpose of Congress not to disregard the limitation upon its power and then, as though to foreclose further consideration of the subject, it is said:

> "But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that each State has full jurisdiction over the lands within its borders, including the beds of streams and other waters."

From which the Court concludes, that each State

> "May determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid regions of the West of the appropriation of waters for the purposes of irrigation shall control. Congress cannot enforce either rule upon any State."

Following this conclusion, the Court says:

> "May we not consider some appropriation by Colorado of the waters of the Arkansas to the irrigation and reclamation of its arid lands as a reasonable exercise of its sovereignty and not as unreasonably trespassing upon any rights of Kansas?"

The opinion throughout seems to us a definite recognition of a sovereign right in and over the

waters flowing within its boundaries subject to no limitation save such as by the act of union and the terms of the Federal Constitution the Supreme Court of the United States in case of controversy may deem essential to the preservation of the equality of rights between the States.

In *U. S. vs. Hanson,* 167 Fed. 881, Judge Gilbert construes the opinion to be a denial of any power in Congress to interfere with State control which control, subject to the power of Congress to regulate commerce, is vested wholly in the States.

We next refer to the cases of

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, and

Bean vs. Morris, 221 U. S. 485.

In both of these cases the views of the Court, as stated by Mr. Justice Holmes, seem to be irreconcilable with the contentions of the Government counsel. In the latter case, he says:

> "We know no reason to doubt, and we assume that, subject to such rights as the lower States may be decided by this Court to have, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that State. Therefore, subject to the same qualification, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements or such private rights and obligations as are in dis-

pute across their common boundary lines. * * * It follows from what we have said that it is necessary to consider what limits there may be to the powers of an upper State if it should seek to do all it could."

We think it must be conceded that the foregoing gives no support to the theory that the right of appropriation is derived from and depends upon the jurisdiction of the United States, and therefore a right common to both States.

The argument of counsel in the main is based upon inferences which they think may be drawn from decisions relating to the power of Congress to dispose of and make all needful rules and regulations respecting its property and specifically concerning treaties made in connection therewith. Such power being derived from the Constitution, it follows that each State is bound thereby, whether one of the original or one of the newer States, all States being in respect thereto upon an entire equality. It is a power of which the original States made surrender and each State comes into being upon the same terms. But was the delegation to the Federal Government of the power a surrender of anything more? Was it a surrender by the States of the ultimate jurisdiction or sovereignty over the lands which the Government possessed? We understand it is conceded that the moment the Government title passes the proprietary and sovereign right, which the Government theretofore possessed, ceases, and that the land becomes subject without qualification to precisely the status it would occupy if the Gov-

ernment had never appeared in the chain of title, in other words, as though the lands were within one of the original States.

If the argument of counsel is to have any value whatever in this or similar cases, it must clearly demonstrate that, although the Government owns no land in a State created out of the public domain, it nevertheless possesses as a residuum from its original ownership of all the lands in the State, the jurisdiction to originate titles to the use of the water within the State, and, if in its wisdom thought wise, to formulate laws regulating the appropriation and use of water to the exclusion, if need be, of the laws of the State bearing upon the subject. A potent, but not necessarily conclusive, argument against any such view is the fact that Congress has never assumed or asserted any such power. As we have said, the power over the territory or other property of the United States is a granted power, and the question, therefore, is not so much what does the Federal Government possess, but what did the State governments intend to give? Did they surrender jurisdiction and control of those elements of material prosperity without which state development might be arrested and state ambitions defeated? Of this paragraph in the Federal Constitution, Mr. Justice Brewer, in the *Kansas-Colorado* case, *supra,* said:

> "The full scope of this paragraph has never been definitely settled. Primarily, at least, it was a grant of power to the United States of control over its property.

> * * * But, clearly, it does not grant to Congress any legislative control over the States and must, so far as they are concerned, be limited to authority over property belonging to the United States within their limits. * * * The powers affecting the internal affairs of the States not granted to the United States by the Constitution nor prohibited by it to the States, are reserved to the States respectively, and all powers of a national character which are not delegated to the National Government by the Constitution are reserved to the people of the United States."

Now, the function which the Federal Government performs in the acquisition of territory and the creation therefrom of States of the Union, is pretty well discussed and settled by numerous decisions of this Court. While it is true that by the Louisiana Purchase and the several grants from Mexico, the United States became possessed of every shred of proprietary and sovereign title that the most favored nation, under like circumstances, could acquire, it was, nevertheless, never a part of our scheme of government that such conditions should be perpetual. This government of ours is primarily a union of States and the ultimate destination of all territorial acquisitions is the foundation of additional States, to the end that we shall continue as we commenced, as an indestructible union of indestructible States. Therefore, the Federal sovereignty and proprietary title of the United States in its territory is but a passing phase, a mere

preliminary to the time when such territory shall be carved into States. The States when so carved out of the territory of the United States, do not come into the possession of their powers by grant from the Federal Government, but because by the very fact of their existence they possess, in virtue of their definition and our political organization, all the powers, functions and sovereignties of their predecessors in the Union.

It was well said by Mr. Justice Lurton, in *Coyle vs. Oklahoma*, 221 U. S., at page 566, that

> "The definition of a State is found in the powers possessed by the original States which adopted the Constitution, a definition emphasized by the terms employed in all subsequent acts of Congress admitting new States into the Union."

It is this characteristic which, upon the creation of States upon the public domain, negatives the right of the United States to impose, by the enabling act or otherwise, any condition which in the slightest degree destroys this equality with every other State. Whatever may be the terms of the enabling act as to reservations or restrictions upon behalf of the United States, they are effective only to the extent that they could be enforced if not mentioned in the enabling act. In other words, the United States, or the Congress thereof, has no power, by virtue of anything contained in the enabling act, in excess of that which may be exercised in the newly created State after its complete establishment and

which likewise may be exercised if the same conditions were presented in any one or more of the original States.

All of this has been so often and so clearly stated that any elaborate quotation of opinions would be out of place; nevertheless, to preserve the continuity of our argument we shall recall the leading cases.

The first case in point of time was *Pollard's Lessees vs. Hagan*, 3 How. 212, in which, after noting the question presented, the Court said:

> "We now enter into its examination with a just sense of its great importance to all the States of the Union and particularly to the new ones. Although this is the first time we have been called upon to draw the line that separates the sovereignty and jurisdiction of the Government of the Union and the State governments, over the subject in controversy, many of the principles which enter into and form the elements of the question have been settled by previous well considered decisions of this Court, to which we shall have occasion to refer in the course of this investigation. * * * We think a proper examination of this subject will show that the United States never held any municipal sovereignty jurisdiction or right of soil in and to the territory of which Alabama or any of the new States were formed, except for temporary purposes and to execute the trusts created by

the acts of Virginia and Georgia legislatures and the deeds of cession executed by them to the United States and the trust created by the treaty with the French Republic of the 30th of April, 1803, ceding Louisiana" (p. 221).

Then, referring to the ordinance of 1787, which extended to the territory in question, the Court said:

"Taking the legislative acts of the United States and the States of Virginia and Georgia and their deeds of cession to the United States, and giving to each separately and to all jointly a fair interpretation, we must come to the conclusion that it was the intention of the parties to invest the United States with the eminent domain of the country ceded, both national and municipal, for the purposes of temporary government and to hold it in trust for the performance of the stipulations and conditions expressed in the deeds of cession and the legislative acts created with them. * * * When the United States accepted the cession of territory they took upon themselves the trust to hold the municipal eminent domain for the new States and to invest them with it to the same extent in all respects that it was held by the States ceding the territory. * * * Whenever the United States shall have fully executed these trusts, the municipal sovereignty of the new States will be complete throughout their respective borders and they and the

> original States will be upon an equal footing in all respects whatever. We therefore think the United States holds the public lands within the new States by force of the deeds of cession and the statutes connected with them and not by any municipal sovereignty which it may be supposed they possess or have reserved by compact with the new States for that particular purpose. The provision of the constitution above referred to shows that no such power can be exercised by the United States within a State; such a power is not only repugnant to the constitution, but it is inconsistent with the spirit and intention of the deed of cession" (pp. 223-4).

Escanaba Company vs. Chicago, 107 U. S. 678, furnishes another judicial land mark. In that case, Mr. Justice Field said:

> "But the States have full power to regulate within their limits matters of internal police, including in that general designation whatever will promote the peace, comfort, convenience and prosperity of their people. This power enbraces the construction of roads, canals and bridges and the establishment of ferries, and it can generally be exercised more wisely by the States than by a distant authority. They are the first to see the importance of such means of internal communication and are more deeply concerned than others in their wise management" (p. 683).

What was then said by Mr. Justice Field bears with peculiar force upon what we shall hereafter say concerning the wisdom of committing to the arid States respectively all matters relating to the appropriation, use and distribution of water.

Further speaking upon the subject, Mr. Justice Field said:

> "And although the Act of April 18, 1818, Chapter 67, enabling the people of Illinois Territory to form a constitution and State government and the resolution of Congress of December 3, 1818, declaring the admission of the State into the Union, refer to the principles of the ordinance according to which the Constitution was to be formed; its provisions could not control the authority and powers of the State after her admission. Whatever the limitation upon her powers as a Government, whilst in a territorial condition, whether from the ordinance of 1787 or the legislation of Congress, it ceased to have any operative force except as voluntarily adopted by her after she became a State of the Union. On her admission she at once became entitled to and possessed of all the rights of eminent domain and sovereignty which belonged to the original States. She was admitted and could be admitted only on the same footing with them. The language of the resolution admitting her is 'on an equal footing with the original States in all respects whatever.' Equality of constitutional right and power

is a condition of all of the States in the Union, old and new. Illinois, therefore, as was well observed by counsel, could afterwards exercise the same power over rivers within her limits that Delaware exercised over Blackbird Creek and Pennsylvania over the Schuylkill River" (pp. 688-9).

In *Shively vs. Bowlby,* 162 U. S. 1, Mr. Justice Gray, in the course of an exhaustive opinion in which all the previous decisions of the Court are brought into view, says:

"The United States, while they hold the country as a territory having all the powers both of National and municipal government, may grant for appropriate purposes titles or rights in the soil below high water mark of tide waters, but they have never done so by general laws, and unless in some case of international duty or public exigency, have acted upon the policy as most in accordance with the interest of the people and with the object for which the territories were acquired, of leaving the administration and disposition of the sovereign rights in navigable waters and in the soil under them, to the control of the States, respectively, when organized and admitted into the Union. Grants by Congress of portions of the public lands within the territory to settlers thereon, though bordering on or bounded by navigable waters, convey of their own force no title or right below high water mark and do not impair the title and

dominion of the future State when created, but leave the question of the use of the shores by the owners of uplands to the sovereign control of each State, subject only to the rights vested by the Constitution of the United States."

Other cases stating the same conclusions are the following:

Permoli vs. First Municipality, 3 How. 589.
Strader vs. Graham, 10 How. 82.
Cardwell vs. American Bridge Co., 113 U. S. 205.
Hamilton vs. Vicksburg Ry. Co., 119 U. S. 280.
Huse vs. Glover, 119 U. S. 543.
Williamette Iron Bridge Co. vs. Hatch, 125 U. S. 1.

The more recent cases in which this matter is discussed are *Coyle vs. Oklahoma*, 221 U. S. 559, in which Mr. Justice Lurton (p. 567) uses the following language:

"'This Union' was and is a union of States, equal in power, dignity and authority, each competent to exert that residuum of sovereignty not delegated to the United States by the Constitution itself. To maintain otherwise would be to say that the Union through the power of Congress to admit new States might come to be a Union of States unequal in power, as including States whose powers were restricted only by the Constitution when others whose

powers had been further restricted by the Act of Congress accepted as a condition of admission. Thus it would result:

First, that the powers of Congress would not be defined by the Constitution alone, but in respect to new States enlarged or restricted by the conditions imposed upon new States by its own legislation admitting them into the Union, and

Second, that such new States might not exercise all of the powers which had not been delegated by the Constitution, but only such as had not been further broken away as the conditions of admission. * * *

The plain deduction from this case is that when a new State is admitted into the Union it is so admitted with all of the powers of sovereignty and jurisdiction which pertain to the original States and that such powers may not be constitutionally diminished, impaired or shorn away by any conditions, compacts or stipulations embraced in the act under which the new State came into the Union, which would not be valid and effectual if the subject of congressional legislation after admission."

And in the already noticed case of *Kansas vs. Colorado*, in which, as a preliminary to a discussion of the relative rights of Colorado and Kansas to the waters of the Arkansas River, an innavigable stream, Mr. Justice Brewer said:

"But when the States of Kansas and Colorado were admitted into the Union, they were admitted with the full powers of local sovereignty, which belonged to other States, and Colorado, by its legislation, has recognized the right of appropriating the flowing waters to the purposes of irrigation."

And after speaking of the conflict between the laws of the two States, he says:

"Now, the question arises between two States; one recognizing generally the common law rule of riparian rights and the other prescribing the doctrine of public ownership of flowing water. Neither State can legislate for or impose its own policy upon the other. * * * Each may determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid regions of the West of the appropriation of waters for the purpose of irrigation shall control. *Congress cannot enforce either rule upon any State.*"

It would seem that what we have already said would be sufficient to dispose of the question, nevertheless it may be contended that we have not yet definitely brought within the principles enunciated, the matter of whether a State, as against the United States, can absolutely exclude the United States from claiming either sovereign or proprietary interests in its waters, or whether the United States can, by act of Congress, legislate concerning the same.

Generally speaking, we understand that the laws of Congress applicable to territories, so far as they concern matters over which the State will have ultimate sovereignty are as temporary as the government title to lands included therein; that is, the rules and principles of territorial government are temporary and subject to be displaced upon the coming in of the State. If, for example, Congress should have given to its lands the common law incident to riparian ownership, the State, in its wisdom, could have displaced that doctrine by the necessary and therefore more appropriate doctrine of appropriation. Or, if the State had deemed the common law doctrine the necessary and appropriate one, it would not be restrained from adopting it by the act of 1866. Such is certainly the logical conclusion to be drawn from the following cases:

In *U. S. vs. Rio Grande Irrigation Company*, 174 U. S. 690, after referring to the common law doctrine of riparian rights, Mr. Justice Brewer said (p. 702):

> "While this is undoubted, and the rule obtains in those States in the Union which have simply adopted the common law, it is also true that as to every stream within its dominion a State may change this common law rule and permit the appropriation of the flowing waters for such purposes as it deems wise."

In *U. S. vs. Cre* 43 U. S. 316, Mr. Justice Pitney says:

> "The States have authority to establish for themselves such rules of property as they may deem expedient with respect to the streams of water within their borders, both navigable and non-navigable, and the ownership of the lands forming their beds and banks, subject, however, in the case of navigable streams, to the paramount authority of Congress to control the navigation so far as may be necessary for the regulation of commerce among the States and with foreign nations; the exercise of this authority being subject, in its turn, to the inhibition of the Fifth Amendment against the taking of private property for public use without just compensation."

In *Hawkins vs. Bleakly*, 243 U. S. 210, Mr. Justice Pitney further says, speaking of what was claimed to be the constitutional guarantee secured to the inhabitants of the State of Iowa by the ordinance of July 13, 1787 (p. 217):

> "It is contended that the guarantees contained in the ordinance were extended to Iowa by the Act of Congress approved June 12, 1838, establishing a territorial government and by the acts for the admission of the State into the Union. This is easily disposed of. The Act of 1838 was no more than a regulation of territory belonging to the United States, subject to repeal like any such regulation, and the Act for admitting the State, so far from perpetuating any particular institution previously established,

admitted it 'on an equal footing with the original States in all respects whatsoever.' The regulation, although embracing provisions of the ordinance declared to be unalterable unless by common consent, had no further force in Iowa after its admission as a State and the adoption of a State Constitution, than other acts of Congress for the government of the territory. All were superseded by the State Constitution."

The cases cited by counsel refute rather than sustain their contention that the Government remains the owner and entitled to dispose of and administer the waters of the arid States. A good deal of confidence seems to be reposed in the decision in *Winter vs. U. S.*, 207 U. S. 564, because it was rendered after the decision in the Kansas-Colorado case. But it will be observed that although the opportunity was presented to recognize the theory now advanced, the Court did not do so, but places its decision upon the basis of a reservation of water for certain lands concerning which the Government had entered into treaty obligations with the Indians. A resort to reservation as the basis of the Government's position in that case was a clear recognition of the fact that except for the reservation, plenary jurisdiction over its waters was vested in Montana upon its admission as a State. Moreover, the reservation was expressed in a treaty which, although entered into with an Indian tribe, nevertheless, as a treaty, possessed the quality of being superior to

the constitution and laws of Montana and of every other State as well.

U. S. Const., Art. 6, § 2.
Hauenstein vs. Lynham, 100 U. S. 483, 490.
U. S. vs. Winans, 198 U. S. 371.

The case of *Gutierres vs. Albuquerque Co.*, 188 U. S. 545, and that of *Boquillas Land & Cattle Co. vs. Curtis*, 213 U. S. 399, are not apposite to the present controversy, the first entitled case having to do with the territorial status of New Mexico, and the second having to do with the rights of a grantee of the State of Sonora to the waters of an arid State.

The only case from which there is any possibility of obtaining support for their theory is *Sturr vs. Beck*, 133 U. S. 541. We have never been impressed by the reasoning of the opinion in that case. The conclusion seems to have been forced and as an authority it should be narrowed to the precise state of facts and the territorial laws of Dakota, and not given any effect as the statement of a universal principle. We think Mr. Justice King was right in saying in *Hough vs. Porter*, 98 Pac. 1083, 1098, that it was overruled by the decision in the *Kansas-Colorado* case.

We conclude that counsel are correct in saying that the question whether the United States or the States own the water of innavigable streams in the West has never been passed upon directly in this Court, if by that statement they mean that they can find no direct support for their theory in anything that this Court has heretofore said. Ownership is hardly the term to use in this connection, since it im-

ports a mere proprietary relation to property. When a part of the territory of the United States is included within a State, the relation of the State to that territory becomes that of a sovereign—a status of paramountcy thereafter prevails antecedent and superior to proprietary right. The sovereign right of dominion which temporarily resided in the United States is assumed by the State, not transferred to it. This sovereign right of dominion over persons and property exists in every State without qualification, except as modified by the universal limitations of the Federal Constitution. Thus, as stated by Mr. Justice Holmes in *Bean vs. Morris, supra:*

> "Subject to such rights as the lower state might be decided *by this court* to have and *to vested private rights, if any, protected by the constitution,* the State of Montana has full legislative power over Sage Creek while it flows within the State."

Mr. Justice Van DeVanter succinctly stated the principle as applied to Colorado in *Snyder vs. Colorado Gold Dredging Co.,* 181 Fed. 62, 65, where he said:

> "In so choosing between these inconsistent doctrines (that is, the doctrine of riparian right vs. the doctrine of appropriation, etc.), Colorado acted within the limits of her authority first as a territory and then as a State, and her choice was recognized and sanctioned by Congress so far as the public lands of the United States were concerned."

We know, of course, that the opinions of the officers of the several departments of the government have no force in this Court beyond their persuasiveness, but the opinions of the Land Department, to whose keeping is committed the disposition of the public lands, may properly be referred to, because they indicate that counsel are now advancing a theory not heretofore entertained in that department.

In the regulations concerning right of way for canals, ditches, etc., under the Act of March 3, 1891, the Department of the Interior said:

> "The control of the flow and use of water is therefore a matter exclusively under State or Territorial control; the matter of administration within the jurisdiction of this Department being limited to the approval of maps carrying the right of way over the public lands."

26 L. D. 520, 524.

And on December 24, 1900, Acting Secretary Ryan reaffirmed the statement in *New Bear Valley Ir. Co. vs. Roberts*, 30 L. D. 382, 386, where he used the following language:

> "The question of the ultimate rights of the parties hereto in and to the waters of said streams under their respective notices of appropriation is solely within the jurisdiction of the state courts and in pursuance with the policy announced in the case of Chicala Water Co. vs. Lytle Creek, the Department will not attempt to interfere

with the control of said waters or determine the rights of the conflicting claimants thereto, except insofar as may be necessary to ascertain whether the applicant has shown such *prima facie* right to the use thereof as will enable him to utilize for the purposes contemplated the grant for which he has applied."

In *Silver Lake P. & I. Co. vs. Los Angeles*, 37 L. D. 152-3, First Assistant Secretary Pierce, on September 9, 1908, stated that:

> "The Department is without jurisdiction to determine the question as to the right to water, that being a matter solely within the province of the state courts."

That Department clearly recognizes the fact that it was dealing with the territory of the United States as the agency of Congress in a proprietary as distinguished from a sovereign sense and with the limitations imposed by the former against the breadth of the latter. That the department was right is evidenced by the opinion of Mr. Justice Van DeVanter in *Utah L. & P. Co. vs. U. S.*, 243 U. S. 389, 410, where he says:

> "Much is said in the briefs about several Congressional enactments providing or recognizing that rights to the use of water in streams running through the public lands and forest reservations may be acquired in accordance with local laws, but these enactments do not require particular mention, for this is not a controversy over water

> rights, but over rights of way through the lands of the United States, which is a different matter and is so treated in the right of way acts before mentioned."

And then he cites *Snyder vs. Colorado Gold Dredging Co.*, 181 Fed. 62, 69, to which we have already called attention.

Section 8 of the National Reclamation Act (Act of June 17, 1902—7 Fed. St. Ann., 1905, p. 1098), clearly limits that act and recognizes the same limitations upon the Government already noted with regard to the Act of 1891. Such was the statement concerning the effect of the act during the debates in Congress and such has been the interpretation thereof by the courts.

> *Con. Record,* Vol. 35, Part 7, pp. 6679-80..
> *Kansas vs. Colorado,* 206 U. S. 46, 92.
> *United States vs. Hanson,* 167 Fed. 881, 884, 93 C. C. A. 371.
> *Twin Falls Canal Co. vs. Foote,* 192 Fed. 583, 594.
> *Bergman vs. Kearney,* 241 Fed. 884, 892-3.

In the last case above cited (*Bergman vs. Kearney*), decided March 3, 1917, by the United States District Court of Nevada, it was contended that all unappropriated waters "belong to the United States Government" (p. 899), the same contention made by counsel in this case, but the argument was treated by the Court as "largely academic, and could lead to no profitable or decisive conclusion," and the unappropriated waters were declared to be the property and under the control of the State (241 Fed. 892-3).

There are some things said by counsel that seem to us quite true; for instance, they say:

> "It is difficult to see how priority of appropriation can be adopted as the rule of decision in this case without taking the federal title as a basis. If we eliminate the rights of the United States and the power of Congress to dispose of those rights and the consideration that the owner of those rights is a sovereign, we have two states facing each other simply as paramount land owners. As such, how can they be confined in their rights in the stream to the water that they have already appropriated, and, as to the surplus waters, be given merely a right to make further appropriations. *The fact that their laws both recognize priority of appropriation as governing the rights of their citizens can have no bearing.* These laws in neither instance were made to govern the State itself as against another State. No rule of comity could apply in a case where the States are seeking to assert rights in *in vitum* against each other. Furthermore, Colorado has lately passed an act designed to retain such waters as she controls within her own borders (Act of March 30, 1917, Session Laws of Colorado 1917, page 539)."

Counsel might have gone much further and said that not only must the federal title be the basis of appropriation, but Congress must supplant all State laws and regulations and give uniformity to all the

laws, rules and regulations respecting the initiation and maintenance of irrigation and other rights, the determination of conflicting claims to water and provide the official force necessary to meet the daily and hourly changes in the flow of the natural streams and the conflicting interests of the various appropriators. The conflicting claims of appropriators in adjoining States from the same stream can never be ascertained, adjudged or regulated so long as each State, or the State called upon to surrender to the demands of the other, refuses to recognize appropriations not made within its borders. It may be said that such a condition of uniformity may be obtained by judicial decree, which would mean that the Federal Court should formulate the rules which should govern. But this would be not only impractical, but in violation of the proper functions of the Court. That Court would be compelled to assume the legislative functions of both Wyoming and Colorado and to become, in effect, an administrative board constantly in session for the purpose of securing to the several appropriators and to the State as well, in respect to the proper utilization of water, the benefits of irrigation.

We fear that some people, and we are sorry to note that this is true of the Government counsel, think that a right of appropriation is an isolated right that when once ascertained, is free from any relation to other appropriation rights. Such is not the case. Each appropriation right, under a highly developed system such as prevails in Colorado, is relative to all other appropriation rights from the same stream, even though they may be, as occurs in

Colorado, 200 miles apart. The principal streams of Colorado, with their tributaries, constitute a single irrigation division in which hundreds of appropriations have been made, and over which the superintending control of the State of Colorado is being daily and hourly exercised for the purpose of securing due observance of the laws of the State and the maintenance of its interests in seeing that the water is beneficially used and that water shall not be taken from the river except when the needs of the land under a particular ditch may require, and that the headgates of the several ditches which are no longer under the private control of the appropriator, but under the control of State officials, shall be closed or opened according to the needs of the appropriator and in accordance with the conditions of supply which may obtain at particular times.

While it is true, paraphrasing the language of Mr. Justice Holmes in *Bean vs. Morris*, that the doctrine of appropriation has prevailed in Wyoming and Colorado probably from the first moment that they knew of any law, and that it was recognized by the statutes of the United States while they were both territories, and that it is recognized by both States now, it does not follow that priority of appropriation is the only attribute of the doctrine. To determine contests between appropriators in different States by that single factor would be to return to the primitive stage of irrigation, when contests over water were purely private contests, relieved of all public concern. But today the science of irrigation, because it has become both a science and an institution, is very little concerned with such primitive notions as who was first in time, as the test of first in right.

We think we are entitled to say that Colorado, because of her extreme arid condition and because, except by the use of her running waters, she must always remain arid, has developed the institution to a point in advance of any other State. But it is to the same degree of finish that other States may be expected to come. So that we are contemplating now, not the mere matter of whether A in Wyoming was prior to B in Colorado, but we are placing the systems of two States in juxta position and in doing so we find that while they are in agreement as to the necessity of irrigating land and to the protection of appropriators, the ways and means and the regulations concerning the subject are far from being identical. The laws of Colorado occupy pages; they determine the conditions under which appropriations may be made, the manner in which they shall be evidenced; they give to the courts special statutory powers to inquire into and determine the rights of the several appropriators; they divide the different water divisions into districts, with a commissioner in each district to keep in daily and hourly touch with the distribution of water, and over the whole system, and as its head and center they place the State Engineer, who is vested with authority to so direct and control the various Division Engineers of each division and Water Commissioners in each water district throughout the entire State of Colorado, that the waters may be at all times beneficially and economically applied in accordance with the several and respective rights of the different appropriators, restrained as they at all times are by the dominant public interest in the wise and proper application of

the water. Wyoming, on her part, has laws either sufficient or tending to be sufficient for the same purpose, but her machinery is different, practically from the first manifestations of a desire to take water up to the moment of its final application. The laws of all the appropriation States differ, and if an appropriator in one State were required to ascertain his rights by reference to the laws of the adjoining States, he would find himself in a state of utter confusion. The test by which to determine the amount of water to which one is entitled, the conditions which would be deemed an abandonment, the procedure in case of shortage, the right to store and the regulation of storage and nearly every incident to the system, have no correspondence in the laws of the various arid States. As is shown by the brief of counsel for the Government, States differ fundamentally, some having mixed conditions, as, for example California, Oregon, Nebraska and probably some others.

We understand that the inquiry of the Court by its recent order is directed to ascertaining not what disposition may be made of the present controversy, but what universal rule should be adopted in case of controversies between States or between appropriators in different States when the laws or the courts of the upper State refuse to recognize or enforce the claims of appropriators in the State or States below. Apparently the time has been reached when it is necessary, quoting the language of Mr. Justice Holmes in *Bean vs. Morris*, to "consider what limits there may be to the powers of an upper State if it should seek to do all that it could." It seems to us that no

rule can be applied, save that which was adopted by Mr. Justice Brewer in the *Kansas-Colorado* case, but the conclusion in that case in our judgment is but a theoretical one, because we cannot conceive that a time will ever arrive when in the wise, judicious and beneficial application of water in Colorado to the reclamation of arid lands and the improvement of the welfare of her citizens, it could be said that Colorado had destroyed the equitable apportionment of benefits between it and a lower State resulting from the flow of a river. Just where the line can ever be drawn it is impossible for us to say, and with all due deference we submit that it is idle to consider it, because there are certain provisions of nature which no human laws can override which serve to maintain an equilibrium of benefits. While Colorado asserts the right to divert all the waters of a stream originating in and flowing through her territory, this is itself but a theoretical assumption, because she does not possess the power to overcome the laws of gravity, nor the direction of moving water in the mass. She may construct dams, she may construct ditches, and she may divert vast volumes of water to the thirsty soil, but when that thirst is appeased the water returns to its former course; and all that has been accomplished by the diversion, as broad and ample as it may be, and the broader the more ample, the more generous the result, she has done nothing but strengthen the flow of the river below the point of use—not strengthened it under flood periods, but strengthened it by equalizing the flow throughout the year.

Let us, in conclu illustrate our contention that there is a law of co..r ion as between States as well as in other r : When the case of *Kansas vs. Colorado* w nstituted, the substantial basis of complaint was there was an underflow underlying the entire . ..sas Valley, which operated beneficially upon surface soil by a form of sub-irrigation. It wa claimed that the diversion of water in Colorado ha: . ered the level of this underflow so that it n onger performed the valuable services theretofore p . med. Since that case was decided, it has been di vered by the advance in electrical science and . improvement in elevating devices that this under is itself as good a supply for the lands in the va of the Arkansas as would have been the surfa ers of the river. The generation of electric the conveyance of the current to the various s permits the pumping of water at no greater exp than is required in the construction of a dite and the diversion of water from a river where the modern perfectness of that method is adopte

OTHER AUTHORITI CITED BY COUNSEL FOR THE D STATES.

Further or ex ed discussion of the cases cited by counsel for United States would serve no useful purpo ... this case. These relate in the main, to the relative e rights of either riparian owners or appropri rs and not to the greater and sovereign rights of States in and to the control of the natural eleme e waters of the streams irrespective of mere p rights. These cases are

largely cited as a basis for the fundamental contention of counsel, that "all the riparian owners on a stream taken together, therefore, may grant such rights in the stream as they see fit. Together they own the entire stream," etc., as a premise to the theory of Government ownership and grant. But in the reasoning of these many cases there nowhere appears or was involved, the fundamental principle that the States in this government of delegated powers have an interest in their streams superior to that of all riparian owners or appropriators and greater than any title or interest which all riparian owners or appropriators combined could convey to a common grantee (*Hudson Water Co. vs. McCarter*, 209 U. S. 349) and the Laramie River or any streams in Iowa, Missouri or other portion of the Louisiana Purchase or any other portion of what was originally the public domain, would appear to be subject to same state control as the streams of New Jersey (*Kansas vs. Colorado*, 206 U. S.; *Marshall Dental Co. vs. Iowa*, 226 U. S. 460; *United States vs. Cress*, 243 U. S. 316).

It is here contended by Wyoming that all the water of the Laramie river has already been appropriated. Under contention of counsel for the United States any discussion of the law of derivation of original title would seem of little value for the reason that, under the theory advanced, these waters have all passed into private hands and like lands gone to patent, are now within the sovereign control of the two states. It is the control of these waters after they have passed into the hands of appropriators that is here involved and the source of the original

title, whether directly from the government by grant according to local laws, customs and decisions of the courts of the respective States as provided by the Act of 1866, or whether by permissive use by the States of one of the great natural and necessary elements of life, is of no moment unless, in fact, if the title be deemed to have been derived by the appropriator directly from the Government, it can then be said that the Government continues to supervise and control the use of the water acquired under the right forever thereafter, irrespective of the laws or necessities of the States. If such be true, control of the waters of the non-navigable streams of Iowa, Illinois or any other public land State must likewise remain perpetually in the United States. Waters of the streams require no particular control or supervision until after appropriation or after riparian, municipal supply or other like rights have attached thereto, except it be for the public protection of the purity of the streams and other like purposes, and academic discussion of the cases cited would be of no ultimate benefit to the court. We however suggest, that nowhere in the brief is there mention of any method, system or machinery by which governmental control could be carried out in a practical manner under, necessarily, one system of laws.

SOME FINAL OBSERVATIONS CONCERNING THE EXTENT OF THE INQUIRY NECESSARY TO BE MADE TO DETERMINE CONTROVERSIES BETWEEN STATES AND BETWEEN RIVAL APPROPRIATORS IN ADJOINING STATES.

Finally, we return to what we said in the opening of this brief to the effect that the matter in hand should be disposed of by reference to the present stage of irrigation development, free from the embarrassment of primitive or obsolete practices or legal conceptions. The question whether the upper State has a full or limited control of the waters flowing through it should be settled definitely and finally. The assaults made upon Colorado by Kansas, Wyoming and Nebraska, successively, not only cloud present titles, but intimidate those desiring to further develop our resources by the more extended use of our waters, and constantly present the problem whether to preserve a supposed equilibrium between Colorado and adjoining States, it may not be necessary to undo something that has been done in Colorado.

With the principle announced in the *Kansas-Colorado* case, upon the basis of which the Supreme Court is enabled to exercise its powers as an interstate tribunal, whenever a substantial reason is presented, we cannot take issue. It is the practical application of the principle that suggests the possibility of injustice. If we consider the particular issue in that case, the unsolved and, as we think, unsolvable, problem was and is: When shall it be said that in the proper and beneficial uses of the waters of the Arkansas River Colorado has reached a point

where the substantial interests of Kansas are injured? And this inquiry, of course, is true of every stream flowing from Colorado into adjoining States. Can the precise point in time or in events be determined? And is it to be ascertained before or after the event? The opinion of Judge Brewer seems to contemplate that the Supreme Court is to act after the point has been passed, which, of course, means that equality is to be produced by a destruction of such development in Colorado as is in excess of what the Court may then fix as the sovereign limit of development. Thus the Court would say to Colorado, your pile is too high, we must sweep a portion of it into Kansas or Wyoming or Nebraska, as the case might be. All of this, in our judgment, denies the further influence in the States concerned of the processes of nature and the genius of man which ought to, and doubtless will, solve problems of this character.

It is true that Colorado and Kansas and Wyoming and Nebraska are States of the Union and amenable to the Constitution which binds them together, but they are at the same time living social and political organisms, entitled to exercise within themselves, respectively, every power and function appropriate to their up-building. And as these powers and functions must operate upon things as well as upon persons, it ought to follow that nothing that has been placed within their physical control should be withdrawn from them, nor should a sword be suspended over their activities, to fall when, in the judgment of the Supreme Court, they should cease. When the people of Colorado assert a right to the

use of all their waters as an attribute of sovereignty, they mean nothing more than that the very nature of a State involves the right to so use its own resources as to advance and contribute to its welfare, and thus to the welfare of the whole country. Is there anyone bold enough to say that the people of Colorado, who have been without government aid in the carrying out of their projects, have not added vastly to the welfare and prosperity of the Union? And with some degree of pride, may we not ask whether there is any one bold enough to say that Colorado has not been in advance of all other States in demonstrating that arid lands may be made fruitful and that the courage and genius of her people have not been of first importance in enabling Congress to dispose of its arid territory? And, yet, if we are to accept the principle of Kansas against Colorado as a living thing, liable to strike at any moment, Colorado and her people must from now on rest under the heavy hand of repression.

So far as the effect upon Colorado is concerned, there is little practical difference between apportioning waters in the mass as suggested in the *Kansas-Colorado* case, or apportioning them by giving to appropriators in Wyoming or any lower State priority over appropriators in Colorado. We are pobably correct in saying that the latter would be the more fatal of the two, because it not only refuses to Colorado the full use of its waters, but it impairs the ability of Colorado to carry to its full fruition the doctrine upon which the use of water in Colorado is founded, namely: That the water belongs to the people and that its use shall at all times be beneficial.

By beneficial is not meant privately beneficial alone, but beneficial from the standpoint of the inital public interest. In Colorado, and we think the same is true of all the arid States, the individual appropriator is but a cog in the machinery or process of irrigation development. He has no independent exclusive right to water, to do with it as he likes, as he may with all other forms of property. On the contrary, he is deemed to be using a public fund, and he must use it to the satisfaction of the public, and he is not left to determine that matter for himself. The State, in the person of its water officials, superintends his taking of water and must be daily satisfied that it is then necessary to his use. If he ceases to use it for an unreasonable time, his right ceases and the water returns to the common fund. He is never free from an obligation to the State and its citizens, as well as to those who are making a like use of the public waters. Thus it is that each State has by law, usage and custom formulated, with more or less claim to completeness, a system of irrigation, the foundation stone of which is necessarily administration. Each State is an administrative unit, in which the success of the system is dependent upon the centralization and unification of jurisdiction and authority in the sovereign power of the people. The rivers in the arid States are fluctuating in volume and usefulness. They may have tidal aspects when the snows of the mountains are alternately melted by the warmth of the day and frozen by the chill of the night. Under these conditions, they rise and fall much after the order of the tides. During some days, and even months, the lower reaches, as was testified in the

Kansas-Colorado case, may not contain upon the surface enough water for a thirsty horse. In the distribution of water for irrigation all contributing supplies, whether by storms or tributary streams, or other temporary causes, must be observed by the water officials and the right to water at the different points of diversion must be daily determined by the river, and even by barometric, conditions then presented. Conservation is the paramount law in the distribution and use of water. Each State devises its own system. Each State is a law unto itself and not unto another, and each State must be unimpeded in the carrying out of its system, else the condition of efficiency, which it is the object of the State to maintain, will be impaired, if not destroyed.

It must be perfectly evident, therefore, that if an appropriator in a lower State may inject his supposed right into that system, he not only takes the water from some one or more of the parties to that system, but impairs the system itself. In other words, he does not strike at an individual appropriator only, but he strikes at the common welfare of the State as endeavored to be promoted by the system. If one appropriator in a lower State may inject himself into the distribution of water in an upper State, a second, a third and an indefinite number may do so, and thus we would have such a series of interpolated claims that the principal duty of the upper State would be to administer its waters in behalf of appropriators in the lower State.

In the *Kansas-Colorado* case, Mr. Justice Brewer said:

> "Now the question arises between two States, one recognizing generally the common law doctrine of riparian rights, the other prescribing the doctrine of public ownership of flowing water. Neither State can legislate for or impose its own policy upon the other."

In the present case, we have to deal with States, in both of which the latter doctrine prevails. This, however, does not negative the fact that the laws of the two States may be different. That they seek a common object does not mean that they adopt a common method. The harmony of the former does not demonstrate the harmony of the latter. All Christian religions are agreed upon the need of salvation, but the most bitter and bloody contests the world has ever known have been over the methods of reaching that desired goal. There is no uniformity in the laws of the several arid States concerning the acquisition, use or administration of water. A cursory examination of the laws of the several States, as set forth in Part 8 of *Weil on Water Rights,* Third Edition, will verify this statement. Not only is there no concurrence of the statutes, but there is a wide variance in judicial opinions, depending to a large degree upon the extent to which the judges are unable to rid themselves of their inherent juridical conceptions of the sacredness of private property. The initiation and history of water rights in Wyoming is different from Colorado. The administration of water in each State is by a different system.

In addition to present variations in the laws of the several arid States it must be borne in mind that still others may occur, as the law, as well as the practice of irrigation and, indeed, of all other uses of water, is still in a state of flux. In no respect has the law or practice settled down to the fixity of the common law doctrine. And let it be remembered in this connection that it took England several centuries to finally and definitely formulate its present doctrine. We must contemplate the possibility that a State may revolutionize its law of waters. New Jersey slumbered along for many years, as time goes in a new country, before it awoke to the fact that back of and superior to the private rights of riparian owners there was a public right that it was entitled to protect. Colorado is not bound to continue its present laws or make them conform to those of Wyoming, nor is Wyoming or Nebraska or Kansas bound to maintain harmony with the laws of Colorado as the basis of a sovereign or individual right to water. Suppose Colorado should conclude to adopt laws similar to Kansas, conceding to riparian owners the right to irrigate, and thus by uses following the course of the stream the water should be exhausted before it passed into Kansas, Nebraska or Wyoming, would these riparian rights be subject to curtailment in the interest of the lower State or other appropriators?

In brief, can this Court, in this or any similar controversy between States, predicate anything upon any actual or supposed concurrence of the laws of the two States? If States assert rights against each other in the waters of interstate

streams, the extent of those rights must be determined by material and physical conditions and by measuring the extent of the resource to which each State is entitled and not by the temporary state of their laws, unless it should be that by their laws they have surrendered something definite. In our judgment, in this as well as in any other controversy which may arise between Wyoming and Colorado, or any other lower State and Colorado, this Court cannot justly apply either the method adopted in the Kansas-Colorado case or the method of recognizing appropriations regardless of state lines. Whatever may be true of the former, because of the fact that *Kansas vs. Colorado* is a precedent, it is, nevertheless, beyond reasonable dispute that to permit an individual appropriator in a lower State to assert and maintain claims against the appropriators in Colorado, would be to destroy and set at naught that system which lays at the foundation of success in irrigation, as well as the success of the United States in the disposition of its territory.

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I

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II.

The United States is the owner of the public domain, however acquired. It holds that property under its own laws and not under those of the former sovereign. What property the United States owns, whether it owns it as a proprietor or as the possessor of municipal sovereignty, and the incidents and extent of its ownership, are Federal questions determinable by this court according to its own view of the Constitution and of the common law, in the light of which the Constitution is to be interpreted..... 19

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In the Supreme Court of the United States.

OCTOBER TERM, 1917.

THE STATE OF WYOMING, COMPLAINANT, v. THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY.	No. 5, Original. In equity.

BRIEF FOR THE UNITED STATES.

Introductory statement of contentions of Wyoming and Colorado and position of United States.

This brief on behalf of the United States is respectfully submitted in response to the order of this court herein requiring a reargument as to the principles of law that should govern the decision of this cause and directing that copies of the record and briefs be submitted to the Attorney General.

Wyoming seeks an injunction prohibiting a certain specific diversion and use in Colorado of a part of the waters of the Laramie River, an interstate stream. Wyoming seeks to protect rights that it claims for

itself as a sovereign State, and rights that it claims on account of State ownership of riparian lands, and also the individual rights of its citizens. It denies the right of Colorado to permit the waters in question to be taken beyond the watershed. It pleads the case in such a way that it can rely upon the pure doctrine of prior appropriation or upon the riparian doctrine, if the riparian doctrine should be upheld as between individuals or as between two States, or, as we take it, upon any rule of division that this court may decide to be the proper one between States.

Colorado in its answer says that the waters of the Laramie River rise in the mountains of Colorado; denies that they have been fully appropriated; alleges certain priorities in Colorado; and claims that there is ample water for all appropriations so far made in both States. Colorado, however, goes further and asserts that as a sovereign State it not only has a right to assert and urge the claims of its citizens, but that it, in its sovereign capacity, is the ultimate owner of all of the waters within its territorial borders, as one of its natural resources, and may do with them as it will.

Colorado, as we understand it, also takes the position that if two States as against each other have rights *in invitum* in streams that flow through the lands of both, there should be applied the doctrine of a reasonable and equitable sharing by the two States of the benefits in the interstate stream, and that under that doctrine the 91,000 acre-feet of

water that it claims on account of the particular diversion here complained of does not constitute an unreasonable trespass upon Wyoming, because after this diversion is made there would be left a reasonable amount of water in the river for use in Wyoming.

We do not understand that the position of Colorado as above outlined, which was that originally taken, is intended to be changed by its brief on rehearing; but we think it proper to state here that in that brief the proposition that States have rights as against each other in interstate streams which, under some circumstances, would have to be adjusted by this court, seems to be conceded. The principles upon which such a controversy should be decided, other than the broad one of equality between the States as sovereigns, we do not find stated in Colorado's brief; nor have we been able to find there the views of the writers as to what facts should be taken into consideration in determining the amount of water each State would be entitled to or what test ought to be applied to find out whether the use of the stream by one State infringed the rights of the other.

Wyoming, in its brief on rehearing, takes the position, if we understand that brief properly, that priority of appropriation should govern between States as it does between individuals, with the exception that between States the uses ought to be confined to the watershed.

The contention of the Government is that the principles sought to be upheld by both Colorado and

Wyoming, failing as they do, to recognize the proprietary rights of the United States in the waters of innavigable streams upon lands that at one time were all public, and seeking a solution of the problem of interstate streams without taking into account such Federal ownership or the grants of water rights made under the acts of Congress, are unsound in law and opposed to the vital interests of the United States, and, if established, might be fatal to important Government policies and result in an almost inextricable confusion of water rights in such streams. The attitude of the executive branch of the Government, as expressed by the Attorney General in his 1914 report, page 39, is briefly that the United States has not surrendered to the States or lost to them or parted in any way with its original right to use the surplus waters (those not appropriated under its own laws) of innavigable streams in the Western States. Our position is that the United States is and always has been, since the cession of the territories now comprised in those States, the owner of all the unappropriated and surplus waters; that the appropriated waters there have been granted by the United States under its own laws, using local customs and State laws as subordinate instrumentalities only; that the rights of the States, both as the actual owners of lands granted to them and as the ultimate owners of the property of their citizens, so far as they may be said to be such owners, are confined to such water rights as have been granted by the United States to them or their citizens under the laws of Congress; and that

controversies such as this should be decided upon the basis of such Federal grants, and without regard to State boundaries.

The effect of these questions upon the public interests and governmental policies of the United States.

In the Western States, which comprise the arid regions of this country, water for irrigation is of the utmost importance. The United States in that territory is still the owner of more than 505,000,000 acres of land. It is also the owner of over 375,000,000 acres in Alaska. This land is held by the Government for the benefit of the whole people, and the Government is under a moral obligation to guard, reserve, and dispose of it in ways that will best serve the interests of the country at large.

Reclamation policy.

The adoption of the reclamation policy is one of the ways in which Congress has undertaken to discharge that duty. Twenty-seven projects (Annual Report Reclamation Service, 1915–16, pp. 659–661) looking to the reclamation by irrigation of 3,117,862 acres of land have already been undertaken. (Same report and pages.) On these projects $109,885,140 have been expended in dams, canals, and other irrigation works. Of the total irrigable land under these projects, 629,036 acres have been entered by private persons, and the entrymen with their families number over 100,000 persons. (Annual

Report Reclamation Service, 1915–16, p. 20.) The lands in private ownership when the projects were undertaken, which are to be irrigated as a part of the projects, comprise 1,522,168 acres. (Same report, p. 661.) The projects also include in the total land to be irrigated 331,470 acres of Indian lands and 114,620 acres of lands belonging to the States. (Same report and page.)

As to the right of these settlers to the use of the water necessary for the irrigation of their land, even in those instances where the water has already been applied to that purpose, there would be a serious question in case the original title of the Government were not upheld. The Government has not been able to comply with the local laws in all instances, and, furthermore, its right to become an appropriator would very likely be assailed. These private water users might then be unable to show a title to the water they were using based upon properly instituted steps taken to initiate a water right, in which case their rights would date from the time the water was applied to the beneficial use instead of relating back to the commencement of the project. The situation of entrymen where water has not been applied would be precarious indeed. In those cases, if it were held that the Government had not taken the proper steps under the local law, and therefore no rights were initiated, it would be hard to see how the entrymen, having done nothing of themselves except to enter Government land under the project, could claim water rights. Experience has shown that the undertaking

of a Government project, even in the most preliminary way, stimulates private persons and corporations to initiate appropriations from the streams depended upon by the project. Many private projects so started are carried through before the Government works are completed, and in the cases where they are, the right of the entryman on the Government project to water with the priority contemplated depends entirely upon the validity of the Government's initiatory steps. If that should fail, these entrymen would be subordinated in their rights to rights under the private projects, and this, in frequent instances, would result in their not having sufficient or any water for their own lands.

It is possible for the Government as to future activities to control this situation to a certain extent by the withdrawal of vast areas of land when it undertakes a project, thereby, if the situation is such as to enable it to be done, preserving the Government's priority until it can build its works and apply the water to the land. The Government could in this way prevent access to the stream and also prevent the entry of public lands, under the land laws, for private projects. But the effectiveness of this method of obtaining the desired result would not be great and the locking up of the public domain and prevention of settlement and discouragement of private enterprise involved, if this method were the only one that could be resorted to, would be unfortunate.

Many of the projects involve irrigation of land in two States and most of them depend for the water essential to their success upon interstate streams.

The projects now under way or contemplated are often of a character and magnitude that would prohibit their being undertaken by private or even State enterprise. Some of those that are being investigated would be wisely undertaken only if a comprehensive development of a great stream system could be made and lands in several States could be irrigated. Of this character is the proposed utilization of the available waters of the Colorado River. There reservoir sites in Wyoming, Utah, and Colorado would be used to store water for the irrigation not only of lands in those States but also of lands in California and Arizona.

As another example of the dependence of reclamation projects upon interstate streams, we have the North Platte project in Wyoming and Nebraska. Here the lands to be irrigated, amounting to 230,000 acres, are located in the two States. The water supply comes mainly from a third State, Colorado, and is stored in the Pathfinder Reservoir situated in Wyoming.

It is apparent that when projects involve irrigation of lands in more than one State or depend upon waters coming from States other than those containing the lands to be irrigated, or where in any case the waters on which the project relies do not come from one State, the possibilities of conflict between one or more of the States affected and the Federal

Government would be great, if the control of water were wholly a matter of State law and so beyond the power of the general Government.

Hitherto, very serious conflicts have not arisen, or if they have arisen, practically none of them has been pressed to a determination. Identity of interests and the desire of the States to have the Federal Government undertake extensive works and developments within their borders tend to prevent dissensions. The possibilities of conflict, however, remain, and they are becoming more apparent as the stage of initial development in each case gives place to that in which the project is well advanced. When the Government is already committed to the doing of such new work as will be undertaken, and the time arrives when rights between the States and the Government and between individuals and the Government have to be determined, diversity of interests is likely to work to the prejudice of the success of the project. In only a few cases have the water rights upon which the projects depend, and without which they would represent only useless expenditures of public money and a fruitless development of public lands, been adjudicated. When these rights do come to determination in the courts it is inevitable that all private claimants, whose interests in any way conflict with those of the Government, will question its rights, and it is also becoming apparent that the States may do likewise.

Even where a project is wholly within one State, dependence upon State laws for the acquisition of

water rights might be impracticable, if not actually impossible. As to the projects already undertaken, full compliance with such laws has in some instances been impossible. In such cases the water rights of the projects must rest upon the doctrine of Federal rights above stated. The States, in their local laws, have quite generally departed from the original pure doctrine of appropriation. Under that doctrine in its original form, a vested water right could be obtained by putting the water to a beneficial use, without the intervention of any State agency. Now, the State laws commonly provide that no right shall be initiated except by application to and the permission of State officials, who are usually either the State engineer or some sort of board of water control. These laws are also in many instances unsuited to forming or carrying out great projects, as they seldom, if ever, take account of or provide for the interstate character of such projects or the time which it takes to complete them. Commonly, the local laws fix time limits for the completion of work, which limits are too short for Government projects. Also, they in some instances require work to be carried on under the supervision of State officers who have the right, to some extent at least, to determine whether it is progressing satisfactorily or otherwise is being done in compliance with law, and if their determination is adverse, they have the power, by their orders, either to stop the work or to withdraw from its

continuance the sanction of the local law defining the steps necessary to the vesting of a water right.

As to the future, if the theory of States' rights advanced here by Colorado should prevail, the fate of Government projects would depend entirely upon the permission of one or more States. Of necessity these plans must in many instances be opposed in part to the narrow interests of particular States. It follows that in only rare cases could the Government depend upon the cooperation of the State, and, where necessary, upon obtaining State legislation. Even if the States, at the inception of the project, welcomed the Government's undertaking and were willing to aid the project by such legislation as executive officials of the Government suggested, it would probably be unwise for the Government to undertake the project thus dependent upon State action, as the local view of the interests of the State might change. Moreover, in a large undertaking, it is impossible to foresee all contingencies, and no legislation made at the beginning would assuredly suffice for carrying the project to completion and for taking care of its operation for an indefinite period.

Indian policy.

The Government's interests on account of the Indians are likewise vitally bound up in the questions here involved. The Indian reservations in the arid regions comprise 70,891,091 acres. (Report Commissioner Indian Affairs, 1916, p. 90.) And in addition to this the Government will doubtless from time to

time, as heretofore, create new reservations for the Indians and make new allotments of land to individual Indians out of the public domain. In carrying out its policy of advancing the Indians in civilized life by giving them the means of becoming the owners and farmers of irrigated lands the Government has undertaken numerous and extensive Indian reclamation projects, and has undertaken the irrigation of many individual allotments and Indian homesteads. In that work there has already been expended $13,470,354. (Same report, p. 163.)

The waters flowing on these reservations are necessary parts thereof, and without them the land itself would be of small value in accomplishing the purposes for which the reservations were made. The fulfillment of those purposes and the full utilization of the waters needed therefor is of necessity a slow process. For this reason it is to but a limited extent as yet that the waters have been used, or their use so provided for as to give the Indians water rights valid under State laws. Inasmuch as this is so, and as in many cases the reservations were made after the States were created, the water rights essential to those reservations may be in jeopardy if the States, by their creation as such, became the owners or obtained control of the unappropriated waters within their borders. Such a holding would probably not affect many, if it would affect any, of the reservations made before the creation of the States, especially those made by treaty with the Indians (*Winters* v. *United States*, 207 U. S. 564), but it would seriously cripple all reser-

vations made thereafter, and it is probably not too much to say would disastrously affect the Government's Indian policy.

Nothing can be hoped for the Indian by way of favorable legislation from the States. Temporary State interest is almost always opposed to the protection of Indian rights. The Indians during the period of tutelage, which may be indefinitely extended, do not pay taxes, are backward in enriching the State by the creation of wealth therein, and do not take part in political activities. They are, therefore, the prey of individuals and lack the support of those in authority that white men can confidently count upon because of self-interest.

Other Government property rights and activities affected.

Besides the interest of the Government on account of its public lands and the reclamation and Indian policies, it is vitally concerned with the questions here raised because of its policy to prevent monopoly of water power on the forest reserves and on the public domain in general, and on account of its military reservations, its Public Health Service and other hospitals, and, in short, wherever its vast property rights and its multiple activities in the arid region are affected by or depend in whole or in part upon the use of water.

It would be difficult, indeed, for the Government to pursue any of its major policies looking to the de-

velopment of its lands in the Western States, if its use of water should be held dependent upon the permission of the States, and it is hard to see by what theory the Government would be saved from such dependence if the unappropriated waters of innavigable streams are either owned, or are, in any true sense, under the control of the States.

The question of original ownership of innavigable waters fundamental in this controversy.

In the order of this court requiring reargument, counsel are requested to direct their attention to the rule which they deem should properly be applied to a solution of the controversy; that is, first, whether the rights asserted ought to be tested and determined solely by the application of the general principles of prior appropriation without regard to State boundaries, or, second, whether, on the contrary, the general principles of prior appropriation are subject to be restricted or their application limited in this case by State lines, and if so, by what principles under that assumption the case is to be controlled.

Addressing ourselves to that task we assume at the outset the importance of finding, if possible, a rule to govern rights in interstate streams that will not disturb the local systems of water law and administration now in force; and we assume also that it is necessary, if possible, to preserve the large Government interests and important Government poli-

cies that are bound to be affected by whatever rule is laid down.

The question of original ownership of the innavigable waters on the public lands is fundamental. The Government's contention that such ownership is in the United States is the basis of its position that private vested rights in the use of such waters are obtained by grants from the Federal Government; that water rights not so granted are still its property; and that the remaining waters are and have been available to the Government for use in the reclamation of its lands and otherwise, as well as for appropriation by others under the act of July 26, 1866 (14 Stat. 251, 253). The original and present Federal title to such waters offers a solution of the question of interstate streams. That solution is in harmony with the various systems of water law that prevail locally (they having been erected consciously and perhaps in part unconsciously upon that foundation); preserves vested rights in such streams; gives a sure foundation for public and private interstate irrigation projects; and does not interfere with the power of the States over all property within their dominions that is properly subject to their disposition or control.

ARGUMENT.

PART ONE.

The United States retains its original plenary ownership of the innavigable waters in the Western States, except in so far as it has parted with it through acts of Congress; and this property, like the property in the public lands generally, is wholly immune from State interference or control. The State power affects only those rights which have been granted by Congress.

I.

Upon the acquisition of the territory now comprised within the Western States, the United States became vested with all property rights in that territory, except vested private rights and such Indian rights as the United States might choose to recognize, and also became the full sovereign thereof. Therefore, at the time of such acquisition the United States had complete control over the waters of the innavigable streams and the right of use and disposition thereof, and it still has that right unless it has since parted with it in some way.

It has long been definitely settled that from the time when the territory now comprised in the new States was acquired until the creation of those States, the United States, as the owner of the lands and all else capable of ownership therein except property in private ownership (which was of small extent), and

as the possessor of municipal as well as National sovereignty, could dispose of all classes of property rights in such territory. It was the proprietor of the things which under our law are the subject of private ownership and of course could do with them all that a proprietor could do. (*United States* v. *Midwest Oil Co.*, 236 U. S. 459, 474.) It was also the possessor of local, as well as National sovereignty; and so the ownership, control, and disposition of property and rights of every nature, that under our system pertain either to State or National sovereignty, belonged to it.

Shively v. *Bowlby*, 152 U. S. 1.
U. S. v. *Winans*, 198 U. S. 371.
Winters v. *U. S.*, 207 U. S. 564.

This court in the *Winters* case, *supra*, decided in 1908, held, with reference to a reservation by the United States of waters of an innavigable stream in Montana made when that State was a Territory "that the power of the Government to reserve the waters and exempt them from appropriation under the State laws is not denied and could not be" (p. 577). The two authorities cited as supporting this proposition were *U. S.* v. *Rio Grande Dam and Irrigation Co.*, 174 U. S. 690, 702, and the *Winans* case, *supra*. The pertinent doctrine of the *Rio Grande Dam* case is that a State's power to change the common law rule and permit appropriations and so dispose of the waters of the streams within its borders is

limited by its lack of power, "in the absence of specific authority from Congress," to "destroy the right of the United States, as the owner of lands bordering on a stream to the continued flow of its waters; so far at least as may be necessary for the beneficial uses of the Government property."

In the *Winans* case, following the reasoning and authority of *Shively* v. *Bowlby*, *supra*, it was decided that the United States had the power to, and in that instance did, reserve for the benefit of the Yakima Indians in Washington, when that State was a Territory, certain fishing rights and the right to occupy shore lands bordering on navigable waters for fishing purposes free from interference by the grantee and licensee of the State.

The doctrine of the *Winters* case is, therefore, that, whether the waters of innavigable streams, like the lands over which they flow, belong to the United States or whether, like navigable waters and their beds and shores, they belong to the States, the United States owned, controlled, and could dispose of them when the States were Territories.

II.

The United States is the owner of the public domain, however acquired. It holds that property under its own laws and not under those of the former sovereign. What property the United States owns, whether it owns it as a proprietor or as the possessor of municipal sovereignty, and the incidents and extent of its ownership, are Federal questions determinable by this court according to its own view of the Constitution and of the common law, in the light of which the Constitution is to be interpreted.

As was said by this court:

> Every nation acquiring territory, by treaty or otherwise, must hold it subject to the constitution and laws of its own Government, and not according to those of the Government ceding it.
>
> *Pollard's Lessee* v. *Hagan*, 3 How. 212, 225.

The constitutional provision (Art. IV, sec. 3, sub. 2) vesting exclusively in Congress the "power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States," like all parts of the Constitution, "must be read in the light of the common law."

Shick v. *United States*, 195 U. S. 65, 69.

To determine what ownership of its property by the Federal Government means—what incidents and rights are attached to and made a part of that property—we must also turn to the common law as

"the system from which our judicial ideas and the legal definitions are derived" (*Shick* v. *United States, supra*). As said by this court in the case just cited, quoting from *Smith* v. *Alabama*, 124 U. S. 465, 478: "The interpretation of the Constitution of the United States is necessarily influenced by the fact that its provisions are framed in the language of the English common law, and are to be read in the light of its history."

Since the vesting of the full power over the Federal property in Congress "implies an exclusion of all other authority over the property which could interfere with this right or obstruct its exercise" (*Wisconsin Railroad Co.* v. *Price County*, 133 U. S. 496, 504; see also, *United States* v. *Insley*, 130 U. S. 263, 265, and *United States* v. *Nashville Ry. Co.*, 118 U. S. 120, 126), the property rights of the United States and their incidents are not to be affected by State laws or by any power whatever save that of the Federal Government. What these incidents are is a question reserved exclusively for the determination of this court according to its own view of the common law of England, brought to this country by our forefathers as a part of their heritage, and its adaptability to conditions here. It was upon this principle that the question of what constituted navigable waters in this country was decided (*Genesee Chief* v. *Fitzhugh*, 12 How. 443), and that the decision was made that such waters and their shores and beds go to the States as the possessors of municipal sovereignty (*Pollard* v. *Hagan*, 3 How. 212, and *Shively* v. *Bowlby*, 152 U. S. 1).

In deciding questions concerning the property of the United States, State laws and the decisions of State courts are considered by this court only as they throw light upon what the common law is. When the question is, what incidents the Federal grantee takes with the title given him by the Government, State laws and decisions are, in certain instances, followed by this court, but for convenience only.

Hardin v. *Shedd*, 190 U. S. 508.

III.

Tested by common-law principles, the innavigable waters belonged to the sole owner of all the riparian lands—namely, the United States—and could be disposed of, like any other real property, as the owner saw fit.

(1) At common law, innavigable waters belong to the owners of the land bordering thereon. Water rights were and are still real property. Rights identical with appropriation rights can be created by the owner of all riparian lands on a stream.

(a) Water rights are usufructuary rights, and when we speak in this brief of ownership of a stream or its waters, we mean ownership of the right to use them as distinguished from ownership of the water itself. The right of use is the substantial property right with which the law has chiefly to deal. Ownership of the corpus of water is of rare occurrence and comparatively unimportant. It does not exist in connection with waters in their natural state.

Failure to distinguish between ownership of the water itself and ownership of the right to use it has

been the cause of confusion of thought in some of the cases, modern as well as ancient. The right to use water is one of the most substantial property rights known to the law and partakes in no way of the transitory character of the water itself which at any particular time makes up the stream in which the right exists. The law does not in a strict sense regard the water flowing in a stream as being owned by those who have the right to use it, or, in fact, as being owned at all. It does, of course, recognize an ownership in water itself when it is confined and treated as a commodity as when, for example, it is bottled for sale. It is then treated as personal property.

On the other hand, the rights which exist in connection with waters in their natural state—rights in waters flowing in a stream or in water of a pond—are rights of use.

Tyler, v. *Wilkinson*, 4 Mason, 397.
Kent, 3 Comm. (Marg.), p. 439.
Embrey v. *Owen*, 6 Ex. 352, 20 L. J. Ex., 212.
Hargrave v. *Cook*, 108 Cal., 72.

Mr. Wiel, in his learned and exhaustive work on Water Rights, thus states the law in this respect:

> This usufructuary right, or "water right," is the substantial right with regard to flowing waters; is the right which is almost invariably the subject matter over which contracts are made and litigation arises. It is not an ownership in the water itself; it is merely a privilege to use the water, and hence purely incorporeal.
>
> *Wiel, Water Rights*, 3 Ed., p. 755.

When therefore we speak in this brief of ownership of a stream or of the water flowing in it, we do so for brevity merely, and refer not to ownership of the water itself, but of the right to use it.

(b) Both at common law and under the appropriation system water rights are real property.

This is established beyond question; also, that title to water rights is of as high dignity as title to lands. There is no authority to the contrary so far as we have been able to find and no difference in this respect between the common law and the doctrine of appropriation.

That a riparian right under the common law is part and parcel of the land, and, therefore, like the land itself and all that constitutes the owner's estate therein, is real property, see:

Long, Irrigation, 2d ed. (1916), sec. 34, p. 70.

1 Wiel Water Rights, 3d ed. (1911), sec. 711, p. 777 *et seq.*, and numerous cases cited.

Chancellor Kent said, in *Gardner* v. *Newburgh*, 2 Johns. Ch. 162, 166:

> A right to a stream of water is as sacred as a right to the soil over which it flows. It is a part of the freehold of which no man can be disseised "but by lawful judgment of his peers or by due process of law."

It is not an easement.

2 Washburn, Real Property, 6th ed., sec. 1284.

Mr. Washburn, in his work on Easements, 4th ed., pp. 316, 317, says:

> The right of enjoying this flow without disturbance or interruption by any other proprietor is one *jure naturae*, and is an incident of property in the land, not an appurtenance to it, like the right he has to enjoy the soil itself, in its natural state, unaffected by the tortious acts of a neighboring land owner. It is an inseparable incident to the ownership of land, made by an inflexible rule of law an absolute and fixed right, and can only be lost by grant or twenty years adverse possession.

It of course passes only by grant or prescription.

That a water right under the appropriation system is real property, see:

1 Wiel, Water Rights, 3d ed. (1911), sec. 283, p. 298.

2 Kinney, Irrigation, 2d ed. (1912), sec. 769, p. 1328.

In Colorado, the leading appropriation State, the courts say:

> Under our decisions a water right is real estate, not personal property.
>
> *Insurance Co.* v. *Childs*, 25 Colo. 360, 363.
>
> In this state the right to the use of water is deemed real estate, and is a distinct subject of grant, and may be transferred either with or without the land for which it was originally appropriated.
>
> *Davis* v. *Randall*, 44 Colo. 488, 492.

Mr. Wiel says:

> A water right by appropriation is not only real estate, but has all the dignity of and is an estate of fee simple, or a freehold.
>
> *1 Wiel, Water Rights*, 3rd Ed. Sec. 285, p. 301.

(c) At common law, innavigable waters are part and parcel of the riparian land. They belong to the owner of such land as an incident of his estate in the land itself. His title to the water is not dependent upon appropriation or prescription and is derived in the same manner as is his title to the land. Such waters are not publici juris.

General expressions by some of the early writers, in which they fail to make the sharp distinction which the law now makes, and in reality always has made, between ownership of the water itself and ownership of the right to use it, and also the existence of prescriptive rights, for a time left some doubt as to whether the riparian owner's right to use the waters on which his land bordered was not dependent in some way upon actual appropriation.

Whatever doubt existed in that respect was put at rest in England by a series of cases of which *Mason* v. *Hill* (5 Barn. & Adol. 1), decided by Lord Denman in 1833, was perhaps the most important. In this country the question had already been disposed of by Mr. Justice Story in *Tyler* v. *Wilkinson, supra* (4 Mason, 397). Since those cases, it has been settled that under the common law, both in England and in the United States, innavigable waters belong to the owner of the land bordering on them; that the

rights of such owners in the water are in no way dependent upon its use; that the water is part and parcel of the land itself; and that title to it has the same origin as the title to the land.

Baron Parke thus states the law:

> The law as to flowing water is now put on its right footing by a series of cases, beginning with that of *Wright* v. *Howard*, followed by *Mason* v. *Hill*, and ending with that of *Wood* v. *Waud*, and is fully settled in the American Courts: see *3 Kent's Comm.*, Lect. 52, pp. 439–445.
>
> The right to have the stream to flow in its natural state without diminution or alteration is an incident to the property in the land through which it passes; but flowing water is *publici juris*, not in the sense that it is a *bonum vacans*, to which the first occupant may acquire an exclusive right, but that it is public and common in this sense only, that all may reasonably use it who have a right of access to it, that none can have any property in the water itself, except in the particular portion which he may choose to abstract from the stream and take into his possession, and that during the time of his possession only: see *5 B. & Ad.* 24. But each proprietor of the adjacent land has the right to the usufruct of the stream which flows through it.
>
> *Embrey* v. *Owen*, 6 Ex. 352, 368; 20 L. J. Ex. 212.

In *Tyler* v. *Wilkinson* the question was as to the right of a mill owner to use the waters of the River

Pawtucket, at a point where it is innavigable, as against riparian owners. Mr. Justice Story, as Circuit Justice, took occasion to review the law, and in the opinion he rendered briefly covered the whole subject of the origin and nature of riparian rights in nonnavigable waters. The case is the leading one on the subject. Mr. Justice Story said that he had read over all the cases which were cited at the bar, or which were to be found in Mr. Angell's work on watercourses, or which his own auxiliary researches had enabled him to reach. In part the opinion is:

> The natural stream, existing by the bounty of Providence for the benefit of the land through which it flows, is an incident annexed, by operation of law, to the land itself. * * * * * * Mere priority of appropriation of running water, without such consent or grant [of the riparian owners], confers no exclusive right. It is not like the case of mere occupancy, where the first occupant takes by force of his priority of occupancy. That supposes no ownership already existing, and no right to the use already acquired. But our law annexes to the riparian proprietors the right to use in common, as an incident to the land; and whoever seeks to found an exclusive use must establish a rightful appropriation in some manner known and admitted by the law. Now, this may be, either by a grant from all the proprietors, whose interest is affected by the particular appropriation, or by a long, exclusive enjoyment, without interruption, which affords a just presumption of right. By our law, upon

> principles of public convenience, the term of twenty years of exclusive uninterrupted enjoyment has been held a conclusive presumption of a right or grant.
>
> *Tyler* v. *Wilkinson*, 4 Mason, 397, 401.

As to innavigable waters being *publici juris*, the law is equally well settled. The question is disposed of in the passage just cited from *Tyler* v. *Wilkinson*, by placing the ownership of the waters in the owners of the riparian land as "an incident annexed, by operation of law, to the land itself." It is specifically disposed of in the passage we have just quoted from *Embrey* v. *Owen*. Lord Denman, in *Mason* v. *Hill*, considered it fully and came to the conclusion that there was no foundation in the common law, or in the civil law either so far as he could find, for the idea that such waters are open to occupancy, or that they are *publici juris*, except in the sense that no one owns the corpus of the water while it flows in its natural state.

After referring to many expressions in the law to the effect that flowing waters are *publici juris*, and the passage in Blackstone (2 Comm. p. 18): "Water is a movable, wandering thing, and must of necessity continue common by the law of nature; so that I can only have a temporary, transient, usufructuary property therein; wherefore, if a body of water runs out of my pond into another man's, I have no right to reclaim it," Lord Denman says:

> None of these *dicta*, when properly understood with reference to the cases in which they were

cited, and the original authorities in the *Roman* law, from which the position that water is *publici juris* is deduced, ought to be considered as authorities, that the first occupier or first person who chooses to appropriate a natural stream to a useful purpose, has a title against the owner of land below, and may deprive him of the benefit of the natural flow of water.

* * * * *

In the *Digest*, Book 43, tit. 13, in public rivers, whether navigable *or not*, it appears that everyone was forbidden to lower the water or narrow the course of the stream, or in any way to alter it, to the prejudice of those who dwelt near. Tit. 12 distinguishes between public and private rivers; and in Section 4 it is said, that private rivers in no way differ from any other private place.

From these authorities it seems that the *Roman* law considered running water, not as a *bonum vacans*, in which any one might acquire a property, but as public or common, *in this sense only*, that all might drink it, or apply it to the necessary purposes of supporting life; and that no one had any property in the water itself, except in that particular portion, which he might have abstracted from the stream, and of which he had the possession, and during the time of such possession only.

We think that no other interpretation ought to be put upon the passage in *Blackstone*, and that the *dicta* of the learned judges above referred to, in which water is said to be *publici juris*, are not to be understood in any other than this sense; and it appears to us there is no

authority in our law, nor, as far as we know, in the *Roman* law (which, however, is no authority in ours), that the first occupant (though he may be the proprietor of the land above) has any right, by diverting the stream, to deprive the owner of the land below, of the special benefit and advantage of the natural flow of water therein.

Mason v. *Hill*, 5 Barnewall & Adolphus, 1, 23, 24.

For an exhaustive discussion of the subject of our sub-heading and a full citation of English and American authorities, see *1 Wiel, Water Rights*, 3rd Ed. Sec. 670 *et seq.* p. 740 *et seq.*

(d) Under the common law, rights identical with appropriation rights can be created. The riparian proprietors taken together are considered as owning the stream. The individual proprietor may grant his land and retain the water, grant the water without the land, or grant both separately. All the land owners on the stream acting jointly, or the sole owner, if there is such, may grant rights in the stream that will be absolute instead of relative, and which may be put to a non-riparian use. City water supplies are examples.

The essential differences between the riparian and appropriation doctrines viewed as systems of water right tenure are that, while under the riparian system, water rights are relative and may be used only in connection with the riparian lands, under the appropriation system they are absolute and may be used anywhere. Each riparian owner's right is restricted by the fact that all of the other riparian

owners on the stream have exactly the same right. The guiding principle is equality. Under the appropriation system rights are absolute. Each owner has a fixed right to a certain amount of water with a certain priority. His right must be satisfied to the full before those who have rights of later priority take anything. Riparian rights, as against objection by other riparian owners, can be used only on riparian land, while appropriation rights may be put to a nonriparian use.

The kinds of uses that are permitted under the two systems do not differ greatly if at all. Under the appropriation system all uses that are beneficial are allowed; and under the riparian system the water may be used in any way so long as the use does not constitute an encroachment upon the reasonable needs of other riparian owners, who have exactly the same rights. Since exclusion of all but riparian owners from the benefits of the stream (*Wiel, Water Rights*, p. 862, *et seq.*) and equality between riparian owners are guiding principles of the riparian doctrine, all uses that are reasonable, under the circumstances of the case, must be permitted. Any other rule would deprive the riparian proprietors, as the virtual owners of the stream, of the opportunity to make full use of its benefits. "Streams of water," says Kent (3 Comm. 429) "are intended for the use and comfort of man, and it would be unreasonable and contrary to the universal sense of mankind to debar every riparian proprietor from the application of water to domestic, agricul-

tural and manufacturing purposes." The extent and nature of permitted uses depends upon maintaining a fair balance between the several owners and upon local needs and the circumstances of the case. So, in an arid region where farming by irrigation is of paramount importance, as in California, it would be entirely consistent with the principles upon which the doctrine of riparian rights is founded to permit the whole stream to be diverted for irrigation in proper cases. In such a case each riparian owner would, of course, get his fair share of the water. On the other hand, in a humid region where other uses are of more importance and irrigation comparatively unnecessary, the riparian owner's right to irrigate might be greatly restricted. That irrigation is one of the uses recognized by the common law, though questioned in some of the cases in the pure appropriation States, we think is well settled. The New Jersey court in a late case says:

> That diversion for use upon riparian land and for domestic and agricultural or manufacturing purposes is in its nature a reasonable use is the settled law of this state, and diversion for irrigation has been held to be a reasonable use in accordance with the general American doctrine and the English authority.
>
> *City of Paterson* v. *East Jersey Co.*, 74 N. J. Eq. 49.

See Mr. Wiel's full discussion of this subject and citation of authorities. (1 *Wiel, Water Rights*, 3d Ed. Sec. 749a, p. 817 *et seq.*)

Under the common law, an innavigable body of water taken as a whole is considered as being the property of the riparian owners. Streams and ponds are spoken of as "private" (*Genesee Chief* v. *Fitzhugh*, 12 How. 442, 445) and as being "owned" (*Hardin* v. *Shedd*, 190 U. S. 508, 519) by the owners of the land over which they flow. All the riparian owners on a stream taken together, therefore, may grant such rights in the stream as they see fit. Together they own the entire stream. The whole estate is theirs and they may divide it up or grant it as they like. A sole owner of all the riparian land, of course, has the same privilege.

> 1 *Wiel, Water Rights*, 3d Ed. Sec. 864, last par. p. 904 and note.

Even if one is not the sole owner, he may divide his own estate as he will. He may separate his water right from his land, grant the land and reserve the water right, or grant each separately. (*Goodrich* v. *Burbank*, 12 Allen, 459, 461; *Lonsdale* v. *Moier*, 15 Fed. Cas. No. 8496, p. 836; *Rood* v. *Johnson*, 26 Vt. 64, 71). He may do this as freely as the land owner can subdivide his estate or grant the minerals separately. Of course, he can only give to his grantee what he himself has, and his rights being relative and confined to use in connection with riparian land as against the other riparian proprietors who are co-owners with him of the whole stream, he can not, if they object, grant a water right which will be absolute or one that may be used on non-

riparian land. Even a grant of that kind, however, is valid against himself.

1 *Wiel, Water Rights*, 3rd Ed. Secs. 845, 846, p, 901 *et seq.*

City water rights in the riparian States are obtained in the way just indicated; so, also, rights for any non-riparian use. The city or the irrigation district or the private land owner who wishes to take a certain quantity of water from a stream and carry it away from the riparian lands and use it there must obtain a grant either voluntary or involuntary from all the riparian owners. If only one riparian owner is left outstanding, the acquired rights are defective to that extent. If, however, all are brought in, the non-riparian use is fully legalized and the right to the quantity of water granted is absolute.

Under the common law, therefore, the United States, as the owner of the public lands out of which the Western States were subsequently created and so the owner of all of the lands in that whole vast territory, with the exception of the few Spanish and Mexican grants, was the owner of the innavigable streams and ponds therein and could, in strict compliance with law and as a mere proprietor, convey water rights such as now exist in the appropriation States and such as exist in the dual system States, as well as ordinary riparian rights such as obtain in those of the public land States which hold fast to the pure riparian doctrine. That that is what,

in fact, the United States did, and that all of these systems rest squarely upon the original Federal title, it is our purpose to show.

Appropriation water rights are not new in character. The only thing in connection with them that is unusual is the freedom of their acquisition. Under the policy adopted by Congress the waters on the public lands, like the lands themselves and the minerals in them, have been thrown open to private acquisition under the laws that Congress has thought best suited to accomplish its purposes. The common law is the basis of it all, and every step has been taken, for the most part consciously, in strict accordance with its principles.

> Where all the riparian rights on a stream are dealt with together in one contract, a right similar in result to a public-land appropriation may arise, since all who could complain have contracted away their rights. A severance of riparian rights by a sole riparian proprietor hence is a close counterpart of a public-land appropriation. An "appropriation" is, on the other hand, under the California doctrine, a grant of water on public land from the United States so far as it was in pioneer days a sole riparian proprietor.
>
> 1 *Wiel, Water Rights,* 3d Ed., p. 904.

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IV.

Water rights now vested in others derive their existence, like titles to land, from the acts of Congress. All interest in water not so granted necessarily remains in the United States. The acts grant nothing to the States, and the mere creation of a State could not work a change of this ownership or control.

(1) The earliest acts of Congress affecting innavigable waters—They show full consciousness of power to deal with such waters on the public lands.

Section 2476 of the Revised Statutes provides:

> All navigable rivers within the territory occupied by the public lands shall remain and be deemed public highways; and in all cases where the opposite banks of any stream not navigable belong to different persons the stream and the bed thereof shall become common to both.

This section is but a continuation of early statutes on the subject (acts of May 18, 1796, 1 Stat. 468; March 3, 1803, § 17, 2 Stat. 235; Feb. 20, 1811, § 3, 2 Stat. 642; and March 3, 1811, § 12, 2 Stat. 666), and is referred to in *Railroad Co.* v. *Shurmeir*, 7 Wall. 272, 289; *Scott* v. *Lattig*, 227 U. S. 229, 242; and *Hardin* v. *Shedd*, 190 U. S. 508, 519.

These acts show that from the earliest times Congress has had clearly in mind the difference that exists in the relation of the Federal Government to navigable and innavigable waters. They likewise show that Congress has been fully conscious of

ownership in the United States of the innavigable waters on the public lands and of its own power to say how these waters shall be disposed of.

Those of the acts preceding R. S. 2476, which affected lands beyond the Northwest Territory (acts of February 20, 1811, and March 3, 1811), omitted the above clause referring to innavigable waters. Since the passage of the act of July 26, 1866, which we shall now discuss, the disposition of such waters on the public lands has been controlled by this latter act and by the local laws and customs used as its subordinate instrumentalities.

(2) History and nature of the act of July 26, 1866, granting water and mining rights and rights of way. Purpose and effect of its adoption of local laws and customs.

(a) The occasion of this legislation was the extensive occupation and exploitation of the public lands in the West following the discovery of gold in California. The need was to legalize appropriations of mineral land, rights of way, and water rights already made under local customs and laws, and to provide for the future acquisition of rights of the same character in the same manner.

The occasion and history of this legislation, with specific reference to water rights and water ways, are sufficiently shown by the opinions in—

Jennison v. Kirk, 98 U. S. 453.
Atchison v. Peterson, 20 Wall. 507.
Basey v. Gallagher, Id. 670.
Broder v. Water Co., 101 U. S. 274.

See also—

1 *Wiel on Water Rights,* 3d Ed., Secs. 66 *et seq.*, 92 *et seq.*

1 *Kinney on Irrigation and Water Rights,* 2d Ed., secs. 596 *et seq.*, 611 *et seq.*, 636 *et seq.*

Almost immediately upon the discovery of gold in 1848 a large population sprang up in California and Nevada and the other western territories. Mining, milling, agriculture, and other industries quickly grew to great importance and large communities dependent upon these activities of the miners and settlers, were established. The country thus so suddenly occupied was up to that time a vacant wilderness, most of which had been but lately acquired from Mexico. There was no general mining law, the lands were unsurveyed and there was no efficient statute under which the Government title to land of any character could be acquired. (*Wiel, Water Rights,* 3d Ed. p. 92).

The miners and settlers and the residents of the towns were alike technical trespassers on the lands of the United States. They took out the gold, set up mills for the reduction of ores, cut the timber, and engaged in agriculture. For all of these purposes the use of water was essential, and they diverted it from the streams. All this was done under orderly and firmly established codes of rules made by the miners' meetings in the various communities, the decisions of courts, and later by State and Territorial legislation. The law that thus grew up was purely a law of possessory rights made to regu-

late the acquisition and holding of the Government property by the miners and settlers among themselves and as against each other. It was all subject to the underlying rights and, at that time, unexercised powers of the United States as the owner of the property affected. As to mineral land, the vein or lode was recognized as the thing discovered, and the thing of value; and so the rules gave title to that rather than to so much land and allowed the following of the vein on its dip even though doing so involved going outside of the limits of the surface claim extending vertically downward. As to water, the lands from which it was taken, the lands occupied by the ditches and flumes, and the lands where it was used, whether for milling ores, washing the gold out of the gravel of the hillsides and stream beds, or for irrigation, were all until such occupancy vacant public lands.

If the miner or farmer felt free to appropriate the vein of mineral that he had discovered or the land that he wanted to farm, he felt equally free to take water for those purposes from the most convenient source. The fact that he thereby took the waters from another piece of Government land bordering on the stream made no difference under the circumstances. He could take that land, too, if he wanted it. The rules, therefore, permitted the diversion of water for any useful purpose and recognized the first appropriator's priority of right just as they recognized the priority of the discoverer and first claimant of a vein of mineral. Throughout this period, during

which these possessory rights had come to be of enormous value and had finally been held by the courts to have, between the appropriators, practically all the dignity of freeholds (1 *Wiel, Water Rights*, Secs. 89 and 90, p. 97 *et seq.* and cases cited), it was realized that the underlying legal title was outstanding. The courts in the cases involving these rights were careful to refer to the paramount Government title. They usually did so by saying that the rights on which they were passing were good "except as against the United States." (*Wiel, Water Rights*, Sec. 91 p. 102 and cases cited; *Atchison* v. *Peterson*, 20 Wall. 507, 510; *Basey* v. *Gallagher*, 20 Wall. 670, 681; and *Sturr* v. *Beck*, 133 U. S. 541, 552).

The uppermost question in everyone's mind was what Congress would do and what effect whatever action Congress might take would have upon these rights. When Congress provided a means for the acquisition of the Government title, would the Government grant of mineral land cut off the right of the miner whose vein ran under that land from following it and abstracting the minerals? Would a grant of land, over which a ditch or flume or road ran, except a right of way for the benefit of the original builder and present occupier, and would a grant of riparian land or of all the riparian land on a stream carry with it the right to stop the use of water by appropriators who had taken it, often to a great distance, and put it to nonriparian uses? To meet this situation the act of 1866 and the supplementary act of 1870 were passed.

Congress had already provided adequate means for the acquisition of the Government title to agricultural lands by passing the homestead act in 1862.

(b) These acts of 1866 and 1870 examined—their interpretation by the courts.

The relation of these two acts to water rights and water ways was precisely the same as their relation to the mineral lands. The first act, July 26, 1866 (14 Stat. 251), was styled merely, "An act granting the right of way to ditch and canal owners over the public lands, and for other purposes;" but it was in reality the first general mining law of the United States. Its first section declared that "the mineral lands *of the public domain*" should be free and open to exploration and occupation by citizens, etc., subject to such regulations as may be prescribed by law and subject also to the local customs or rules of miners in the several mining districts, *so far as the same may not be in conflict with the laws of the United States.*

Sections 2 to 4 provided for the locating, entering, and patenting of lode claims occupied and improved "according to the local custom or rules of miners" in the mining district "so extended laterally or otherwise as to conform to the local laws, customs, and rules of miners," giving them the right to follow the vein or lode to any depth "although it may enter the land adjoining, which land shall be held subject to this condition" (sec. 2), authorizing

the Surveyor General to vary the form from rectangular "to suit the circumstances of the country and the local rules, laws, and customs of miners," with a proviso that no location should exceed a certain length for each locator (sec. 4).

Section 5 provided:

> That as a further condition of sale, *in the absence of necessary legislation by Congress*, the local legislature of any State or Territory may provide rules for working mines involving easements, drainage, and other necessary means to their complete development; and those conditions shall be fully expressed in the patent.

Section 8:

> That the right of way for the construction of highways over public lands, *not reserved for public uses*, is hereby granted.

In section 9 we find substantially and almost in words R. S. section 2339. It was as follows:

> That whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purpose aforesaid is hereby acknowledged and confirmed: *Provided, however*, That whenever, after the passage of this act, any person or persons shall, in the con-

> struction of any ditch or canal, injure or damage the possession of any settler on the public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage.

Section 10 allowed settlers on nonmineral lands, which had been excluded from survey as mineral, to acquire them under the preemption and homestead laws.

The act of July 9, 1870 (16 Stat., 217), amended the act of 1866 by adding six new sections numbered 12 to 17, inclusive. Section 12 extended the law, with certain modifications, to placer claims. Section 13 provided that where claims had been held and worked "for a period equal to the time prescribed by the statute of limitations for mining claims of the State or Territory where the same may be situated", the right to patent should be deemed established. Sections 14 to 16 dealt with land office procedure, fees, and surveys. Finally, section 17, which has been modified into R. S. section 2340, *supra*, declared:

> That none of the rights conferred by sections five, eight and nine of the act to which this act is amendatory shall be abrogated by this act, and the same are hereby extended to all *public lands* affected by this act; and all patents granted, or preemption or homesteads allowed, shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water rights, *as may have been acquired under* or recognized by the ninth section of the act of which this act is amendatory.

The sections 5, 8, and 9 here referred to are the section allowing local legislatures, in the absence of legislation by Congress, to provide rules "for working mines involving easements, drainage, and other necessary means to their complete development," the section granting rights of way over public lands for highways, and the section concerning water rights and ditches. (R. S. 2339.)

The mining features of this act were crude and were repealed and their place taken by the more detailed act of May 10, 1872. (17 Stat. 91.)

In this latter act, however, the policy adopted by the former of favoring local laws and granting mining rights in accordance therewith is adhered to. The water features of the original acts have been preserved and are still in force.

That the act of 1866 provides a means for the future acquisition of rights, water as well as mining, is the settled holding of the courts. That it looks to the future as well as the past is made perfectly clear by the act of 1870 through the use of the words: "Such water rights * * * as may have been *acquired under* or recognized by the ninth section of the act of which this is amendatory." Two classes of rights are under consideration and provided for; rights existing prior to the passage of the act and rights acquired afterwards and so under the express authority of the act itself.

Jacob v. *Lorenz*, 98 Calif. 332, 335.
Beaver Brook v. *St. Vrain*, 6 Colo. App. 130, 138.
1 Wiel, Water Rights, 3d Ed., Sec. 99, p. 116.
Long, Irrigation, 2nd Ed. Sec. 74, p. 134.

Without unduly extending this analysis or resorting to too extensive citations of authority, we wish to invite still further attention to certain of the salient features of this legislation and its interpretation, as it is, in our view, the foundation of all water rights in the Western States to-day and provides a solution and, we think, the only solution of the problem of interstate streams.

It will be seen that this act of 1866, while treating principally of mining, governs also water rights and rights of way for ditches, canals, and highways. These several subjects are handled together and in the same way. As to each the act gives the fundamental title to those who already had possessory rights, and provides a way by which grants of mining and water rights may be obtained in the future. Mineral lands are held open to "exploration and occupation", and he who occupies is given the right to take the other steps which lead to a grant. Water rights are "protected and preserved" to whomever has "possessed" them. Local laws, rules, and customs are used in both cases to define the right and provide the course that must be followed to acquire it. The mineralized vein is recognized by the act, as it was before by the customs of the miners, as being the thing appropriated, and so the right is given to follow it regardless of the surface limits of the claim extending vertically downward, which ordinarily define the extent of land holdings. In the field of water rights, again in accordance with local customs, the one who first "appropriates,"

even for use on nonriparian lands, is given the better right. Both as to mining and water, however, the rights granted are only such as any proprietor of the whole property involved could grant, and the rule of priority is only that which necessarily follows from successive conveyances of defined parts of a whole.

Further, it should be observed that under this act the proprietor, the United States, in a way holds its landed estate for conveyance in three classes—mineral rights, water rights, and what may be called, for convenience, ordinary land rights. It holds all of these rights for conveyance separately or together, as the case may be. Consequently, riparian rights pass or not under a patent of riparian land, generally speaking, according to whether or not the riparian doctrine or the appropriation doctrine is the rule in the locality where the land is situated. Congress has provided that it shall be otherwise in the Black Hills Forest Reserve in South Dakota (34 Stat. 233, 234). As to this point, we shall speak more in detail when we come to consider the Mexican grants and the cases, holding that in the pure appropriation States the Government's patent does not carry riparian rights.

It is well understood that the local rules, whether found in miners' customs, court decisions, or legislative acts, were adopted merely to supplement the particular provisions and fundamental conditions of the act, in order to fit it to local conditions, including local preferences, and avoid unnecessary complexity and volume in the act itself. This plan of adopting

local laws or rules as the laws and rules of Congress is familiar enough. It is seen in the legislation defining crimes on reservations under exclusive jurisdiction of the General Government; in the conformity provisions governing the Federal courts in common-law cases; in various laws for the taking of affidavits, etc. Illustrations might be greatly multiplied.

As we have already said, the local laws, customs, etc., in respect of mining claims, retain their function under the mining law as it is to-day. They depend, of course, upon the express permission of Congress therein contained.

> State statutes in reference to mining rights upon the public domain must, therefore, be construed in subordination to the laws of Congress, as they are more in the nature of regulations under these laws than independent legislation.
>
> *Lindley on Mines* (2d ed.), sec. 249.

Quoted with approval in *Butte City Water Co.* v. *Baker*, 196 U. S. 125.

Their constitutionality, challenged in the case last cited, was upheld upon the ground that a delegation of authority to adopt "minor and subordinate regulations" concerning the disposition of the public domain is not a delegation of strictly legislative power. See also *Clason* v. *Matko*, 223 U. S. 646, 654.

It is somewhat astonishing to find the *Broder* case (101 U. S. 274) and *Jennison* v. *Kirk* (98 U. S. 453, 456) cited in Colorado's brief as authority for the

idea that the act of 1866 recognized an independent title or power in the States. They hold exactly the reverse.

The act is a grant of rights belonging to the United States. This Court in *Broder* v. *Water Co.*, *supra*, 101 U. S. 274, 275, construing the right of way part of the ninth section of the act says that the same is an "unequivocal grant." The Circuit Court for the District of Nevada in *Union Co.* v. *Ferris*, 2 Sawy. 176, 184, held:

> The policy of this enactment (sec. 9, act of 1866), so far at least as it relates to agricultural districts, may be doubtful; but it is the law of the land, and the courts must carry out what appears to be the intention of the legislature (Congress) as therein expressed. And that, as indicated by the act, appears to be to grant to the owner of possessory rights to use the water under local customs, laws, and decisions, the absolute right to such use, which the Government alone could grant.

The text writers so construe it. (See: *1 Wiel, Water Rights*, 3d Ed. Sec. 97, p. 113; Sec. 155, p. 177 *et seq.*; *Long, Irrigation*, 2d Ed., Sec. 74, p. 134.)

The grant is made directly to the individual appropriator. It takes effect upon his bringing himself within its terms by complying with the local laws. No patent follows as in the case of mining claims, but the title passes by virtue of the statute itself and compliance with it, as is the case with railroad grants and grants of rights of way.

> The language of this act (act of 1866) makes the right a confirmation *in praesenti* as to the

> claims included (referring to water rights), without any preliminary proceeding to obtain a title, as in the case of a mining claim. A grant conferred by an act of Congress is the highest source of title known to our laws.
>
> *Yale, Mining and Water Rights*, p. 380.

The law of water rights in California and the numerous States which have followed her lead is based squarely upon the Federal title. These States are California, Kansas, Montana, North Dakota, South Dakota, Washington, Nebraska, Oregon, and possibly Oklahoma. (1 *Wiel, Water Rights*, 3rd Ed., p. 226.) Appropriation rights in those States are explicitly held to be derived from the United States by direct grant under this act. Riparian rights, which there exist side by side with rights by appropriation, are held by the courts to be derived from the United States under grants by it of riparian lands.

> It has never been held that the right to appropriate waters on the public lands of the United States was derived directly from the State of California as the owner of innavigable streams and their beds. And since the act of Congress (1866) granting or recognizing a property in the waters actually diverted and usefully applied on the public lands of the United States, such rights have always been claimed to be deraigned by private persons under the act of Congress, from the recognition accorded by the act, or from the acquiescence of the general government in

previous appropriations made with its presumed sanction and approval.

Lux v. *Haggin*, 69 Cal. 255, 339.

An appropriator of water under these circumstances, and while the land which he subjects to his necessary uses continues to be a part of the public domain, is a licensee of the general government; but when such a part of the public domain passes into private ownership, it is burdened by the easement granted by the United States to the appropriator, who holds his (water) rights against this land under an express grant.

Smith v. *Hawkins*, 110 Cal. 122, 125.

The Supreme Court of Washington, referring to this act, said:

It was for the purpose of protecting the rights of appropriators of water for beneficial uses on the public lands which had vested and accrued, by virtue of local customs, laws, and decisions of the courts, that the ninth section of the act of Congress of July 26, 1866, the substance of which is included in section 2339 of the Revised Statutes, was enacted. It was apparent to Congress, and, indeed, to every one, that neither local customs nor State laws or decisions of State courts could vest the title to public land or water in private individuals without the sanction of the owner, viz., the United States.

Benton v. *Johncox*, 17 Wash. 277.

In Oregon it is held that "an appropriation of water is a grant by the General Government to the

settler of the right to its use." *Morgan* v. *Shaw*, 47 Oreg., 333, 337.

> A water right can, therefore, be acquired only by the grant, express or implied, of the owner of the land and water. The right acquired by appropriation and use of the water on the public domain is founded in grant from the United States Government as the owner of the land and water. Such grant has been made by Congress.
>
> *Smith* v. *Denniff*, 24 Mont., 20, 21.

See also *Barkley* v. *Tieleke*, 2 Mont., 59, 64.

To the same effect see:

> *Cruse* v. *McCauley*, 96 Fed. 369, 373–374.
> *Howell* v. *Johnson*, 89 Fed. 556, 558.

Colorado and the other pure appropriation States, and the Territory of Alaska (Alaska, Arizona, Colorado, Idaho, New Mexico, Nevada, Utah, and Wyoming; 1 Wiel, Water Rights, 3d ed., p. 226), endeavor to find some basis for water rights other than the Federal title. The arguments advanced for their position we shall examine under a different head. In those States water rights are identical with appropriation rights in California and the other dual system States, and, of course, are derived, as they are there, from the United States by grants under this act, unless indeed the effectiveness of that legislation, so far as it covers water, came to an end upon the admission of the States, a proposition which it is in part the purpose of this brief to refute.

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(3) Subsequent acts of Congress contradict the theory that the Federal ownership has been abdicated.

Since the act of 1866 there are a number of statutes reiterating the policy of Congress to permit the appropriation of water and leave it largely within the control of the local regulations. These laws do not bear out the assertion that the Federal interest in nonnavigable water has been transferred to the States, and still less do they lend support to the theory advanced in Colorado's brief that Congress recognizes the States as having any ownership of or control over such water independent of a transfer from the Federal Government.

It is to be noticed that in these later declarations by Congress concerning water there is evident not only a consciousness of the power to deal with this subject without State intervention, but in some instances an actual exercise of the power itself. It is as impossible to gather from these acts that Congress intended by them to divest the United States of its interest in water as it is to obtain the impression that Congress in legislating believed it was without power in the matter. All of these acts merely adhere to the general principle of the act of 1866 as one of convenience. They favor the laws of the Territories quite as much as those of the States and in some instances they give rules independent of either. On this subject see the discussion and citations in *Kinney on Irrigation and Water Rights* (2d ed.) Sec. 637.

The desert-land law of March 3, 1877 (19 Stat. 377), contains this proviso:

> *Provided, however*, That the right to the use of water by the person so conducting the same, on or to any tract of desert land of six hundred and forty acres shall depend upon bona fide prior appropriation; and such right shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation; and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights.

It has been suggested that this is an irrevocable "dedication" to the States, but a glance at the whole provision will convince one that it will not bear such a construction. The proviso makes no mention of the States and does not even refer to the local laws and customs. Congress itself undertakes to lay down the essential conditions of the water right which the desert entryman may acquire: It "shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation," and the free right of appropriation is made coextensive with the public lands in the States and Territories named. The claimed dedication to the States is no more than a declaration that it was

not intended by the act to withhold from free appropriation and use by the public (as theretofore under the act of 1866) for "irrigation, mining and manufacturing purposes," surplus water over and above such actual appropriation and use, under the act, and over and above that already held by virtue of "existing rights." The declaration is similar to that in the mining law of 1872 (17 Stat., 91): "All available mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are hereby declared to be free and open to purchase, and the lands in which they are found, to occupation and purchase * * * ."

In both instances Congress states its present policy and leaves itself free to change it at will. The language of the desert land law is that of a proprietor dealing with its own property.

The case of *Hough* v. *Porter*, 51 Oreg. 318, is sometimes cited as sustaining the theory that this act is a dedication of water to the States. The learned and exhaustive opinion of Mr. Justice King finally sustains, and, indeed, depends throughout, upon the proposition that the United States, as the owner of the public domain, is quite competent to dispose of the waters thereon together with the land, or to dispose of each separately, or to dispose of one and retain the other. The question examined was whether various owners who had obtained patents for riparian lands from the United States *after* the desert land law became effective had thus acquired

full riparian rights in the waters, no reservation in that regard being expressed in the patents. The court holds that such rights (except for domestic and other purposes not named in the act) were withheld from disposition with the land by reason of this declaration of the desert land law, which the opinion in some places treats as amounting to a reservation by the Government and in others as a dedication by the Government to "the public." To hold that there was actually a dedication and that the Government had thus at one stroke parted with all its interest in the unappropriated waters was quite unnecessary to the decision; for, obviously, if the intent of the declaration was, as it may well have been (*Williams* v. *Altnow*, 51 Ore. 275; *United States* v. *Rio Grande Dam Co.*, 174 U. S. 690; *Gutierres* v. *Land Co.*, 188 U. S. 545), to set the waters apart from the land for acquisition by appropriation only, subsequent land patents would not operate to give riparian rights, whatever might be their terms as drafted in the department.

See 1 *Kinney, Irrigation*, pp. 1091, 1095.

It is this idea of the severance of the water from the land by Congress (see *Wiel, Water Rights*, p. 222) and the withholding of it for appropriation, we take it, that was said to be plausible in the reference to *Hough* v. *Porter* in *Boquillas Cattle Co.* v. *Curtis*, 213 U. S. 339, 344. The reference is as follows:

> The opinion that we have expressed makes it unnecessary to decide whether lands in

> the arid regions patented after the act of March 3, 1877, c. 107, 19 Stat. 377, are not accepted subject to the rule that priority of appropriation gives priority of right by virtue of that act construed with Rev. Stat. Sec. 2339. The Supreme Court of Oregon has rendered a decision to that effect on plausible grounds.

Wholesale dedications by the Federal Government to the States are not to be implied or found in words perfectly consistent with a different intention. *United States* v. *Oregon & C. R. Co.*, 186 Fed. 861, 893; *Oregon Railway* v. *Oregonian Railway Co.*, 130 U. S. 1, 26; *Slidell* v. *Grandjean*, 111 U. S. 412, 437.

It should be noticed further that in this proviso Congress was careful to confine its legislation to water "*upon the public lands*" and "*not navigable*," showing that it fully realized the distinction the law makes between public and private waters and that the relation of the United States to innavigable waters is that of a proprietor.

The clause in the Timber and Stone Act of June 3, 1878 (20 Stat. 89), as follows:

> That none of the rights conferred by the act approved July twenty-sixth, eighteen hundred and sixty-six, entitled "An act granting the right of way to ditch and canal owners over the public lands and for other purposes," shall be abrogated by this act; and all patents granted shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water

> rights, as may have been acquired under and by the provisions of said act; and such rights shall be expressly reserved in any patent issued under this act,

protects the water rights and rights of way "conferred by" the act of 1866 and declares that all patents shall be subject to such rights "acquired under and by the provisions of said act." This is a clear recognition that the source of water rights is the United States, and is very far from giving support to the idea that such rights are the issue of a State law, or that the power to grant them has been devolved to the States. It also shows that Congress had clearly in mind that "vested and accrued" water rights in the public-land States become such by virtue of the act of 1866 with the act of 1870, some of the language of which is used in this later legislation.

The act of March 3, 1891 (26 Stat. 1095, sec. 18), granting rights of way for irrigation purposes, declares that the privilege granted shall not be construed to interfere "with the control of water for irrigation and other purposes under authority of the respective States *or Territories*." This means the authority to control the appropriation of water on the public lands conferred by the act of 1866. The territories are put on the same plane with the States.

Colorado's brief on rehearing (vol. 1, p. 122) points out that the act of August 18, 1894 (28 Stat. 422), known as the Carey Act, grants to public-land States each a million acres of land or so much as the State

may cause to be irrigated, reclaimed, and occupied. We do not see what bearing the fact that under the act the State is to cause the lands to be irrigated has upon the questions here. The State receives the grant upon condition that it will reclaim the land in the manner provided by the act. It is required to cause it to be irrigated, reclaimed, occupied, and not less than 20 acres of each 160-acre tract cultivated by actual settlers "as thoroughly as is required of citizens who may enter under the said desert-land law."

The forest-reserve legislation of June 4, 1897 (30 Stat. 11, 34), contains a clause which provides that—

> All waters on such reservations may be used for domestic, mining, milling, or irrigation purposes, under the laws of the State wherein such forest reservations are situated, or under the laws of the United States and the rules and regulations established thereunder.

Here the uses of water intended to be allowed are such as may be practiced consistently with the objects of the reservation and by ways authorized by Congress. This provision concerning their use is merely a modified reiteration of the consistent policy of Congress, to which we have already given some attention, to leave the matter of defining and controlling the uses of water as far as possible to the local laws.

There were persons "residing within the boundaries of such reservation" owning "property or

homes" there. Others were permitted to enter for "proper and lawful purposes," including mining and milling, if they complied with the rules and regulations. *United States* v. *Grimaud*, 220 U. S. 506. The situation called for the use of water, and the object of the provision under discussion was to recognize the legitimacy of the use for the purposes specified, if consistent with the laws of the State or other laws of the United States.

An act approved February 26, 1897 (29 Stat. 599) opened to use reservoir sites which had been reserved by the General Government, with the proviso that *charges* for the water should be "subject to the control and regulation of the respective States and Territories," etc.

On March 2, 1897, Congress passed a special act (29 Stat. 603) restoring to the public domain a reservoir site, theretofore reserved, and authorizing the Secretary of the Interior to sell it to whomever might buy it for the building and maintaining of a reservoir there. It contained a proviso that the act should not be construed to "deprive the State of Colorado of the control of the water in any reservoir which may be constructed on this site by any person or corporation or association, under the regulations provided by the State laws in such cases."

Under the first of these acts Congress rates the Territories and the States on a par and makes it clear that the reservoir owner will not be allowed to fix charges for the water he stores upon any claim that State and Territorial laws respecting such matters

do not affect him. The second act preserves to the State of Colorado the regulative control of the water that may be stored in the reservoir. This act is quoted in Colorado's brief, Vol. 1, p. 122, but how it can be considered a recognition of the State's inherent or acquired ownership of innavigable waters, we do not see.

The reclamation act of June 17, 1902 (32 Stat. 388) inaugurates a new policy by which the United States itself undertakes the development of its land and water resources in the arid States, although development by private enterprise or by State action (under the Carey Act, 28 Stat. 422) is not excluded. Consequently the right of appropriators under the act of 1866, through the subordinate instrumentality of of State laws, is carefully preserved. Money received from the sale of public lands is devoted to "the construction and maintenance of irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semiarid lands." Apart from any consideration of whether this policy would have been adopted if Congress had believed that the waters, indispensably necessary to make these undertakings a success, belonged to the States and so were subject to withdrawal by them at any time, the act shows that the water is assumed to be subject to the use and disposition of the Government. In section 5 it is provided that—

> No right to the use of water for land in private ownership shall be *sold* for a tract exceeding one hundred and sixty acres to

> any one landowner, and no such *sale* shall be made to any landowner unless he be an actual *bona fide* resident on such land * * * and no such right shall permanently attach until all payments therefor are made.

As rights by appropriation become vested only by beneficial use, it would seem from this that it was not thought that the Government, by undertaking these projects, would become merely a public ditch owner with no vested right in the water which the ditches would carry.

Section 8 is as follows:

> That nothing in this act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this act, shall proceed in conformity with such laws, and nothing herein shall in any way affect any right of any State or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof: Provided, That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated and beneficial use shall be the basis, the measure, and the limit of the right.

The first part of this section is simply a recognition of vested rights acquired under the act of 1866, and

a preservation of the existing systems of water law in the States and *territories* which have grown up under that act. (See *Gutierres* v. *Albuquerque*, *infra*, 188 U. S. 545, 552–554.) The direction of the Secretary of the Interior to "proceed in conformity with such laws," is meant like the conformity provisions in other Federal statutes to harmonize Federal activity with that which must, by compulsion of State law, go forward, if at all, under local procedure, deriving its authority from the Federal act of 1866. The concluding clause is significant: "That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right." Here again, we see that the State and territorial laws are rated on a par and that Congress itself undertakes to create water rights and define them. A water right acquired by appropriation and beneficial use in irrigation is not usually appurtenant to the land irrigated. 1 *Wiel on Water rights* (3d ed.) sec. 550.

Colorado's brief (Vol. 1, p. 119 et seq.) cites the acts that we have been discussing, with the exception of those of May 10, 1872, June 3, 1878, and June 4, 1897, as showing that Congress in them has recognized and affirmed the proposition laid down in the brief that the States have full, and as we understand the brief, the same soverign jurisdiction and control over all waters within their borders, innavigable as well as navigable. The distinction which the law makes between these two classes of waters is not

discussed there or elsewhere in the brief, and no attempt is made to point out how these Federal statutes recognize any such doctrine or are in any way inconsistent with Federal proprietary ownership of the innavigable waters.

In concluding this topic we observe that the legislation of Congress with regard to water rights all centers upon and is intended to preserve the policy adopted in the act of 1866 of granting the right to use the unreserved proprietary waters of the United States to individuals in accordance with local systems of water-right law.

The right-of-way parts of the act of 1866 under which appropriators of ways were granted easements over the public lands without formal action or coming into contact with Federal executive officers, have for the most part, given way to a more exact system created by the acts of 1891 (26 Stat., 1095) and 1901 (31 Stat., 790) considered by this court in the late case of *Utah Power & Light Co.* v. *United States*, 243 U. S., 389. These later laws in general adopted a plan for granting permits or licenses under executive regulation instead of easements without regulation, and substituted direct dealing between the Federal Government and the grantee for the loose indirect process permitted by the act of 1866.

Had such a plan been adopted as to water rights, or had patents for these rights been given as in the case of mining rights, is it likely that the proprietary right of the Government to the waters would ever

have been questioned, or at any rate, questioned at a later period or more persistently than was its title to the public lands? It is the long continuance of subordinate State control under a system that involves no recourse to the source of power, that has caused the fact that such control is subordinate, sometimes to be lost sight of.

(4) Grants of riparian lands in the pure appropriation States do not carry riparian water rights. The decisions to this effect are in keeping with the act of 1866, the public land policy of this country preceding that act, the same policy of Mexico, and with the rule of convenience adopted by this court by which the incidents of title taken by grantees of the Government are to be determined by the local law in the absence of congressional legislation to the contrary.

In Colorado and the other States that have not followed California's lead in retaining the riparian system, the cases hold that a grant of land from the Federal Government does not carry with it riparian rights.

Coffin v. *Left Hand Ditch Co.*, 6 Colo., 443, 448.

Clark v. *Ashley*, 34 Colo., 285.

Similarly this court has held that Mexican grants in Arizona and New Mexico did not carry water rights.

Boquillas v. *Curtis*, 213 U. S., 339.

Gutierres v. *Albuquerque Co.*, 188 U. S., 545.

The act of 1866, with the act of 1870, as we have said, protected water rights that had "vested and accrued" by "priority of possession" according to the "local customs, laws, and decisions of courts." It also provided the same means of acquiring such rights in the future. Undoubtedly the appropriation rights that had grown up in California and elsewhere in the West were the rights that were chiefly in the legislative mind at the time, because it was those rights that were the subject of controversy. Equally, without doubt, the predominant thought of Congress was to support the existing local customs and also to give the States and Territories all reasonable freedom to make their own rules in the future. The act itself speaks to that point, and the subsequent legislation that we have just been considering shows reflexively that Congress intended to favor the local law, future as well as present.

If the local law recognized riparian rights, as well as appropriation rights, the riparian owner would under that law have possession of such rights as an incident of his title to the land, and so would have that "priority of possession" which the act of Congress intended to support. If, on the other hand, the local law only recognized appropriation rights, the owner of riparian land as such would not have possession of a right to the use of water, and so would take no water right under the act of Congress nor by virtue of the Government's patent of the land.

In view of this act of 1866, it could not have been the intent of Congress to grant riparian rights with its lands when the local law recognized only appropriation rights. The construction of such a grant in the sovereign's favor and in accordance with its will, which the law requires, would not give to the grantee rights not recognized by the local law. In *Sturr* v. *Beck*, 133 U. S. 541, decided in 1890, the question was as to the right of a homesteader of riparian land, who had made no use of the water, as against a subsequent appropriator of water from the stream. The case arose in Dakota, a dual system territory. The opinion by Mr. Chief Justice Fuller treated the homesteader, Smith, as "a prior appropriator" and as having "priority of possession" under the act of 1866. The opinion (p. 552) says:

> Thus, under the laws of Congress and the Territory, and under the applicable custom, priority of possession gave priority of right. The question is not as to the extent of Smith's interest in the homestead as against the government, but whether as against Sturr his *lawful occupancy under settlement and entry* was not *a prior appropriation* which Sturr could not displace. We have no doubt it was, and agree with the brief and comprehensive opinion of the supreme court to that effect.

With less foundation it is held that the appropriator who made use of water according to the local customs before the act of 1866 has a right good

against a subsequent grantee of riparian land who also obtained his rights before that act.

> 1 *Wiel, Water Rights*, 3d Ed., Sec. 89, p. 97, and the court decisions there cited and discussed.

Here the act could do no more than throw a reflexive light upon the intent of the Government in granting the land. The controversy in the West, where possessory rights of enormous value had grown up prior to the act of 1866, was about this point, and the local courts and this court finally held, as to rights of way (*Broder* v. *Water Co.*, 101 U. S. 274), and the State courts have held as to water rights, that these possessory rights were not to be disturbed by the subsequent grant of the Government.

> *Coffin* v. *Left Hand Ditch Co.*, 6 Colo. 443, 446, 449.
> *Lux* v. *Haggin*, 69 Calif. 255.
> *Conger* v. *Weaver*, 6 Calif. 548.
> *Merritt* v. *Judd*, 14 Calif. 59, 64.

To preserve such rights this court has frequently said that the act of 1866 as to them was "more the recognition of a preexisting right than the creation of a new one."

> *Broder* v. *Water Co.*, *supra*.
> *Atchison* v. *Peterson*, 20 Wall. 507.
> *Basey* v. *Gallagher*, 20 Wall. 670.
> *Jennison* v. *Kirk*, 98 U. S. 453.

In speaking of these decisions, Mr. *Wiel* (*Water Rights*, pp. 115–116) says that the possessory rights

the public domain "as to mines and rights of way ... ers" are in the nature of fictitious grants deduced from the silence of Congress; that the act of 1866 ... legitimacy to this local custom, and that "this legislation related back to its birth and continued for the future." Says he: "It is a clear case where the law was evolved from the exigencies of the times, molded by circumstances pressing it now one way, then the other; the growth of two wars and the winning of desert and wilderness and the peopling of a continent, more potent than closeted logic."

Regardless of whether the position taken by the courts was strictly logical, the possessory rights were upheld, and the fact that they were does not militate against the original ownership of all these rights by the United States or against the present ownership of all other similar rights. The argument that it does, ... the case of water, is confronted by the fact that rights of way were equally protected, and no one would claim that the United States does not own the public land.

These cases, as far as water rights go, are in complete harmony with the rule of convenience adopted by this court under which rights in the beds of meandered innavigable streams and lakes pass or not under the Government patent in accordance with the local laws; all, of course, in the absence of legislation by Congress to the contrary.

Hardin v. *Shedd*, 190 U. S. 508.

We discuss the case just cited more fully below ... tent ourselves with pointing out here that it

fully recognizes the ownership by the United States of the beds of such waters and, by implication, of the right to the waters themselves and the full power of Congress to grant these rights if it sees fit. The doctrine of *Hardin* v. *Shedd* was applied by this court to riparian water rights in the late case of *Los Angeles Farming and M. Co.* v. *Los Angeles*, 217 U. S. 217, 233.

In *Gutierres* v. *Albuquerque Land Co.*, *supra* (188 U. S. 545), one of the contentions against the right of an appropriator to make surveys for the construction of a ditch, was that the water to be carried thereby belonged to the plaintiff as the owner of lands riparian to the stream. This court, speaking by Mr. Justice White, held that such ownership was immaterial, because for one reason it was conceded that by the laws of Mexico, in force when the Territory of New Mexico, in which the lands lay, was ceded to the United States, the use of water was not limited to riparian lands. The case thus in effect holds that a Mexican grant of lands in New Mexico did not carry riparian rights. In that case, also, the point was urged that the waters in New Mexico belonged to the United States, and that therefore certain territorial legislation permitting their appropriation was invalid as an interference with Federal property. The decision of the case was put upon the ground that the local laws did not recognize riparian rights, and is in full accord with the theory of Federal ownership of water.

Although the riparian doctrine was the general law of Mexico (*Lux* v. *Haggin*, 69 Calif. 255, 313; *I Wiel Water Rights*, 3d Ed., sec. 68; *1 Kinney, Irrigation*, 2d ed., sec. 577 et seq.), riparian rights were, it seems, not recognized in the State of Sonora. (*Boquillas* v. *Curtis*, 213 U. S. 339, 343.) The situation in Mexico was analogous to that in the territory ceded by Mexico to the United States when this country first obtained jurisdiction. (See 1 *Wiel, Water Rights*, 3d Ed. pp. 68, 966.) The water rights were the property of the owner of the public domain which was Mexico, and the lands were practically all public. The few settlers that were in Sonora had merely possessory rights on the public domain. They made use of the water just as the early California miners did, and their rights or claims were protected, not against an assertion of right by Mexico, but against an assertion by the grantee of riparian land, taking his title from Mexico. All water rights that were not granted by Mexico, being property, passed by the cession of the territory to the United States and were taken by the United States under its own law.

This court, in the case we have just been considering, while holding that riparian rights so far as the owners of Mexican grants were concerned, did not exist in New Mexico, was careful to point out that the New Mexico statute cited by the plaintiff was "not inconsistent with the legislation of Congress on the subject of the disposal of waters flowing over the public domain of the United States" and to say "O course. as held in the Rio Grande case (p. 703)

[*United States* v. *Rio Grande Dam & Irrigation Co.*, *supra*, referred to in the beginning of our argument], even a State, as respects streams within its borders, in the absence of specific authority from Congress, 'can not by its legislation destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far at least as may be necessary for the beneficial uses of the Government property.' "

Similarly in *Boquillas Cattle Co.* v. *Curtis*, 213 U. S. 339, this court refused to protect a Mexican land grant on the San Pedro River in Arizona from a diversion of water from a stream to which that grant was riparian. The decision goes upon the ground that in Sonora, when the grant was made, the riparian system did not prevail, but appropriations were permitted, consequently the Mexican grant did not carry riparian rights.

Whenever Congress desires that the local law shall not govern in construing water rights in connection with its grants of lands, of course, it can so provide (*Hardin* v. *Shedd*, *supra*) and it has done so in at least one case. In South Dakota the riparian system obtains. There Congress has provided by statute (act of June 11, 1906, 34 Stat. 233, 234) that in the Black Hills Forest Reserve water may be appropriated, and specifically that the Government patent of riparian land shall not carry water rights. We shall refer more fully to this statute under the next heading.

(5) Hardin v. Shedd and other cases holding that the Government's grantee of lands bordering meandered innavigable waters takes the submerged land or not according to the local law, support the Government's title to both land and water. That the rule is merely one of convenience in interpreting the Government's grant, and that it is competent for Congress to change it, is well settled.

Colorado's brief cites these cases as supporting its theory of State ownership of innavigable waters. That the cases preceding *Hardin* v. *Shedd*, 190 U. S. 508, should not be taken as giving any support to the idea that this court recognized an ownership in the States, of the beds of innavigable waters, was made perfectly clear in the latter case. The opinion, by Mr. Justice Holmes, points out that "when land is conveyed by the United States bounded on a nonnavigable lake belonging to it, the grounds for the decision must be quite different from the considerations affecting a conveyance of land bounded on navigable water." "In the latter case," he says, "the land under the water does not belong to the United States, but has passed to the State by its admission to the Union." He then says that "when land under navigable water passes to the riparian proprietor along with the grant of the shore by the United States, it does not pass by force of the grant alone, because the United States does not own it, but it passes by force of the declaration of the State which does own it that it is attached to the shore."

"The rule," he goes on to say, "as to conveyances bounded on nonnavigable lakes does not mean that the land under such water also passed to the State on its admission or otherwise, apart from the swamp-land act, but is simply a convenient, possibly the most convenient, way of determining the effect of a grant." Then significantly, the opinion says: "We are particular in calling attention to this difference, because we fear that there has been some misapprehension with regard to the point." A dissenting opinion was written in that case by Mr. Justice White, with whom concurred Mr. Justice McKenna. The difference between the majority and the minority of the court was not, however, as to the ownership of the land or the water. Both agreed that that was in the United States.

The same question was before this court in *Kean* v. *Calumet Canal & I. Co.* (190 U. S. 452), which was decided prior to *Hardin* v. *Shedd*. In that case there was the same divergence of opinion in the court upon the question as to whether this rule of convenience should be further upheld. The majority opinion there, also delivered by Mr. Justice Holmes, said: "It is not necessary to consider how we should decide the case with our present light if the question were a new one. It is not a new one. For twelve years the decisions in *Hardin* v. *Jordan* and *Mitchell* v. *Smale* have stood as authoritative declarations of the law. Probably in most cases the statute of limitations has cured the defects of title which those cases

may have shown. Meantime many titles must have passed on the faith of those decisions. *The United States can meet them by the form of its conveyances.* It seems to us that it would be likely to do more harm than good to allow them to be called in question now."

In the dissenting opinion, which was upon the point of the wisdom of changing the rule, Mr. Justice White, with whom concurred Mr. Justice McKenna, referred to the act of 1866, the desert-land act of 1877, the right-of-way act of 1891, and the reclamation act of 1902, and also cited *Gutierres* v. *Albuquerque* and *United States* v. *Rio Grande Dam & Irrigation Co.*, as showing that the laws of the United States alone should be considered in determining questions which have arisen under them with respect to grants by the United States of its property. Mr. Justice White, referring to these statutes, said: "Besides the implication resulting from the general legislation of Congress concerning the sale and disposition of the public domain, *the special statutes granting rights in, and regulating the use of, the nonnavigable waters upon the public lands are very conclusive.*" (P. 484.)

In a later case, *Scott* v. *Lattig*, 227 U. S. 229, 244, this court adhered to the rule that the State law should govern as one of convenience, and the opinion delivered by Mr. Justice Van Devanter quotes the passage in *Hardin* v. *Shedd*, where the distinction between grants of lands bordering navigable and innavigable waters is made.

It, therefore, is the settled law that the United States owns the lands under innavigable bodies of water on the public domain, and that Congress may, if it sees fit, grant those lands in any way that it thinks proper, and may provide a rule for its grants of land bordering on such water, contrary to that of the State in which the lands lie.

Each of the three propositions which we have just stated as being settled law with regard to the shores and beds of innavigable waters is, we submit, equally the law as to the waters themselves. It must be the law as to the waters on the public lands in Colorado as well as to the waters on such lands in Illinois.

If these waters belong to the United States, as we contend they do, Congress has exclusive power over them, and it is inconceivable that any State law by virtue of its own force can determine how Congress shall grant them, or to what extent the grant of Congress shall be effective.

Wilcox v. *Jackson*, 13 Pet. 526, 537;
Gibson v. *Chouteau*, 13 Wall. 92;
Irvine v. *Marshall*, 20 How. 558, 561, 563.

Any other rule would take from Congress the disposing power over the property of the United States and put that power in the States. State sovereignty stops when it reaches the Federal property. See the cases just cited and also *Light* v. *United States*, 220 U. S. 523, 536, 537;

United States v. *Midwest Oil Co.*, 236 U. S. 459, 474;
Camfield v. *United States*, 167 U. S. 518, 526.

That Congress has, at least in one instance, exercised its right with regard to the waters themselves to provide that grants of the United States shall not be construed in accordance with the local law, is shown by the forest reserve act of June 11, 1906, 34 Stat., 233, 234, already referred to. Section 3 of that act is as follows:

> That all entries under this act on the Black Hills Forest Reserve shall be subject to the quartz or lode mining laws of the United States and the law and regulations permitting the location, appropriation, and use of the waters within said forest reserves for mining, irrigation, and other purposes; and no title acquired to agricultural lands in said Black Hills Forest Reserve under this act shall vest in the patentee any riparian rights to any stream or streams of flowing water within said reserve; and that such limitation of title shall be expressed in the patents for the lands covered by such entries.

As South Dakota is a State holding to the riparian doctrine, the patents of the United States, both under the act of 1866 and the rule of convenience, would carry with them riparian rights. Here, Congress says that it shall be otherwise and provides for the vesting of water rights in accordance with its own laws covering appropriations upon forest reserves.

(6) The claim made by the pure appropriation States, that the States own innavigable waters, was originally an outgrowth of the controversy about the protection of possessory rights before the act of 1866. It is now but an expression of opposition to the constitutional provision vesting the disposal of the property of the United States in Congress. Arguments for State ownership or control examined.

The claim of State ownership of innavigable waters was an aftermath of the bitter controversy that at one time existed about the protection of possessory rights that had grown up on the public domain after the discovery of gold and prior to the act of 1866. The fear during that period was that Congress might not provide any means for the protection of those rights and that they could not be upheld as against grants of land by the Federal Government. In the West, the principal thought of that day was that some means must be found for upholding those rights and thereby protecting existing conditions and what had been built up upon them.

Only three States were admitted before 1866—California, Oregon, and Nevada. When the appropriation States came to be admitted the controversy about possessory rights was still fresh in mind and although Congress had settled the matter in favor of those rights by the passage of the act of 1866 and had provided for the acquiring of the same sort of rights in the future, the controversy had been so bitter and the fear that those rights would not be

protected had been so great that some of the new States took the position that innavigable waters did not belong to any landowner, the United States included. They put provisions in their constitutions asserting that such waters belonged to the people. (*Wiel, Water Rights*, p. 96.)

The primary desire was to protect these so-called vested possessory rights, and it was thought that that could not be done without abrogating the common-law system of riparian rights. (See *Coffin* v. *Left Hand Ditch Co.*, 6 Colo., pp. 443, 446). Since then, various arguments have been made to support the claim of right in the States as against the Federal Government. An analysis of the positions taken by those who attempt to uphold the right of the States shows that it is now simply one of opposition to the constitutional provision which puts the disposal of the public domain and other property of the United States in Congress and therefore wholly removes such property from State control. The arguments that are usually made are, stating them briefly, (*a*) that the United States, by permitting the States to assert ownership of water in their constitutions and by ratifying those constitutions, has transferred its interest in the water to the States; (*b*) that the needs of these States, on account of their being situated in the arid region, demand the substitution of the appropriation for the riparian system and that this involves a denial of the Federal title; (*c*) and that flowing waters, because of their nature, are, like animals, *ferae naturae*, under the control of the

municipal sovereign, and so rights in such waters are under the same control.

Colorado's brief seems to argue also that, because the States have control of navigable waters, subject to the control of Congress over navigation, they also have control of innavigable waters.

(a) Ratification of State constitutions asserting State ownership of waters does not divest the United States of its property rights therein.

The provisions of the constitution of Colorado may be taken as fairly representative of those contained in the constitutions of the other States having provisions asserting ownership of water, and are as follows:

> The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the State, subject to appropriation as herein provided.
>
> Colo. Constitution, Art. XVI, sec. 5.
>
> The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over

those using the same for manufacturing purposes.

Colo. Constitution, Art. XVI, sec. 6.

The contention is that it was the duty of Congress when creating the States to see to it that their constitutions asserted no ownership in, and assumed no control over, property of the United States which it was not the intention of Congress to convey to the States; and that if those constitutions when finally adopted contained provisions of that character they must be taken as effective congressional grants of such property to the States.

Considering the purpose to be accomplished and the part that Congress plays in creating a State, this seems an astonishing position to take. What Congress does is to bring into being a new State sovereignty to take its place with the others already existing. Its purpose is the creation of a State. It is true that by the act accomplishing that purpose it has been the invariable custom of Congress also to make specific grants of land and sometimes it makes grants of other property to the new State, but such granted property passes by virtue of the act of Congress, which is complete in itself, and not because of anything contained in the constitution adopted by the State. In those grants, also, things not enumerated are excluded by implication.

The constitution which the State adopts is not a contract between the United States and the State regarding property rights, but the fundamental instrument of the new State's polity.

The Supreme Court of Colorado quotes Mr. Cooley and says, concerning the constitution of a State:

> It is not the beginning of a community nor the origin of private rights. It is not the fountain of law nor the incipient state of government. * * * It grants no rights to the people; but it is the creature of their power, the instrument of their convenience.
>
> *Packer* v. *People*, 8 Colo. 364, 365.

The constitution may be supervised and reviewed by Congress or it may not. That of Colorado was not, and that of Oklahoma was.

Mr. Justice Lurton in speaking, for this court, of the Oklahoma Constitution, said:

> A constitution thus supervised by Congress would, after all, be a constitution of a State, and as such, subject to alteration and amendment by the State after its admission. Its force would be that of a State constitution, and not that of an Act of Congress.
>
> *Coyle* v. *Smith*, 221 U. S. 559, 568. See also.
>
> *Ex parte Webb*, 225 U. S. 663, 690.
>
> *Wilcox* v. *McConnell*, 13 Peters, 498, 516.

So far as we have found, this argument when it has been made by the Courts, has consisted merely of an assertion that the United States, by permitting the State to insert a claim to the waters in its constitution and by ratifying that constitution, has assented to the claim and done that which vests the water in the State. (See *Stockman* v. *Leddy*, 55 Colo. 24).

[illegible] case that we have found has any attempt been [illegible] to analyze the proposition, and in only one [illegible] any authority been cited. Our search has not been exhaustive however, and there may be [illegible]. The case in which the authority was cited is *[illegible] Investment Company* v. *Carpenter*, 9 Wyoming, 110, 135, 136. The passage in point is as follows:

> So far as proprietary rights of the United States are concerned, the question would seem to be settled in favor of the effectiveness of the declaration, by the act of admission, which embraces the following provision: "And that the constitution which the people of Wyoming have formed for themselves, be, and the same is hereby, accepted, ratified, and confirmed." *McCornick* v. *Western Union Tel. Co.*, 79 Fed. 449. In that case the circuit court of appeals for the 8th circuit of the United States, held that under a similar provision in the act of Congress, admitting Utah, all the provisions of the Utah constitution were invested with all authority conferred by any act of Congress.

In [illegible]*nick* v. *Western Union Telegraph Company* [illegible] sole authority cited by the Wyoming court the question was as to the right of removal to the United States court of a cause that was pending in one of the territorial courts of Utah at the time of the admission of the State. By specific provisions in the enabling act Congress had empowered the constitutional convention to provide

by ordinance for the transfer of all such cases to the Federal and State courts. The convention, pursuant to that authority, embodied a provision for that purpose in the constitution. The question before the Circuit Court of Appeals, and the one which that court considered, was whether or not what Congress had done amounted to an unconstitutional delegation of its own powers. The decision was that it did not. That is far from holding, as the Wyoming court states, that "all the provisions of the Utah constitution were invested with all authority conferred by any act of Congress" or that property rights of the United States would pass to a State by an assertion of ownership of them in a State constitution.

> The adoption in the constitution of a State, or the enactment by its legislature, of a provision that all waters within the State are the property of the State or the Public, can in no way effect the rights of the United States in and to those waters, but all rights acquired by the State must be subject to the rights of the general Government.
>
> 1 Kinney, Irrigation (2nd Ed.) Sec. 388, p. 657.
>
> A State, therefore, has the power to dedicate its waters to itself or to the public, as far as its own rights in those waters are concerned, and to regulate the use between its citizens. But to hold that a State constitutional convention or a State legislature could virtually appropriate all the waters

flowing over the public domain and belonging to the United States to itself, and acquire a good title thereto, would be too much like holding that an individual could make a deed to himself of other people's property and acquire a good title thereto.

1 Kinney, Irrigation (2nd Ed.) Sec. 388, p. 660.

(b) The argument based on the necessities of the arid region examined. It wrongly assumes that the riparian system is not suited to western conditions and that, therefore, the States can dispose of the Federal property in water.

Free appropriation of water, like free appropriation of land and minerals, was originally, as we have said, the outgrowth of conditions in the West, when, by the nonaction of Congress, all of the property of the United States could be freely taken and used by persons who were technically trespassers. Later, the protection of the rights thus acquired was the principal thing that the courts and the legislatures had in mind. The thought was that if riparian rights were recognized these possessory rights would be destroyed, and that if riparian rights could in some way be denied they would be protected. After the controversy was settled, as far as the United States was concerned, by the act of 1866, it was still thought that the development of the West demanded the free appropriation of lands and water and that the denial of riparian rights was somehow necessary to that end. All of the property

in those States, except the possessory rights which had been recognized by Congress, belonging to the United States, and Congress having by that act legislated in favor of State laws, all the States had to do to prevent riparian rights from attaching to the riparian lands as the Government granted them, was to declare by law that such rights should not so attach, and that water rights should only be acquired by appropriation. They actually did this by legislation and by the decisions of the courts.

The courts, however, in their opinions confused the riparian system as a system of water-right tenure, with the idea of free appropriation, and in some cases said that the appropriation system was better adapted to an arid region than the riparian system. They overlooked the fact that the appropriation feature of the system, that goes by that name, has nothing to do with that system as one of water-right tenure and is only a means of acquiring rights to real property, just as the entering of public lands or of a mining claim is a means of acquiring title in those cases. Further, they thought that it would be better for the development of the West if water rights should be absolute in character rather than relative, probably because, from the circumstances that surrounded the original settlers, water rights had assumed that character. They were unfamiliar with the basic principles of the riparian system and did not realize its flexibility. Many of them thought that irrigation and other extensive uses of the water were not permitted by that system

and that, therefore, less land would be watered under the riparian system than if free appropriations were permitted. However that may be, it is apparent from the early decisions and from those of the present day that the matter has not been analyzed and that no distinction has been made in the cases between the appropriation system as a means of acquiring rights and that system as a method of holding and using them.

As we have already shown, irrigation was permitted and more or less frequently practiced under the common law. It was one of the reasonable uses that the riparian owner could make of the water and that could not be objected to by other riparian owners. It would make no difference, however, if this were not the case, because the principle of the common law was that the riparian owners, taken together, could do what they would with the stream and that their rights, among themselves, were to be determined upon the principle of equality, and, therefore, that any use in the circumstances that was reasonable, both as to manner and extent, was permitted. In order that the various permitted uses could be enjoyed and protected, it was common practice under the riparian system for courts of equity to apportion the stream between the several owners. This was done in some instances even with respect to domestic uses. For a full discussion of this subject see Mr. Wiel's Work (p. 820), where he shows that apportionment between riparian owners, which is common in California, was a recog-

nized equity practice and that the California custom is not a modern departure.

Whether the western courts, if they ever had gone into the matter, would have held that the riparian system was not applicable to western conditions, is a question. It probably can be safely said that it is also a question whether, when the Western States are fully settled and all the public lands are taken up and all of the water of the streams put to use, more lands would be irrigated and more crops raised under the one system than the other.

Probably the only striking difference between the appropriation system and the riparian system is the fact that under the former the rights are absolute, while under the latter, they are relative. There is, of course, also the difference that the appropriation right may be used anywhere, while the riparian right, as against other riparian owners, can be used only within the watershed. However, the appropriation right, when it has once been acquired, may not be changed as to point of diversion, place or manner of use when such change would be to the injury of any other water users from the stream, whether they are senior or junior to the right in question. Changes of use usually do involve an injury to others, so the appropriation system in this respect is like the riparian system, as the appropriator must get the consent of other users on the stream to make a radical change.

The appropriation system permits water to be used anywhere, provided the use is a beneficial one;

and the courts have been liberal in allowing water to be transported to great distances through open and porous ditches, so that great losses are often occasioned. This fact, as far as making the best use of a stream is concerned, balances the correlative feature of the riparian system, which might in some instances fail to put the water to its highest use, by dividing it up between too many owners. Whenever this would be the case, though, under the riparian system, it is likely that the water would be put to a high use by some of the riparian owners purchasing the rights of others.

There is a tendency even now in the West for the rights of water users to become correlative and some of the State legislatures have attempted to make them, to a certain extent, of that character, by providing that the waters shall be apportioned among the several appropriators when the stream is at low stages. (*Wiel, Water Rights*, secs. 309 and 313).

Water is of such great value in the arid region that its full use, and, as far as possible, its best use, is necessary. Such best use is not being brought about by legislation, however, but by purchase and condemnation. As the low flow of the streams becomes fully appropriated no further development can take place without a storage of flood waters or a consolidation of ditches and lands irrigated. The modern tendency is, therefore, to undertake great projects which will accomplish these things. The flood waters are stored, and new and larger ditches take the place of the numerous small ones. Water is

conserved in both ways. It is often impracticable to undertake these projects unless the vested rights can be acquired or brought into the project in some way. This is often done, and when it is done, it is usual to put all of the rights of the water users on an equal basis. The water users, then, have correlative rights, as they do under the riparian system. The project, as a whole as against other users on the stream, if there are any, has the various absolute rights that it has acquired. If the project utilizes all of the waters of the stream the situation is exactly like that at common law, except, of course, that the lands are not necessarily riparian. (See statement of Mr. Bien, then supervising engineer of the Reclamation Service, quoted in *Wiel, Water Rights*, pp. 169, 339.) In these cases, where absolute rights are transformed into relative rights, the change is brought about in the same way that absolute rights have always been created, that is, by the grant of the owner or owners of the real property rights involved.

All of these systems have their firm foundation in the common law. The United States, as the owner of the innavigable waters under the common law, could, in perfect keeping with that law, grant the riparian and appropriation rights that it has granted. In California and the other States that follow her lead grants of both kinds were made. In Colorado only grants of appropriation rights were made. In both the appropriation and riparian States new kinds of uses are being made and new kinds of rights are

being created. Correlative rights are being turned into absolute rights and absolute rights are being turned into correlative rights. All these changes are being made by grant, and with the full knowledge that the subject matter is real property of the highest value. It would be unsafe to say that any particular system that exists to-day in these States is the best suited to conditions there or that any one of these systems is not suited to those conditions.

Even if the appropriation States had deliberately decided that the appropriation system was better adapted to their conditions than the riparian system and, therefore, desired that it should be put into effect, they would have been powerless to accomplish any such result without the consent of the United States. Their decision in that regard would have meant merely that they thought that more or better lands would be irrigated if absolute rights were acquired by those who should become the owners of the lands, and that the result would be best if a system of free acquisition of such absolute rights obtained. The waters would of course be of no use without the land, so the States, even if they could control the water, could accomplish nothing unless the United States provided a means for conveying the land so as to carry out the State's purpose.

Even conceding, *arguendo*, that the appropriation system would in the end produce better results than the riparian system or a lease or sale system or any other plan that a proprietor might devise for the disposal of his property, it could not be imposed

upon the United States with regard to its waters. If, the fact that one system of holding water rights is better suited to local conditions than another, is a sufficient reason for holding that the United States, which under the law owns those water rights, shall not own them, it must follow that a similar decision as to land rights would produce a similar result. It may well be that the prosperity of the arid States would be greater if the United States would convey its lands in smaller or larger tracts or would set aside certain of its lands to be held and used as commons; but would that be any warrant for the law's interfering with the plans of the United States with regard to that property? The Federal Government, of course, can make or ruin the prosperity of a State by the manner in which it disposes of the public domain, but no differences of opinion, as to how that property should be disposed of, can affect in any way the power of Congress to make the choice for itself. As a matter of fact, Congress has supported the local view and has arranged the disposition of the Federal property in full accord therewith, so that the opposition to ownership by the United States of the waters on the public lands, is simply opposition to the right of Congress, rather than the States, to have the disposal of that part of the Federal property. If the disposal of that part of the Federal property were in the hands of the States it would not change in the least the plan that they, themselves, adopted and approved; and its only practical result would be to give the

States the power to determine whether or not the Federal Government, in the use of its remaining lands and the carrying out of its Federal policies, may use the unappropriated waters of the streams and lakes. Of course, the fact that unappropriated waters belong to the United States leaves it within the power of Congress to change its policy as to future appropriations, but a radical change in that respect is not likely.

Government reclamation projects, whether of public lands or of Indian reservations, fit in perfectly with the water-right tenure features of the appropriation system. The United States holds its water as it does its land, for appropriation by others, until it withdraws or reserves some of it for the accomplishment of a Federal purpose. When it does reserve water it reserves only so much thereof as is necessary for the purpose intended and holds it, in all essential respects, as an appropriation water right. The right is, of course, subject to the grants, by appropriation, already made, and whatever water is left in the stream after the Government's reserved right is taken out, the Government holds for others to appropriate and for further reservations by itself if the need arises. The priority of a Government's reserved right is the date when it made the reservation. The right takes its place in the order of rights on the stream given it by that date.

Winters v. *U. S.*, 207 U. S. 564;
Conrad Investment Co. v. *U. S.*, 161 Fed. 829.

(c) Water rights being vested rights in real property, the State has the same and no greater control over them than over vested rights in land. The argument that water is public juris is unsound in reason and unsupported by authority and is advanced merely to support State as against Federal ownership.

Undoubtedly the States have the power to control individuals in their use of water. This right of the State may not be confined to the police power, but it can not go beyond that power and the right of eminent domain. Whatever the power is, it is limited by the provisions of the Fourteenth Amendment protecting vested rights. The power itself is the same as that which the State has over vested rights in lands. Water rights, as we have seen, under both the appropriation and the riparian doctrines, are vested rights in real property, which can be lost only by grant, condemnation, prescription or abandonment.

The Massachusetts court in a case decided in 1909 (*Home for Aged Women* v. *Commonwealth*, 202 Mass. 422, 433–434) explained the distinction in this respect, between the rights of a riparian owner in navigable and innavigable waters. Mr. Chief Justice Knowlton, who wrote the opinion, said:

> It is to be noticed first that the nature of their ownership on the border of tidewater differs from the ownership of a riparian proprietor upon an innavigable river or small stream. The title of the owner in the latter case goes to the thread of the stream, or, if his estate extends beyond the stream he owns all

> of the land under the water with a right to the flow of the water which goes with the land as a part of the real estate included in his ownership. The State has no ownership of any part of these small streams, nor any control over them except such as it has in all parts of its domain for governmental purposes. But the common law and the Colonial Ordinance give owners on the shore of the sea or on navigable tidewater in bays, harbors and inlets only a limited right beyond the line of their private ownership. Their right is that of members of the public for whose benefit the property is held by the State, with such special advantages to their property in the use of these public rights as come from its contiguity.

The Colorado Supreme Court says:

> Rights to the use of water for a beneficial purpose, whatever the use may be, are property, in the full sense of that term and are protected by Section 15, Article II, of our Constitution, which says that "private property shall not be taken or damaged for public or private use without just compensation."
>
> *Sterling* v. *Pawnee Co.*, 42 Colo. 421, 426.

The ways in which this power of the State is exercised, of course, will differ in accordance with the kind of property, the use of which is to be affected or controlled. Thus, we have regulations limiting the use of land for the public good that would not be at all applicable to water, and, *vice versa*, we have regulations concerning water that could not apply to land. Of this character are the administrative rules

and the means of enforcing them, by which officers appointed by the courts, or provided for by statute, see to it that gates are opened and shut so that the waters will be apportioned to the various owners of rights therein, according to the decrees of the courts by which they have been defined and established. This is a clear exercise of the police power, and is so held by the courts.

> The State's office is regulative, to see that those who use the water do not violate their duties to each other; and hence acts in its sovereign capacity only—not as owner of the water; the State operates only under the police power.
>
> *Wiel, Water Rights*, 3rd Ed., p. 197.
>
> No lawyer denies that sovereignty or regulative power over public uses of waters, under the police power, resides in the States; and this has not been distinguished from ownership thereof.
>
> *Wiel, Water Rights*, 3rd Ed., p. 196.
>
> This court has repeatedly upheld the irrigation law of this State as being the exercise of the police power of the State.
>
> *Roberson* v. *People*, 40 Colo. 119, 124.
>
> They (the water adjudication statutes) have been held to be a legitimate exercise by our general assembly of the police powers of the State, and the proceedings thereby furnished are in the nature of a proceeding *in rem*.
>
> *Broad Run* v. *Duel*, 47 Colo. 573, 579.
>
> The statutes are in the nature of police regulations to secure the orderly distribution of water for irrigation purposes, and to this end

to provide a system of procedure for determining the priorities of rights as between consumers.

Combs v. *Farmers*, 38 Colo. 420, 428.

Undoubtedly the State also has the right, in the interests of the public health and general welfare, to prevent the pollution of streams, but the same right extends to preventing a use of land that would be detrimental to the public in the same way.

Both appropriation and riparian rights may be lost through adverse possession (*Wiel, Water Rights*, 3d ed., sec. 579, p. 622 and sec. 863, p. 916); and it is held that the appropriation right may be lost by abandonment. The rules with regard to abandonment of a water right are the rules of the law concerning abandonment generally. The determining question is whether the circumstances show an intention on the part of the owner to abandon his property. Nonuse, however long continued, is generally only considered as an element in determining that fact. (*Wiel, Water Rights*, 3d ed., sec. 569, p. 608.)

The statutes in many States, however, provide that if the nonuse shall continue for a certain length of time, abandonment will be presumed. These statutes, however, are like those governing adverse possession and are supported on the same principle. (*Wiel, Water Rights*, 3d ed., sec. 576, p. 618.)

The courts in the appropriation States have the right to determine the amount of water necessary to irrigate crops or necessary for other uses and so to fix the limits of the appropriator's right. This is simply

because the water right does not vest in the appropriator until he has applied the water to a beneficial use and it only vests to the extent of that use. The courts do not attempt to prefer one use over another, as all uses that are beneficial are recognized, and when once the appropriator has applied water to any beneficial use he has a vested right that can not be taken away from him without just compensation. (*Wiel, Water Rights*, 3d ed., sec. 284, and cases cited in footnote 4, p. 300.)

If, under the pressure of a need in the public interest, there should be legislation to restrict the use of water to the more valuable and productive crops or to enforce an abandonment in case the water were not used, it could be supported under the police power, just as similar legislation with regard to the use of land could be upheld and just as the State would have the power to prevent the destruction of forests on private land where they were needed for the protection of stream supply and the like.

In the appropriation States the argument is now frequently made that water is *publici juris* and so under the control of the State. We can not see how this can be, as in all of those States the laws contemplate the complete appropriation of the streams. The constitution of Colorado, for instance, provides (Art. 16, sec. 5): "The water of *every* natural stream not heretofore appropriated within the State of Colorado is hereby declared to be the property of the public and the same is dedicated to the use of the people of the State, subject to appro-

priation as hereinafter provided"; and again (sec. 6): "The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied." It is therefore seen that if the waters are *publici juris*, they are so only to serve a temporary end. It is merely to make the State the conduit by which those things which are owned by no one, under this theory, all become owned by some one. The State becomes merely the agency by which that, which it says belongs to the so-called negative community, is all transformed into ordinary rights of real property, owned by its citizens. These rights were real property under the common law, but according to this argument, their ownership can not be left where the common law puts it. The desire is to have them all ordinary real property rights again, but in order to redistribute them, the expedient of calling them things owned by no one is resorted to.

The Supreme Court of Wyoming, in the leading case of *Willey* v. *Decker*, 11 Wyo. 496, 533, puts the matter rather frankly by saying: "Under the rule permitting the acquisition of rights by appropriation, the waters become perforce *publici juris*." They do, of course, if the rights of their owner are ignored, and, in the same way, if the rights of the owner of the public lands were ignored and the State courts held that their free appropriation was not by the permission of the United States but by permission of the States, they would be forced to hold that the lands were *publici juris*, or in some other way under the control of the State sovereign. The

Wyoming court in the same case (p. 533) goes on to say that the waters of natural streams "are to be regarded as belonging to the public, subject to the right of appropriation." Here, there is clearly no public interest to serve by State ownership, save only the getting of the property into the private hands that the State chooses. The legislatures of the States are to be denied the right to withhold the waters from appropriation, and waters are to be subject to that right of the people, to be exercised by them as individuals.

The same court in the same case (p. 530), quoting *Coffin* v. *Left Hand Ditch Co.*, *supra*, says that "the doctrine of right by priority of appropriation for agriculture is evoked, as we have seen, by the imperative necessity for artificial irrigation of the soil," and it makes the assumption that we have already referred to, that irrigation was impossible under the riparian system. The court then goes on to say (p. 534): "Whatever title, therefore, is held in and to such water, resides in the sovereign as the representative of the people. The public ownership, if any distinction is material, is rather that of sovereign than proprietor."

We have quoted from this case because it is one of the leading cases—if not the leading one supporting the theory of State as against Federal ownership of innavigable waters. Its doctrine and the doctrine of all of these cases that put State ownership upon the ground that waters are *publici juris*, is, in reality, that they must be so in order that the State

may have the title. However, those cases usually go back to the expressions in Blackstone and other early English writers and to expressions in the civil law, from which the confusion on this subject of *publici juris* arose. As we have seen, the confusion was in failing to distinguish between the corpus of flowing water, which is not considered either in the civil law or in ours as being owned, and the right to use the water, which is the right of prime importance in the law and the one that is real property at common law and is real property under the system of appropriation. Upon analysis, even these expressions in the old law, which caused the confusion, will be found to refer to the corpus of the water while it flows in the stream, and not to the right of use. They are only misleading when they are read without the distinction between these two ideas in mind. This is the conclusion that Lord Denman came to in *Mason* v. *Hill, supra*. The whole question, as we have already said in the first part of this brief, was settled finally long ago in England by *Mason* v. *Hill* and other cases, and in this country by a series of cases, of which *Tyler* v. *Wilkinson, supra*, decided by Mr. Justice Story, is the classical example.

In spite of the fact that it is and has been the settled law of England and of this country that innavigable waters are not *publici juris;* that the right to their use and the full right to it, belongs to the owners of the riparian land unless they have granted them away; that that right is not dependent

upon appropriation or use, long continued or otherwise; and that it does not come from the Crown or other public authority nor is otherwise derived than is the title to land itself, we think it proper to examine still further the reasoning upon which the argument to the contrary is based.

When this argument is made in its more extended form, it is that the water itself, being a fugitive, fleeting thing, is incapable of ownership, unless and until it is reduced to possession. Then, by way of bridging a gap, it is argued that by taking possession of some of the water the appropriator obtains the right to take other water, and so gets a water right. That is to say, he who captures certain individual drops or particles of water flowing in the stream, obtains thereby the right to capture other drops or particles that may be flowing there in the future.

The argument, as we understand it, seeks to get away from the idea that the one who gets a favorable position from which to capture the fleeting substance, or, in other words, has access to the stream, obtains the right, because that comes perilously near being the riparian doctrine. It tries to avoid having the right depend, in essence, upon the possession of land, or the obtaining of access to the stream, or anything of that sort, and to find the true foundation of the individual's right in the fact that he has reduced to possession a fugitive thing, which, because it was of that character, belonged, before he captured it, to the sovereign. The reasoning has a gap in it that it is impossible to bridge.

One does become the owner of the very substance of the water that he actually takes into his possession, by putting it into a bottle, for instance; and he continues to be the owner of it so long as he keeps it in his possession; but it is only by a fiction that the ownership of what is in one's possession can be said to give him the ownership of what is not, or that the taking of possession of one thing can be said to amount to the taking of possession of another, or that the capture of some water can be said to give one a water right.

We find no fault with the proposition that he who first occupies unoccupied things gains a sort of moral right, good against every one but the true owner, to continue his occupancy.

In *Atchison* v. *Peterson*, *supra* (p. 515), the possessory rights of the miners on the public domain were recognized as good against each other on this principle.

Further, we find no fault with the claim that a stream or part of it, or, to be more accurate, a water right in a stream, is the sort of thing that can be occupied. The settler on the public domain, who establishes his residence on a tract of land a mile or more from a stream and builds a ditch from the stream to that land and diverts water through the ditch, can well say that he has gained a right, even in the absence of the public-land laws, good against all others except the true owner, not only to the land and the right of way for his ditch, but to the water right. He can say that he has done that in connec-

tion with the stream which can be said to give him as good a right to continue to do it as his occupancy of the land gives him a right to continue to hold that. But on the other hand, we deny that the right so acquired is based in any way upon the fleeting character of the particles that compose the stream or upon the impossibility of their being subjected to ownership unless they are taken and kept in possession.

The whole matter, as we have said, is, to our mind, academic, as the law has been settled against those who would claim that innavigable waters are *publici juris*. It is now advanced merely to support State as against Federal ownership. If it were to be adopted as sound reasoning for the appropriation States, it would disturb the law of waters everywhere in this country. Being based in its pure form on the nature of water itself, it would apply as well to water in New Jersey and Illinois as to water in Colorado and Arizona.

The argument made in *Willey* v. *Decker* that waters are *publici juris* because they ought to be subject to appropriation is simply another way of saying that waters ought to be subject to disposition by the State rather than the Federal Government, and it is just as applicable to the public lands.

(d) The argument that because navigable waters and their shores and beds go to the States on their admission to the Union, in avoidance of State inequality and as one of the royalties of the British crown, innavigable waters should do likewise, is wholly unfounded.

In the first volume of Colorado's original brief (pp. 5 to 7) and in the brief on rehearing (pp. 30 to 83) some reliance appears to be placed upon the doctrine that the beds and shores of navigable waters go to the State in avoidance of State inequality. This doctrine is too well understood to require lengthy discussion. (See *Shively* v. *Bowlby*, 152 U. S. 1, 15, 48, where its origin and limitations are explained with great care.) Because of the public importance of navigation and fishery, navigable waters were *publici juris* at common law. The lands, being inseparable from the waters, were necessarily affected by the public interest also. The title, *jus privatum*, was in the Crown; the dominion, *jus publicum*, was also vested in the sovereign, as the representative of the nation and for the public benefit. The title to the land was thus one of the royalties or sovereign rights which passed to the original States as an incident of sovereignty when they separated from England. (*Ib.*, 46, 48; *Hardin* v. *Jordan*, 140 U. S. 371, 381.) Where there were no States, the United States held this particular class of property in trust for States to be created, and the trust was executed automatically as the new States came.

What has this to do with the question whether the States or the United States owned the innavigable waters undisposed of at the time the States were admitted, or now own the waters that up to this time have not been appropriated? As we have several times pointed out in this brief, the innavigable waters did not belong to the Crown in England, but belonged to the owners of the riparian lands, and so were, like their shores and beds, real property in private ownership. There is no public interest to protect in connection with them. The interests of navigation and fishing, on which the right of the Crown to navigable waters is based, are wholly lacking. The original States did not take this class of property, and if the Western States should take it, it would not be in avoidance of inequality, but actually would be to create an inequality between the States.

(7) The question whether the United States or the States own the water of innavigable streams in the West has never been directly passed upon by this court. The cases support Federal ownership. Opinions of text writers given and statement in report of Attorney General quoted.

As we have already shown, the California law of waters is based squarely upon the Federal title and the act of 1866; and the California cases, in this respect, are followed in the other States that have not adopted the pure appropriation system, while in those States which have adopted that system the courts for the most part deny the Federal title and

seek to find the origin of all titles to water in the State. The question has never been directly passed upon by this court; however, in a number of cases this court has incidentally considered it and expressed the view that the United States has a title and right to the waters on its public lands wholly independent of State permission. In no case that we have found has this court given countenance to the contrary theory.

None of these cases lends support to the theory that the States have any inherent power to dispose of or affect the innavigable waters flowing on the public lands and all of them accord perfectly with the theory of water law, based upon the Federal title, that we have been maintaining. The dictum in the *Rio Grande Dam* case, placing limitations upon the States as to such waters, stands not only unmodified, but is supported by the later decisions.

The cases here briefly analyzed are:

Atchison v. *Peterson*, 20 Wall. 507.

Basey v. *Gallagher*, 20 Wall. 670.

Sturr v. *Beck*, 133 U. S. 541.

United States v. *Rio Grande Dam and Irrigation Co.*, 174 U. S. 690, 704.

Gutierres v. *Albuquerque, Etc. Co.*, 188 U. S. 545.

Kansas v. *Colorado*, 206 U. S. 46.

Winters v. *United States*, 207 U. S. 564.

Boquillas Land & Cattle Co. v. *Curtis*, 213 U. S. 339.

In the early case of *Atchison* v. *Peterson* (20 Wall. 507), arising in California, and decided in 1874, an owner of water rights, acquired by appropriation in 1864, sought to enjoin subsequent mining operations on the stream on the ground that they polluted the stream to such an extent as to impair the plaintiff's prior rights. These prior rights were conceded in the opinion, but the injunction was denied because the proof failed to show that they were infringed. The opinion, by Mr. Justice Field, treats mining and water rights as on the same footing and as both coming from the United States. It also recognizes the right of the Federal Government, as the owner of both the land and the water, to convey the water separately from the land. The opinion in part reads:

> But the government being the sole proprietor of all the public lands, whether bordering on streams or otherwise, there was no occasion for the application of the common law doctrine of riparian proprietorship with respect to the waters of those streams. The government, by its silent acquiescence, assented to the general occupation of the public lands for mining, and to encourage their free and unlimited use for that purpose, reserved such lands as were mineral from sale and the acquisition of title by settlement. And he who first connects his own labor with property thus situated and open to general exploration, does, in natural justice acquire a better right to its use and enjoyment than others who have not given such labor. So the miners on the public lands throughout the Pacific States and

> Territories by their customs, usages and regulations everywhere recognized the inherent justice of this principle; and the principle itself was at an early period recognized by legislation and enforced by the courts in those States and Territories. * * *
>
> This doctrine of right by prior appropriation, was recognized by the legislation of Congress in 1866. The Act granting the right of way to ditch and canal owners over the public lands, and for other purposes, passed on the 26th of July of that year, in its 9th section declares "That whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws and decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same." 14 Stat. at L., 253.
>
> The right to water by prior appropriation, thus recognized and *established* as the law of miners on the mineral lands of the public domain, * * *

In the following year, 1875, this court, speaking by the same learned justice, held in *Basey* v. *Gallagher* (20 Wall. 670), that waters could be appropriated for agricultural purposes as well as mining, and reaffirmed the position taken in *Atchison* v. *Peterson*. Speaking of *Atchison* v. *Peterson*, the court said:

> We had occasion to consider the respective rights of miners to running waters on the mineral lands of the public domain and we

> there held that by custom which had obtained among miners in the Pacific States and Territories, the party who first subjected the water to use or took the necessary steps for that purpose was regarded *except as against the government* as the source of title in all controversies respecting it. (p. 681.)

Basey v. *Gallagher* was a suit brought by a ranch owner to protect his prior appropriation of water for irrigation from infringement by a subsequent appropriator. The opinion (p. 681) points out that neither party had any title to the land, from the Government, and so the question of riparian rights did not arise.

> The question on the merits in this case is whether a right to running waters on the public lands of the United States, for purposes of irrigation, can be acquired by prior appropriation, as against parties not having the title of the government. Neither party has any title from the United States; no question as to the rights of riparian proprietors can, therefore, arise. It will be time enough to consider those rights when either of the parties has obtained the patent of the government. At present, both parties stand upon the same footing; neither can allege that the other is a trespasser against the government without at the same time invalidating his own claim.

In *Sturr* v. *Beck* (133 U. S. 541) decided in 1890, the question of the rights of a private riparian land owner did arise. Beck, as successor to Smith, an appropriator of a water right, sought to enjoin inter-

fer ace therewith by Sturr, the owner of riparian l d who had initiated his right to the land before the wr r right appropriator had initiated his rights. The i.gu tion was refused. The opinion by Mr. Chief ustice Fuller, after stating that "the right of a rip an proprietor of land bordering upon a runnin eam to the benefit to be derived from the flow . it waters as a natural incident to or one of the e ments of his estate, and that it can not be lawfu y diverted against his consent, is not de-n ," nd that "the question raised is whether Smi . cupied the position of a riparian proprietor or . rior appropriator as between himself and Sturr — the latter undertook to locate an alleged water righ " quotes the acts of 1866 and 1870. It then evie to the statement in *Atchison* v. *Peterson* to the effe that when the Government is the sole proprie of all of the lands, whether bordering on a stream or otherwise, there is no occasion for the appli ion of the common law doctrine of riparian proj orship, and states:

> Thus, under the laws of Congress and the Territory, and under the applicable custom, priority of possession gave priority of right. The question is not as to the extent of Smith's interest in the homestead as against the government, but whether as against Sturr his lawful occupancy under settlement and entry was not a prior appropriation which Sturr could not displace. We have no doubt it was, and agree with the brief and comprehensive opinion of the supreme court to that effect.

The question was whether in Dakota the acquisition of riparian lands under the laws of Congress amounts also to the acquisition of a water right. The holding that it does is in exact accord with the theory of Federal ownership of both land and water. Riparian rights were recognized by the local law as also were appropriation rights. The Federal Government's grant of riparian land, therefore, carries with it a grant of riparian water rights, since Congress has made no provision to the contrary as it has, as we have shown, with regard to patents of lands in the Black Hills Forest Reserve (34 Stat. 233, 234). To put the matter another way, as the opinion does, the land entryman under such circumstances "appropriates" both the land and the water. There is here, as also in *Atchison* v. *Peterson*, and *Basey* v. *Gallagher*, no thought of title to the water coming other than from the United States or of its originally being held by the United States in any other capacity than that of a proprietor. All of these cases are in strict accord with the California doctrine, the basis of which is the Federal title.

The proposition that the United States is the owner of the unappropriated water on the public lands and its correlary that the appropriation system, so far as it is legally effective, is the creation of Congress and not of the States finds strong support in the next case to come before this court in point of time. That case is *United States* v. *Rio Grande Dam and Irrigation Company* (174 U. S. 690). It was a suit by the United States to restrain the building by the defend-

ant company of a dam across the Rio Grande in New Mexico and appropriating the waters of that stream for irrigation to the detriment of navigation. The court assumed, for the purpose of its inquiry, that the defendants were intending to appropriate the entire unappropriated flow of the river at the point where they proposed to construct the dam, and that such appropriation would "seriously affect the navigability of the river where it is now navigable." (P. 702.) The decision was that the cause should be remanded with instructions to order an inquiry as to whether the intended acts of the defendants would substantially diminish the navigability of the steam, and, if so, to enter a decree restraining those acts to that extent.

The opinion, by Mr. Justice Brewer, is important here because the limitations upon the power of the States to deal with innavigable waters were considered from the standpoint of the Federal proprietary interest as well as from that of the Federal power to protect navigation. In part the opinion is as follows (p. 703):

> Although this power of changing the common-law rule as to streams within its dominion undoubtedly belongs to each state, yet two limitations must be recognized: *First, that in the absence of specific authority from Congress a state can not by its legislation destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far at least as may be necessary for the beneficial uses of the*

Government property. Second, that it is limited by the superior power of the general government to secure the uninterrupted navigability of all navigable streams within the limits of the United States.

Further along in the opinion, the water sections of the act of 1866 and of the desert land act are quoted and it is stated that "obviously by these acts, so far as they extended, Congress recognized and assented to the appropriation of water, in contravention of the common-law rule as to continuous flow," and "in reference to all of these cases of purely local interest the obvious purpose of Congress was to give its assent, so far as the public lands were concerned, to any system, although in contravention to the common law rule, which permitted the appropriation of those waters for legitimate industries." The conclusion is then reached that it was not the intent of Congress by the acts above referred to to permit appropriations to the detriment of navigation.

The next case, in point of time, is that of *Gutierres* v. *Albuquerque, etc., Company,* 188 U. S. 545, heretofore considered by us, in connection with our argument that those cases which hold that United States and Mexican grants of land in pure appropriation states do not carry grants of riparian water rights, are in full accord with the theory of Federal ownership of unappropriated waters. In this case an act of the legislature of the Territory of New Mexico, incorporating the defendant ditch company, was drawn in question.

The opinion, by Mr. Justice White, assumes, *arguendo*, the title to the water on the public lands to be in the United States, and upholds the local legislation as being such as permitted by the act of 1866 and subsequent legislation of Congress. It reasserts the proprietary rights of the United States as they were asserted in *United States* v. *Rio Grande Dam and Irrigation Company*, *supra*, and points out that it was the purpose of Congress "to recognize as well the legislation of a Territory as of a State with respect to the regulation of the use of public waters" (p. 553). We quote further from the opinion (p. 552):

> The contentions urged upon our notice substantially resolve themselves into two general propositions: First, that the territorial act was invalid, because it assumed to dispose of property of the United States without its consent; and, second, that said statute, in so far at least as it authorized the formation of corporations of the character of the complainant, was inconsistent with the legislation of Congress and therefore void. These propositions naturally admit of consideration together.
>
> The argument in support of the first proposition proceeds upon the hypothesis that the waters affected by the statute are public waters, the property not of the Territory or of private individuals, but of the United States; that by the statute private individuals, or corporations, for their mere pecuniary profit, are permitted to acquire the unappropriated portion of such public waters, in violation of the right of the United States to control and

> dispose of its own property wheresoever situated. Assuming that the appellants are entitled to urge the objection referred to, we think, in view of the legislation of Congress on the subject of the appropriation of water on the public domain, particularly referred to in the opinion of this court in *United States* v. *Rio Grande Irrigation Co.*, 174 U. S. 690, 704–706, the objection is devoid of merit. As stated in the opinion just referred to, by the act of July 26, 1866, c. 262, sec. 9, 14 Stat. 253; Rev. Stat. sec. 2339, Congress recognized, as respects the public domain, "so far as the United States are concerned, the validity of the local customs, law and decisions of courts in respect to the appropriation of water."

The desert-land act, the right of way act of 1891, and section 8 of the reclamation act are then mentioned and in part quoted, and the opinion then proceeds (p. 554):

> It would necessarily seem to follow from the legislation referred to that the statute which we have been considering is not inconsistent with the legislation of Congress on the subject of the disposal of waters flowing over the public domain of the United States. Of course, as held in the *Rio Grande Case* (p. 703), even a state, as respects streams within its borders, in the absence of specific authority from Congress, "cannot, by its legislation destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far at least as may be

> necessary for the beneficial uses of the government property;" and the power of a state over navigable streams and their tributaries is further limited by the superior power of the general government to secure the uninterrupted navigability of all navigable streams within the limits of the United States. Necessarily, these limitations are equally applicable in restraint of the legislative branch of a territorial government, controlled, as is such body, by Congress.

Kansas v. *Colorado*, 206 U. S. 46, decided in 1907, is not an authority to the contrary of the position taken in *Rio Grande Dam & Irrigation Co.* v. *U. S.* The Government there sought to maintain its intervention upon the broad theory that because the policies of Colorado and Kansas, respecting the use of the waters of the Arkansas, were conflicting, and because neither State was competent to regulate that use outside of her own borders, the entire power of regulation must be held to reside in the United States. Such a Federal power was said to be essential to insure the reclamation of arid lands—not lands of the United States alone, but arid lands generally. This was claimed as an inherent power of sovereignty—a sort of national police power springing from the needs of the situation. The opinion, of course, concedes the power of the United States to control the disposition of its public domain. Its interest in the use of water upon its own lands or the advantageous reclamation, use, and disposition of its own lands, or its general proprietary interest in nonnavigable waters was not in issue.

Winters v. *United States* (207 U. S. 564), discussed at the beginning of this brief, was decided a year after *Kansas* v. *Colorado*. The suit was brought by the United States to restrain appropriators of waters of Milk River in Montana from preventing those waters from flowing to the Fort Belknap Indian Reservation in sufficient quantity to supply the needs of the reservation. In 1888, while Montana was still a territory, Congress ratified a treaty or agreement with the Indians, under which the Indians ceded a large area of land to the United States, and Congress, in turn, set aside for their use the reservation referred to; and it was expressed in the agreement that this was done so that the Indians might "become self-supporting as a pastoral and agricultural people." Milk River, an innavigable stream, was designated as the northern boundary of the reservation, but the agreement made no mention of its waters and made no mention of any waters as reserved for the Indians. The State was admitted into the Union in the following year. The Government used a small quantity of water on the reservation, and above it on the river a considerable farming community of white settlers subsequently grew up. The prosperity of this community was largely based upon the use of Milk River water that had been appropriated under the desert land act and the local laws. The lower court held that, under the circumstances, a reservation of sufficient water for the needs of the Indian Reservation must be implied, and enjoined interference in any manner with the

use by the reservation of 5,000 inches of water, which was a much greater amount than had at any time been used by the Government or the Indians. This decree was affirmed by this court.

The opinion by Mr. Justice McKenna, after holding that a reservation of water in favor of the Indians must be implied, concludes:

> Another contention of appellants is that if it be conceded that there is a reservation of the waters of Milk river by the agreement of 1888, yet the reservation was repealed by the admission of Montana into the Union, February 22, 1889, c. 180, 25 Stat. 676, "upon an equal footing with the original states." The language of counsel is that "any reservation in the agreement with the Indians, expressed or implied, whereby the waters of Milk River were not to be subject to appropriation by the citizens and inhabitants of said state, was repealed by the act of admission." But to establish the repeal counsel rely substantially upon the same argument that they advance against the intention of the agreement to reserve the waters. The power of the government to reserve the waters and exempt them from appropriation under the state laws is not denied, and could not be. *United States* v. *Rio Grande Ditch & Irrig. Co.* 174 U. S. 702; *United States* v. *Winans*, 198 U. S. 371. That the government did reserve them we have decided, and for a use which would be necessarily continued through years. This was done May 1, 1888, and it would be extreme to believe that within a year Congress

destroyed the reservation and took from the Indians the consideration of their grant, leaving them a barren waste—took from them the means of continuing their old habits, and yet did not leave them the power to change to new ones.

Appellants' argument upon the incidental repeal of the agreement by the admission of Montana into the Union and the power over the waters of Milk river which the State thereby acquired to dispose of them under its laws, is elaborate and able, but our construction of the agreement and its effects make it unnecssary to answer the argument in detail. For the same reason we have not discussed the doctrine of riparian rights urged by the government.

It will have been noticed that neither the appropriators' argument that a State, by the fact of its admission as a State, acquired the right to dispose of the waters of the river, nor the claim made by the Government that the reservation was entitled to riparian rights, was discussed in detail, because the court's "construction of the agreement and its effects made that unnecessary." The "effect" of the agreement was to reserve the water, and it was held that "the power of the Government to reserve the waters and exempt them from appropriation under the State laws is not denied and could not be." As supporting this proposition only the two cases of *United States* v. *Rio Grande Dam & Irrigation Co.* and *United States* v. *Winans* were cited. The Government's power is, therefore, put upon two grounds, first, that a State's

right to dispose of the waters of innavigable streams within its borders is limited by its lack of power to destroy "the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far at least as may be necessary for the beneficial uses of the Government property," which is the doctrine of Government ownership for which we are contending; and, second, that the United States, at the time when the reservation was made, which was before the admission of the State, as the possessor of full sovereignty, both national and municipal, Federal and State, had full power to reserve the waters, even if they were, like the beds of navigable streams, property of a character that, if undisposed of previously, would pass to the State upon its admission to the Union. The holding that it was unnecessary to discuss the Government's claim of riparian rights as such is significant in view of the opinions being based, in part, at least, upon the doctrine of the *Rio Grande Dam* case. It is, we submit, equivalent to saying that, even if riparian rights do not exist in Montana, the United States is entitled to, at least, enough of the waters flowing upon its own lands to supply their needs as was stated in the *Rio Grande Dam* case.

The decision in the *Winters* case upholds the doctrine of Federal reservation of water rights, and has been followed in *Conrad Investment Co.* v. *United States*, 161 Fed. 829 (C. C. A.).

Boquillas Land & Cattle Company v. *Curtis* (213 U. S. 339), decided in 1909, and above discussed in

our consideration of the question of Federal and Mexican grants of land not carrying with them riparian water rights, was, as we there said, a case in which the owner of a Mexican land grant on the San Pedro River in Arizona sought to enjoin a diversion from that stream on the ground that it would interfere with its rights as a riparian owner. The relief was denied. The main thing considered was whether the land owner, because of its ownership of riparian lands under its grant from the State of Sonora, was entitled to riparian rights in the water as at common law, and it was held that it was not. The decision was put upon the ground that, under the law existing in Arizona at the time of the grant and since, the riparian system did not prevail, and appropriations were permitted. The source of the title to appropriation rights was not inquired into, nor was the right of the United States to convey riparian rights with its grants of riparian lands considered. The court held that the patent of the United States to the grant owner operated merely as a confirmation of the Mexican grant and in no way as an enlargement thereof. Therefore, what water rights the United States had to convey and whether a grant by the United States of riparian lands in Arizona would carry water rights, were questions not decided.

The opinion says in effect that, in view of the holding that the confirmatory patent was not to be taken as a grant from the United States, but merely as a confirmation of what Mexico had already granted,

it was not necessary to decide whether a patent from the United States, made after the passage of the Desert Land Act, would carry riparian rights. It will be remembered that that act provides that "* * * All surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers, and other sources of water supply upon the public lands and not navigable, shall remain and be free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights," and that the supreme court of Oregon in *Hough* v. *Porter*, *supra*, 51 Oreg. 318, decided that after that act the United States' grants of riparian land have not carried water rights. The opinion mentions the Oregon case and says, in a passage we have heretofore quoted, that it was decided on plausible grounds. The grounds on which it was decided and which were said to be plausible, were that riparian rights had been abrogated by *Congress* and not by the State.

The attitude of the executive branch upon this subject is thus expressed by the Attorney General in his 1914 report, page 39:

> The department takes the position that in the arid and semiarid regions, where the legality of diverting and appropriating water for beneficial uses on nonriparian lands is generally established, the original right of the Government to appropriate surplus water for its own uses, particularly for the reclamation of its enormous holdings of arid lands, has not

> been surrendered by any act of Congress or divested by the mere creation of the States into which those regions have now become incorporated. This position has been sustained by one of the district courts of the State of Colorado. Its soundness has been challenged by certain claimants who would have the Federal user dependent on the permission of State laws. The question, never passed on, I am advised, by the Supreme Court, seems very important theoretically, but in practice it has hitherto been obviated by the general identity of interests, and the disposition of the Government to follow the State administrative procedure wherever practicable.

Colorado's brief (pp. 137–142) cites an opinion of Assistant Attorney General Campbell (*In re Withdrawal of Public Lands for Irrigation Purposes*, 32 L. D. 254) given in 1903, as supporting the claim that the United States has no authority over innavigable streams flowing over the public lands within a State. We can not see how that opinion can be made to bear any such construction.

That opinion dealt only with the power of the executive branch to assert the common-law rights of the United States in unappropriated waters, and expressly stated that the power of Congress in that regard was not being passed upon. The conclusion that the executive was without authority to withdraw waters from appropriation was erroneous. See the Reclamation Act, 32 Stat. 388, and *United States* v. *Midwest Oil Co.*, 336 U. S. 459.

[illegible] text-book writers who discuss the subject at all, so far as we have found, are unanimous in their support of the Federal title. Mr. Wiel, in his elaborate work "Water Rights in the Western States," 3d ed., obviously takes that position (see pp. 183, 197, 223).

Mr. Kinney in his late work (1912) says:

> Our conclusions upon this subject are, that the United States, as the original owner of all of the land on the public domain, was also the owner of all the waters of the natural streams and other bodies flowing thereon. By various Acts of Congress the United States has disposed of some of these waters under the Arid Region Doctrine of appropriation; and that the United States is still the owner of these waters, which have not been disposed of, regardless of the action of the State or Territory wherein they are located. The right to the use of other of its waters has also vested in the individuals who have from time to time acquired tracts of lands from the Government bordering upon the streams, as a riparian right, in those States where those rights are permitted. It was left to the various States, as a matter of sovereignty or jurisdiction to prescribe how the title to the use of the waters might be acquired by individuals, in accordance with its local customs, laws, and decisions of the Courts. When the local customs, laws, and decisions of the Courts had been fully complied with by an individual seeking to acquire a water right the title to the same vested in the individual direct from the United States, and not from any State.
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> 2 Kinney, Irrigation, 2d Ed., Sec. 640.

Mr. Long, in the second edition of his work, A Treatise on the Law of Irrigation (sec 74, p. 134), says:

> More fully, according to the former view, the United States (or the State in the case of State lands), as the original owner of the public domain, enjoyed all the rights of a riparian proprietor in respect to the streams thereon, and such rights as have been acquired by settlers have been derived, either expressly or by implication or acquiescence, from the United States as grantor. In early times, prior to any federal legislation on the subject, settlers appropriated the water of the public domain, and their claims were recognized by the local customs, laws and decisions of courts, in all of which the federal government tacitly acquiesced. It may be said that the appropriator's rights then rested upon an implied or presumed grant from the United States. Finally these rights were expressly recognized and confirmed by the acts of 1866 and 1870. Rights acquired since the passage of these statutes, rest, of course, upon the express grant contained in the acts themselves.
>
> The view that the appropriator's rights are based upon a federal grant obtains in California and the other states which recognize the doctrine of riparian rights, and is also held in federal courts in cases arising in these states.
>
> The other view, which is generally implied rather than expressly stated in the opinions of the courts, is based upon the rejection of the common-law doctrine of riparian rights. It

seems to depend upon the proposition that even the United states as the owner of the land embraced in the territory of the states which reject the doctrine of riparian rights, never had any riparian rights in respect thereto, inasmuch as the state or territorial governments have never recognized those rights, and hence the rights of the appropriator could not have been derived from the United States but must exist as a product of state law. There is little direct judicial authority for this view, and it is certainly an extraordinary proposition that a state government, and a *fortiori* that a territorial government, has power to define the extent of the rights of the United States in respect to the public domain.

(8) Upholding of State control would disintegrate the law and destroy Federal interests without working any practical good to the States.

The Western States can show no grant of innavigable waters to them, so they can not be held to own or control such waters without putting the whole law in that field on a new foundation.

As we have already shown, the argument that the sovereign owns all waters because of the nature of water is either applicable in all of the States or is not applicable in any of them. Also, local conditions can not work a transfer of ownership from the United States to certain of the States without a distinction being made, which the law has never made, between water and other things which are the

subject of ownership, or without giving to the arid States a power and field of jurisdiction that is denied to the other States.

Water law in the dual-system States is incapable of explanation or of being put upon any logical basis if common-law principles and their sure result, Federal ownership, are to be abandoned in favor of any principles that can support ownership or power in the States. On the other hand, as we have seen, the appropriation system in Colorado and the States that follow her lead, rests as a matter of history and with logical completeness upon the same principles that that system rests upon in California, where it originated.

It certainly is an astonishing proposition that the owner of most of the land over which these waters flow lost title to the water at some period, near or remote, upon the mere admission of the States. The common law considered these estates in land and water as one. They could be separated, as we have seen; but normally and originally they belonged together. These particular lands were practically useless without the water, and certainly the water was useless without the land. Furthermore, access to the water could not be obtained without the landowner's permission. To say that under these circumstances the owner of all the land had no interest in the water, or that it would be desirable that one sovereign should own the land as a proprietor and that another sovereign should own the water as a royalty or otherwise would be a *reductio ad absurdum*.

Besides these objections based upon the law, there is this very important practical objection to State ownership of water—that while working no practical good to the States, because the liberality of Congress has fully taken care of appropriations within them according to their own laws, it would put the Federal Government, as the proprietor of vast areas of land, at the mercy of the States, and so would disastrously affect its great reclamation, Indian, and other Government policies.

PART TWO.

The controversy, as one involving an interstate stream, should be decided upon the basis of the Federal ownership of lands and waters, thereby confining the ownership of the States, as ultimate proprietors, to such water rights as have been or may be granted to the respective States for themselves or for use in connection with the lands within their borders.

(1) Examination of the question of division of waters between States upon the basis of State ownership of innavigable waters and disregarding the Federal title.

In coming to the question of the principles that should govern the determination of this controversy as one involving an interstate stream, it is important to be borne in mind that any division of such waters at all between the states must involve a restriction upon the right of the upper State on the stream to use all of the water. A right somewhat in the nature of an easement must be upheld over the

stream in the upper State in favor of the lower State. This is so because water rights, whether riparian or appropriation, to be of any real value (except in the few instances where the land on which the water is to be used embraces the very sources of the stream) must have two elements, namely: The right to take the water from the stream at a particular point and use it, and the right to have the water flow down to that point uninterfered with by any one above.

In this case we have the State of Colorado, within whose territory the Laramie River rises and flows for a considerable distance, contending that as a sovereign State it has the right to use the waters of that stream as it will within its own borders, regardless of the effect of such use upon the flow of the stream below in Wyoming; and contending further that if its rights do not go to that extreme, it is entitled, as against Wyoming, to an equitable share of the waters of the stream. Both of these contentions are based upon the doctrine that a State, as such, has a title to all property and resources within its borders, superior to and behind the titles of its citizens. (See *Georgia* v. *Tennessee Copper Co.* 206 U. S. 230.) That doctrine, as applied by Colorado, embraces the idea that, in the last analysis the State owns all that its citizens own and all else within its dominions, and that therefore the State has the right to say the last word as to everything within its territory—air, land, minerals, and water. This is also the conception embraced in Colorado's first contention of absolute right over the stream until it leaves

its State line. We do not understand that this idea of absolute right is insisted upon strongly by Colorado. The brief filed on Colorado's behalf, while not abandoning the idea of absolute right, concedes that the upper State's rights in an interstate stream may be limited to a certain extent in favor of the lower State, upon the theory that States, like individuals, can only enjoy their own rights in so far as their doing so is consistent with a recognition of exactly the same rights in others.

Both States in their arguments have left entirely out of consideration the fact that the United States was the original owner of all of the land, and all of the water within their borders, and still is the owner of all unpatented lands and of all unappropriated waters. They also leave out of consideration the position of the United States as a proprietor which is at the same time a sovereign, and treat the question of the rights in this stream as one involving only the two State sovereigns. But the presence of the United States, the superior sovereign, as both owner and grantor, gives the controversy an entirely different character from that which it would have if it were one between two States, the property within which was all owned by or came from the States; for since the United States has had and has granted to individuals and still has, such vast property interests in the two States, it can not be said that these two States represent, as ultimate owners or otherwise, all of the property within their respective borders.

However, before discussing the significance of the Federal title in this connection, let us examine the possibilities of a division of the waters of the stream as if the case were one where the States are entitled to say the last word as to all of the property involved.

In determining the respective rights of States in property we are entitled to assume that the broad principles of the common law are to be adhered to, generally speaking, not because those principles have any force or controlling power over the States, as law, but because they are fundamentally just, and so give rules, generally speaking, as applicable to sovereign landowners as to landowners who are the subjects of a sovereign. Under the doctrine of *Georgia* v. *Tennessee Copper Co.*, supra, the rights of States are to be considered in a broader and less technical way than those of individuals. However, in fixing a rule binding upon States, the welfare of all the States taken as a whole should be considered, and in order to do that the effect of any such rule upon the rights and opportunities of the citizens of the United States, regardless of State citizenship, must be taken into account.

The question in a controversy between States regarding a stream that flows through the lands of both is, What interests do the respective States have in that stream? That is to say, what property rights do they own in the stream as against each other?

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(a) The proposition that the upper State on a stream may use all of the water regardless of the effect of such use upon the flow of the stream in the lower State, is untenable.

This is so, both on authority and on principle. This court decided in *Kansas* v. *Colorado*, 206 U. S. 46, that a dispute between States concerning an interstate stream constitutes a justiciable controversy determinable in this court. No countenance was given to the idea that the upper State was free to use all the water. On the contrary, the idea that rights in the stream possessed by the lower State would reach up to and affect the stream as it flowed in the upper State was accepted as one of the basic principles upon which the case was considered.

One can easily imagine circumstances that would make the great use of the water of an international stream by a State situate above another thereon to the detriment of a lower State so repugnant to natural ideas of justice as to warrant the lower State in resorting to force to put a stop to it. (*Missouri* v. *Illinois*, 200 U. S. 496.) If that is so, it surely follows that between the States of our Union the principle must be recognized that the upper State is not entitled in all cases and under all circumstances to use and exhaust the stream as it will, but that in some cases at least it must, in spite of its own needs, allow a certain amount of the water flowing within its borders to leave them and flow down to the State below.

Our treaty with Mexico regarding the Rio Grande (May 21, 1906, 34 Stat. 2953) and the treaty with Great Britain involving the waters of the St. Marys and Milk Rivers in the United States and Canada (Jan. 11, 1909, 36 Stat. 2448, 2451), were made upon this theory. It is true that in both treaties stipulations to the effect that they should not be taken as precedents and should not constitute an acknowledgment of obligation were made. The fact, however, remains that in these instances where controversies actually arose, neither this country in dealing with Mexico, nor Canada and the United States in dealing with each other settled those controversies upon the basis of the upper State's being free to take all of the water.

Furthermore, the rights of the United States and the rights of private persons as its grantees make the allowance of such a claim between the two States here impossible. We have not paused to consider that matter under this head, however, as we are here considering the principles that should control the settlement of this controversy if Federal interest were eliminated.

(b) A division upon the basis of priority of appropriation illogical under theory of State ownership of water.

If the upper State is not to be allowed to use all of the water if it sees fit to do so, some rule of division of the water between the States must be found, or at least some means must be had for determining

when the uses in the upper State infringe the rights of the lower State.

Private rights in interstate streams, except where they have been decided on the basis of priorities created by Federal grants under the act of 1866, as in *Howell* v. *Johnson*, 89 Fed. 556, have been determined upon the theory that the two States permit overlapping rights to be acquired as a matter of comity, each State having in substance the same or at least reconcilable laws under which rights can be acquired by individuals and not having provided by statute, as was the case in *Hudson Water Co.* v. *McCarter*, 209 U. S. 349, that State water should not be taken beyond the State line.

Bean v. *Morris*, 221 U. S. 485.
Hoge v. *Eaton*, 135 Fed. 411.
Anderson v. *Bassman*, 140 Fed. 14.
Morris v. *Bean*, 123 Fed. 618; 146 Fed. 423.
Rickey Land & Cattle Co. v. *Miller & Lux*, 218 U. S. 258.
Taylor v. *Hulett*, 15 Idaho, 265.
Willey v. *Decker*, 11 Wyo. 496.

Wyoming, in its brief on rehearing, takes the position that priority of appropriation should govern here, notwithstanding this is a controversy between States. We understand, however, that it is her contention that that feature of the riparian doctrine which confines the uses of riparian owners to the watershed (unless all of the riparian owners consent to a diversion beyond the watershed) should likewise govern.

It is difficult to see how priority of appropriation can be adopted as the rule of decision in this case without taking the Federal title as a basis. If we eliminate the rights of the United States and the power of Congress to dispose of those rights and the consideration that the owner of those rights is a sovereign, we have two States facing each other simply as paramount landowners. As such, how can they be confined in their rights in the stream to the water that they have already appropriated, and, as to the surplus waters, be given merely a right to make further appropriations? The fact that their laws both recognize priority of appropriation as governing the rights of their citizens can have no bearing. These laws in neither instance were made to govern the State itself as against another State. No rule of comity could apply in a case where the States are seeking to assert rights *in invitum* against each other. Furthermore, Colorado has lately passed an act designed to retain such waters as she controls within her own borders. (Act of Mar. 30, 1917, Session Laws of Colorado, 1917, p. 539.)

If these States were, in truth, the original and ultimate owners of all of the property within their borders, they would have a right to a fair share of the water upon whatever principle determined, regardless of whether they had put it to use or not. Would Wyoming, for instance, be willing to admit that as against Colorado she was without power to change her local water system to-morrow to the riparian system, for instance? She certainly ought

to have that right, as against another State; and she would not have it if priority of appropriation were to be the rule between these States. If each State has full rights in the stream, save only as those rights must yield to the possession of the same rights by the other State, some rule ought to be found by which the unappropriated waters could be divided, in case either of the States insisted upon it. Only in that way could the rights of the States, treating them as original and ultimate property owners, be given full consideration, and they be left free to use their property or not as they see fit.

Clearly no rule ought to be adopted in this case that would be opposed in principle to a rule of division that would have to be adopted between other States, and the rule of priority of appropriation would not be applicable to a controversy between two riparian States. Since it would not, and such States must be considered as having full rights in the stream covering all of its waters whether used or not, subject only to the equal rights of other States on the stream, how can it be said that Colorado and Wyoming do not have exactly the same rights? There is nothing that distinguishes them from the riparian States except that, as a matter of local law, each has imposed, following out the idea of State control, the doctrine of appropriation upon its citizens.

There is another serious objection to the solution suggested in Wyoming's brief, and that is that it would leave the right to use the unappropriated waters as existing in no one unless and until they

were appropriated. That idea has never found favor in the law, and the adoption of it, even as between States, might have serious and unfortunate consequences. To adopt that theory would be to announce a new and unnecessary doctrine and one which might shake the foundations of the law of waters. Furthermore, its adoption here, if the law does not require it, might be embarrassing to the political branch of the Government in its conduct of international relations.

As to the idea that uses as between States should be confined to the watershed we shall speak below, saying here merely that if a division could or should be made between States as such it ought to leave the States free to use their respective shares of the stream as they see fit; and that a rule that confined uses to the watershed would impair many vested appropriation rights now existing.

(c) A division upon the basis of riparian rights, while logical, would be difficult to work out with justice. Present developments and vested interests could not be protected by a division upon that basis.

In *Rickey Land & Cattle Co.* v. *Miller & Lux*, *supra*, the broad outlines of what might possibly be the rule for determining rights *in invitum* between the States were suggested. This court there said (p. 261):

> It is conceivable, to be sure, that the decisions of this court may determine that the states have rights as against each other *in invitum* in streams that flow through the land of both. *Kansas* v. *Colorado*, 206 U. S. 46, 84. *Missouri* v. *Illinois*, 200 U. S. 496, 519, 520.

> These rights may vary according to the system of law required by natural conditions. They may be more or less analogous to common law rights between upper and lower proprietors, where irrigation is not necessary, as in most of the older states. See *New York* v. *Pine*, 185 U. S. 93, 96. There may be some, perhaps limited, right of appropriation in the upper state, at least in the watershed of the stream, where irrigation is the condition of using the land. See *Kansas* v. *Colorado*, 206 U. S. 46, 100–104, 117. But whatever this court may decide, if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his state, and those rights, the petitioner insists, can, or at least should be, determined only in a suit brought by the state itself.

It should be pointed out that in suggesting the foregoing as the possible basis of a rule in such cases as this, this court did not have before it and did not consider the rights of the United States in the innavigable waters within the States, but considered the matter entirely upon the basis of the rights of the respective States as the paramount owners of all within their borders, and furthermore, that the controversy being between private persons, the States were not before the court and their rights were only incidentally considered.

The suggested rule would mean, that between pure appropriation States or between such a State and one having the dual system (where contro-

versies of this character are most likely to arise, for irrigation is not practiced to any great extent in the pure riparian States) the rule would be that the underlying principles of riparian rights, as at common law, would be the guide. The lands capable of irrigation within the watershed of the stream and their needs, taking them altogether, and disregarding State lines, would be ascertained and all other reasonably likely uses would be taken into account. Then we assume the waters would be divided between the States according to each State's ownership of such lands. Each State could then allow its share of the water to be appropriated by individuals and the United States or could reserve it for itself as it saw fit, either as appropriation or riparian rights or both. They could use part or all of it beyond the watershed.

The ability to use water beyond the watershed is important, as without that right reclamation projects and uses of water for domestic purposes would be in many cases made impossible. The appropriation doctrine provides the most ample scope for such uses as under it watersheds are ignored. (1 Wiel, Water Rights, 3d Ed., secs. 281, 282, and 363, and cases cited.)

Uses beyond the watershed are not so freely made under the riparian system, but they are common there. The riparian owners, whose rights would be affected thereby, can join in sanctioning such use and, of course, the right to make such a use for public purposes can be acquired by eminent domain.

In working out this plan it would be possible to make a hydrograph of the stream, as it flows in both States, and then a division of the waters, as they would flow in a state of nature at the State line, could be made that would take into account the respective quantities of riparian lands in the two States and other circumstances.

It is difficult indeed to see how a division could be made, on this theory, that would take into account private vested rights. We do not mean to imply that in a controversy between independent States there would be any need to be concerned with vested rights of private persons as such. The statement in the *Rickey* case, *supra*, that if private persons obtained any advantage from an action between States it would be accidental and not by virtue of any rights that they themselves could assert, we understand to mean merely that the States in controversies against each other, if the Federal title is left out of consideration, represent everything that is under their control within their borders, and, therefore, that if State laws have permitted the holding of rights that must fall before the claims of another State, that fact is immaterial in such a controversy. The States, however, through their citizens or otherwise, having made use of the water to a greater or less extent, and, therefore, having interests built up upon such uses, it is important not only for the welfare of the particular States, but of the country as a whole, that these uses be protected if possible.

As we said with respect to a division upon the basis of prior appropriations, if the States as landowners have rights in the stream they have them whether they make use of them or not. To say that a division that would be fair if neither State had made any special use of the water would have to be modified because one State had made a special use of it, would be either to deny the State's right as a landowner or to say that it had lost, in a measure, that right by the activity of the other State. A division, however, that ignored developments already made would be disastrous in its effects. Lands in the West have been developed and communities have grown up based upon that development, by the free appropriation of water regardless of State lines.

While a division that would take into account and preserve existing developments would probably, on the whole, be a fair one as between States, it doubtless would be easy to show that on particular streams one State is now often making use of very much more water than the other state and that the practical present division so made is not at all what would be demanded by taking into account merely stream flow and the quantity of irrigable lands within the watershed in the two States. Ascertaining and providing for present uses would of course bring further complications into the inherently difficult matter of making a division on the basis of riparian rights.

Under all of these circumstances it is hardly likely that the decision of one case would be of great help in settling other cases, or what is per-

haps more important, in making other litigation unnecessary. The decision being based upon the circumstances of the case, and those circumstances being many and involved, the question of State rights in interstate streams in the West, where the matter is of such great importance, could not well be considered as settled until the matter was litigated as between all of the States and possibly as regards each stream. In the meantime, private rights would rest under a cloud of uncertainty and interstate reclamation enterprises of every nature could hardly go forward unless under agreements made by the States with the sanction of Congress.

We respectfully submit that because of the above results no rule for the determination of interstate rights that involves the establishment of such a system ought to be adopted unless its adoption is made necessary by imperative rules of law. That, however, is not the case, as the doctrine of original Federal ownership of innavigable waters and present Federal ownership of all unappropriated waters is not only sound in law but offers a solution of the problem of interstate streams that is free from difficulties involved in any other theory.

(2) A determination of this and similar controversies on the basis of the Federal title, giving to each State only such water rights as have been granted to it or for use on its lands, would: Protect existing conditions and vested rights, including Federal property and Federal projects; make possible the undertaking of further interstate projects; make litigation between States unnecessary; and would not deny to the States sovereign control over all property rightly subject thereto. Such a settlement would be the most equitable one between States, even if not necessary under the law.

Federal property within a State, being under the exclusive control of Congress, can not be affected by State laws. The Federal Government, therefore, has full power to use that property as it sees fit and may do so regardless of State lines. Having that right, it may also grant the property to others, regardless of State lines, and its grantee's title being in no way dependent upon State law, is good and can be acquired by a State only by voluntary grant or condemnation. The Federal Government owning the property regardless of State lines and unaffected by State sovereignty, the title of its grantee is good even though it is used upon lands that would not be given a water right under a division of the waters of the stream, made in disregard of the Federal title and as between the States considering them as independent sovereignties. Under this theory, the two States here, having no interest in the waters of the Laramie River, except such as they have obtained as the ultimate owners of water rights granted by the United States to them or to private persons for

use upon lands within their borders, the rights of the States as against each other are merely to protect these water rights so obtained and the determination of any controversy arising respecting them, resolves itself into a decision as to respective priorities and their infringement.

Upon this theory, the respective rights in the stream can be determined practically as well for the whole stream, as it flows in both States, as they could be if it were wholly within one State. The local laws as to the initiation and vesting of rights may differ somewhat, but that circumstance affords no difficulty. The vested rights in Colorado would take their place among all the rights on the stream, with priorities as of the dates upon which they were initiated under the Colorado law, and the priorities of the Wyoming rights would coincide with the dates upon which those rights were initiated under Wyoming laws.

The adjudication of these rights would be no more difficult than is the adjudication of rights upon a stream of equal length wholly within one of the States. In Colorado, water districts are formed and adjudications take place within those districts. The right, however, is reserved to those who own water rights on the stream that are in another district to have their rights determined in relation to those within the district, so each right can take its proper place among all the rights in the stream. (See *O'Neil* v. *Northern Colorado Irr. Co.*, 242 U. S. 20.) As a practical matter, the adjudication within the dis-

trict usually suffices, as few, if any, rights outside of the district are so affected thereby as to make a determination of their exact relation to the rights within the district necessary.

In Arizona, where some of the streams are very long and of a flashy character, with the consequence that the rivers run water throughout their lengths during flood periods and during dry periods rise and sink in the stream beds, it is common to adjudicate the rights within a fairly compact irrigated area and not to attempt to have one adjudication cover the whole stream. (See *Montezuma C. Co.* v. *Smithville C. Co.*, 11 Ariz. 99.) The rule that the stream is a unit and that the one first in time has the prior right to the use of the waters of the stream and all its tributaries above him, is not denied, but to give him this priority does not, as a practical matter, necessitate an adjudication covering the whole stream. The plan has been adopted in some instances where groups of water users situated at some distance from each other on a stream desire to have their rights fixed, of settling the rights of the groups as such, against each other, instead of attempting to give each right its exact place among all the others. (See *Anderson* v. *Bassman*, 140 Fed. 14, 28.)

The courts in these cases do not deny the rights of the individual or lay down any new principle of law, but arrive at justice in a practical way. Often the decree takes a form, theoretically irregular but practically just, by common consent of the numerous

litigants. Wherever there is a distinct invasion of a right it can be and usually is remedied, but that rarely happens where the users are far separated on the stream.

The difficulties of settling water rights are not greater when rights are recognized regardless of State lines than they would be if State lines were considered as controlling. This is so because the Western States are so great in area and the streams in them are so long that all the difficulties that arise in settling rights regardless of State lines, are present within the States. The Gila River, for instance, extends across the whole width of Arizona and the irrigated valleys along its course are widely separated.

The question of the jurisdiction of the courts is not serious, as the courts of the upper State and the Federal courts therein would be open to the citizens of the lower State and would protect their rights. This has been done in numerous instances, as shown by the cases between private persons cited above.

A determination of the rights between these particular States upon the basis here suggested would be equitable. It would be founded upon actual appropriations made from a source held open to the citizens of each State upon the same free basis. It would be in accordance with the needs in the two States as they have actually arisen. It would respect rights already vested and would protect the communities built up upon them. If it should turn out that in the end one State got more of the waters of

the stream than the other, it would only be because in the settlement and upbuilding of the whole area out of which both States are composed, it happened that more of the lands of one State were chosen for development than the other, at a time when the choice was free. The right of the two States to control the water rights within their borders, except those belonging to the Federal Government of course, would be unimpaired within the limits of their police power. They could make such rules as they might see fit, affecting the water rights of their citizens.

The administrative system of each State would have no difficulty in distributing the interstate waters. The upper State would simply have to see to it that gates within its borders were closed in times of shortage to the proper extent and in the proper order to insure the satisfaction of prior rights in the lower State. The administrative system of the lower State would then have unhampered control within that State's boundaries.

Subject to the limitation that they could not interfere with the property of the United States, the States would retain, of course, their right to have the last word with regard to all rights within their borders, and so whatever power they possess to say that the water rights of their citizens shall not be used beyond the confines of the State would be unhampered.

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The sovereign powers of the State could be exercised over all property within the State properly subject thereto.

Whatever rights the States have to sue on their own behalf or for the protection of the rights of their citizens would, of course, remain unimpaired; but such suits would probably be unnecessary, as all interstate controversies would arise, in the first instance, from conflicts between individuals, and they could and would be settled by litigation between individuals.

In order to decide this case, it is perhaps not necessary to find a rule applicable to other situations. However, Federal ownership lessens the difficulty of apportioning the water of interstate streams when the States have different systems of water law.

As we have seen, any division between States as such, if logically made, would have to disregard vested rights and the important developments built up upon them. If, on the other hand, vested rights are to be protected, and so the waters apportioned regardless of State lines, no rule can be found that would uphold local systems when those systems differ, unless it is based on the Federal title. This is so because riparian rights and appropriation rights can have no relation to each other unless they come from a common source. In a contest between them, in the absence of common origin, priority could not be the test because the riparian right always existed and therefore would always be first.

Here the Federal title resolves the difficulty. The United States, as sole owner of both land and water,

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grants both riparian and appropriation rights. The riparian grantee takes subject to all appropriation rights previously granted. He has the right to share what is left of the stream with the United States and its other grantees of riparian rights.

Inasmuch as the United States still continues to grant appropriation rights, after having granted some riparian rights, the late grantees of riparian rights, taking subject to such appropriations, must share with the former riparian grantees upon that basis. The stream as to them is diminished by the subtraction of all appropriation rights, while as to the earlier riparian grantees it is only diminished by the still earlier appropriations.

The difficulties here presented arise and have been fairly successfully overcome in California and all the other dual system States. They occur in the adjustment of the rights of late appropriators with those of prior grantees of riparian land. The matter becomes a practical one when a riparian owner seeks to enjoin a subsequent appropriator who takes water above him on the stream; and when, on the other hand, an appropriator seeks to enjoin a prior riparian owner above him from making an excessive, unreasonable, or nonriparian use to his detriment. In strict theory the nonriparian user, be he the owner of riparian land or not, has no rights as against riparian owners who would be affected by his use, unless he can show a grant of some kind from them; and so any nonriparian use that he makes is illegal against them, and likewise any use that they make

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can not be objected to by him as unreasonable. However, in practice, the nonriparian use is generally, if not always, permitted, unless and until it interferes with the actual needs of the riparian owners; and often the unreasonable uses of the riparian owner are restrained when they interfere with the nonriparian use.

This can not be done upon any theory that the riparian owners as a whole do not own the stream or that their rights, as against the rest of the world, are confined to their actual needs, as all nonriparian uses are made or permitted by riparian owners; but it is rather a widening in one way and a narrowing in another of the rights of riparian owners themselves.

A dog-in-the-manger policy, enforced against one who has been granted an imperfect interest in the stream, is abhorrent. Likewise the making of a nonriparian or an unreasonable riparian use as against an established use, though it be itself nonriparian and imperfect in right, offends ideas of justice. Consequently, the courts in many instances have decided as we have said. (See the full discussion of this subject and cases cited in *Wiel, Water Rights*, 3d ed., sec. 821 *et seq.*)

In California the courts now refuse to enjoin a nonriparian use that is not interfering with present needs but declare the riparian owners' rights so they will not be lost by adverse possession. (*Wiel, Water Rights*, 3d ed., secs. 802 and 833.)

Original Federal ownership puts these adjustments upon a sure foundation. The United States holds

its water and its land to be granted as appropriation or riparian rights as the case may be, and in accordance with the local law. These grants are made in vast areas, and it is not to be supposed that it intends by making one class of grants to unduly limit itself in making others. The rights granted should be construed in the light of the Federal policy, and when the two classes of grants are near enough together to conflict, the riparian rights can well yield its minor incidents to carry out the Federal policy with regard to the other rights. Giving the riparian land, as against all subsequent appropriations, a full right to such water as it needs, reasonably used, protects the riparian grant as fully as it can properly demand protection.

In practice a nice adjustment between riparian rights in one State and appropriation rights in another State would seldom be necessary. The pure riparian States are far distant from the pure appropriation States, and between them are situated dual system States in which irrigation is practiced extensively only in their western portions.

Irrigation generally takes place within the watershed, and the use of large quantities of water when the stream is high tends, by storage in the land and the slow return of such waters, to increase the flow of the stream beyond what it would naturally be in the low flow season. The storing of the flood waters in reservoirs and releasing it later has the same effect. These effects are especially apparent upon large streams.

Between rights in pure appropriation States and riparian rights in dual system States conflicts would seldom arise except between water users closely adjoining the boundary line. There a nice adjustment can be made, practically as such adjustments are made in the dual system States themselves.

Even if a determination of rights on interstate streams upon the basis of the Federal title and grants from the Federal Government were not made necessary, as, we contend that it is, by the law, it would still be the most equitable method to follow. The Federal Government, when all of the land in question was included in the Territories and before State lines were drawn, made its grants without any regard to where those lines would run. Eastern Colorado was in the beginning a part of Kansas. Utah was included within New Mexico, and Nevada and western Colorado were at first parts of Utah. To readjust the rights so granted to some idea of a right of the States, as now formed, to have a division on some other basis, would seem to be highly inequitable. Furthermore, a determination upon the basis of the Federal grants is the only one that fits the various systems of water law now prevailing and so makes it possible to reconcile conflicts between States having different systems, without disturbance of present rights.

(3) Ownership by the superior sovereign, the United States, of all ungranted water, and the Federal origin of all private vested rights in water, necessitate the ignoring of State lines.

What we are dealing with here is the question whether the property rights in this stream are affected by the fact that the stream is crossed by the line between the two States.

It is obvious that if the entire course of the stream were in one State these rights in its waters would in legal contemplation apply to and affect the whole stream from its source to its mouth. This would be so whether the rights were appropriation rights and so absolute in character, or riparian rights and therefore relative. A first appropriator, having the right to use ten cubic feet of water per second on a thousand acres of land at the mouth of the stream, would be entitled to enjoin a diversion made at the source, if he could prove that such diversion interfered with his getting the full amount of water that he was entitled to; similarly, a riparian owner at the mouth of the stream could enjoin a diversion at the source, if it prevented his getting his fair share of the whole stream.

Does the fact that the stream flows partly in one State and partly in another make any difference? If we have succeeded in establishing our basic proposition of Federal ownership, the answer to this question will be found in the consideration of the relation of the United States, as contrasted with that of the States, to the property which belongs to the United States.

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The two States here are litigating as political entities having the right to exercise certain of the powers of independent sovereigns. One of them takes the position that such powers as our States possess make them, in the last analysis, the owners of all property within their borders, and entitle them to settle all controversies with regard to property situate within their joint boundaries as they would if they were independent Nations. It is claimed therefore on its behalf that all property rights within the States, regardless of who are the proprietors of them or how their titles were derived, are included in the larger titles of the States and stand or fall therewith.

The questions then are simply, first, whether the property rights of the United States in the public lands and the water flowing thereon are held subject to the will of the United States as a soverign which is superior to the States and supreme in that field, or are held subject to State sovereignty; second, whether the property rights granted by the United States to individuals are held by them as grants from a superior sovereign and protected by that sovereign's constitution and laws, or are held, in the last analysis, as coming from the States and as being subject to destruction by the States, so far as any other sovereign power is concerned; and, third, whether any principle of the relation of the Federal Government to the States compels, or any grant of power to the States permits, State boundaries to control water rights owned by the United States or its grantees.

(a) State lines can not affect rights acquired before the States were created; therefore, in no event could a division between the States wholly disregard private vested rights.

It is clear that grants of water rights, made by the United States before the creation of the States, were not affected by the changing boundary lines of the Territories, and that those rights remain as then created, now that the States have been admitted.

Whether the power of Congress over innavigable waters within the States is limited or unlimited, it is settled that the power of Congress over them, before the States were created, was plenary. See

Shively v. *Bowlby*, 152 U. S. 1;
U. S. v. *Winans*, 198 U. S. 371;
Winters v. *U. S.*, 207 U. S. 564.

The act of 1866 provided that the owners of vested rights in water should "be maintained and protected in the same;" and the act of 1870 declared that all patents should be subject to such rights.

When the States came they found these rights existing. They were vested rights in real property granted not by them nor depending for their existence in any way upon their laws, but granted by the United States, as the proprietor and full sovereign of the whole territory, and protected by its constitution.

These rights can not be bound up in the fortunes of the States as such. New States may be created out of those now existing, or new boundaries between the States may be made. Even the States might cease to exist without such rights being affected.

Nebraska was admitted into the Union in 1867; Colorado, in 1876; Montana, North Dakota, South Dakota, and Washington, in 1889; Idaho and Wyoming, in 1890; Utah, in 1896; and New Mexico and Arizona, in 1906. It will be seen, therefore, that many of the earliest and most valuable water rights date back to territorial days. Even on the Laramie River one of the ditches, and one for which Wyoming seeks protection in this suit, was constructed, according to the list of priorities given in Wyoming's brief (p. 24), in 1868, which was before the admission of Colorado to the Union.

If we are right in our view that State lines can not affect these rights that were acquired when the States were territories, no division of waters between States could be made disregarding vested rights in general, regardless of what the position of rights acquired after the creation of the States might be.

(b) The sovereignty in the United States is vested in the whole people and not in any subdivision of them, and the control and disposition of the property which belongs to the whole people is vested exclusively in Congress.

As was said by Mr. Cooley (Const. Lim., 7th ed., p. 56), "the theory of our political system is that the ultimate sovereignty is in the people from whom springs all legitimate authority." Chief Justice Marshall, in *Cohens* v. *Virginia* (6 Wheat. 264, 389) makes it clear that the people, in whom rests the sovereignty, are not the people of the States as such but the whole people of the Nation.

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Our Federal and State governments are merely the means through which the sovereign, which is superior to and behind them both, works its will; and the State constitutions, as well as the activities of the Federal Government, must conform to the Constitution of the United States, which is itself but the creature of the sovereign people. (*Chisholm* v. *Georgia*, 2 Dall. 419, 470–1.) It is elementary that the Federal power is supreme in its sphere.

McCulloch v. *Maryland*, 4 Wheat. 316, 427.
Claflin v. *Houseman*, 93 U. S. 130, 136;
Mondou v. *New York Ry.*, 223 U. S., 1, 57.

Even in the absence of any express grant, Congress would have the power to control and dispose of the property which belongs to the whole people, but Congress is given the power expressly. The grant is without limitation. It is "to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States."

The proposition that the control and disposition of the lands and other property of the United States are lodged exclusively in Congress has been examined repeatedly by this court in varying applications and always decided in the affirmative. Among the cases which apply it are:

Wilcox v. *Jackson*, 13 Pet. (1839) 498, 516.
United States v. *Gratiot*, 14 Pet. (1840) 526, 537.
Jourdan v. *Barrett*, 4 How. (1846) 168, 184.
Irvine v. *Marshall*, 20 How. (1857) 558.
Gibson v. *Chouteau*, 13 Wall. 92, 99.
McCarthy v. *Mann*, 19 Wall. 20.

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Van Brocklin v. *Tennessee*, 117 U. S. 151, 167.

United States v. *Insley*, 130 U. S. 263.

Redfield v. *Parks*, 132 U. S. 239.

Shively v. *Bowlby*, 152 U. S. 1, 50, 52.

Mann v. *Tacoma Land Co.*, 153 U. S. 273, 283.

Camfield v. *United States*, 167 U. S. 518, 525.

United States v. *Rio Grande Dam & Irrigation Co.*, 174 U. S. 690, 703.

Stearns v. *Minnesota*, 179 U. S. 223, 251.

Gutierres v. *Albuquerque L. & I. Co.*, 188 U. S. 545, 555.

Kansas v. *Colorado*, 206 U. S. 46, 89.

Light v. *United States*, 220 U. S. 523.

United States v. *Grimaud*, 220 U. S. 506.

Hallowell v. *United States*, 221 U. S. 317, 324.

United States v. *Midwest Oil Co.*, 236 U. S. 459, 474.

Utah Power & Light Co. v. *United States*, 243 U. S. 389.

(c) To allow State lines to limit the United States, or its grantees, in the use or protection of their water rights would be to deny to Congress the right to control and dispose of the property of the United States. Government grants of water rights are made regardless of State lines.

It is impossible to reconcile any controlling effect of State lines upon the use by the United States of the water belonging to it with exclusive and unlimited power in Congress to control the Federal property.

When the States were created no grant of power over such property was given to them and the

Federal Government in no way restricted itself as to how or where its property should be used; on the contrary, the States were required to disclaim any title to the public lands, including, of course, all their incidents, and to declare that they should be at the sole and entire disposition of the United States. Clearly the United States is free to use its property as it sees fit, unless the States have some inherent power over such property and to admit such a power in the States would be to deny that of Congress, and even to deny the paramount sovereignty of the United States within a field set apart to it by the Constitution in the most positive terms.

The uses which the Federal Government has made of the water belonging to it, including its grants of water rights to individuals, have been only such as a private proprietor could make under the common law, if the theater of such proprietor's actions were confined to one State. What the United States has done on its reclamation and other projects has been to use its water on its own lands and to a certain extent on the lands of others wherever it thought best, regardless of State lines. In making its grants of water rights it has given rights in the whole stream and not in particular parts of it.

Conceding, *arguendo*, that a private proprietor, similarly situated, could not do this, especially if the State forbade it, his lack of power would come from his being subject to State authority. It would be because he could not do with his own property that which the State, as his sovereign, forbade and had

the right to forbid. Must it not follow that if the United States can not reclaim its lands situate on both sides of a State line, using the water where it thinks best, regardless of that line, the States and not the United States are in reality the paramount owners of the property of the United States and the true sovereigns with regard to it? If the States can say to the United States "You must use your property here, and not there," it can only be because they have the sovereign right to control that property; in which case they, instead of Congress, become the disposers of the property of the United States.

The Federal Government, being competent to use the water belonging to the United States, regardless of State lines, can grant that right to others. As was said in *Irvine* v. *Marshall*, *supra* (20 How. 558, 563), the control and the disposing power of Congress over the Federal property is not dependent upon locality but "must be exclusively in the United States anywhere and everywhere within their own limits." The United States "can prohibit absolutely or fix the terms upon which its property may be used" (*Light* v. *United States*, supra, 220 U. S. 523, 536); and so, it follows, can allow its grantee to use the water where it could use it itself. To deny that right would be to put an important limitation upon the disposing power of Congress.

We are not dealing here with the power of the States to condemn water rights, after they have come into the hands of private persons, or with their right, either before or after such acquisition, to seek as against

another State or its citizens the definition, the setting off or the protection of those rights, but merely with the right of the United States to give to the individual a vested interest in water with the right to use and protect it as granted, unless and until it is condemned and paid for. A water right granted for use on land immediately across the State line would be practically useless unless the future diversions from the stream above and on the other side of the line had to respect the prior grant. The United States can place a restriction or burden of this character upon its own property which can not be taken away from the Federal grantee, at least without compensation.

It can not well be argued that Congress has not intended to grant water rights that shall be effective regardless of State lines. As we have already pointed out, the Act of 1866 provided that the "owners of such vested rights shall be maintained and protected in the same;" and the Act of 1870 provided that all patents granted should be subject to such rights.

Almost all of the reclamation projects depend upon interstate waters. The grants of water rights to the settlers on these projects are grants of rights in all the project waters. If such rights were invalid or could be construed as intended to be affected by State lines, they would have to be readjusted or modified; and that would almost certainly disastrously affect a great number of the projects.

Under the North Platte project, for instance, lands in both Wyoming and Nebraska are irrigated; and it happens that the greater part of the lands, that it

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was found feasible to include in the project, are situated in Nebraska. The water comes from the North Platte River, which flows through both States; and, since all but the high-water flow was already appropriated, the project depends largely upon waters stored in the Pathfinder Reservoir, which is situate in Wyoming. The whole project was founded upon that reservoir. The grants of water rights to the Nebraska settlers are grants of rights in the water stored in that reservoir, and they derive almost their whole value from that fact.

(d) Rights granted by the United States to individuals are not included in and do not stand and fall with the rights of the States.

Colorado's contention, that this controversy should be decided as though it were one between independent nations, falls to the ground when once it is conceded that the water rights here involved come from the United States and are protected by its sovereign power.

The reason that the private rights of a country's citizens are included in the larger rights of the nation, and stand or fall with those rights, is that private rights come from, are dependent upon, and may be destroyed by the sovereign power of the nation. This is clearly set forth in the passages from Vattel's Law of Nations (1872 edition, Chitty), quoted in Colorado's brief (pp. 16–19).

If a political entity can not order its internal affairs as it will, free from external control, and, in the society of nations, speak the last word with

regard to all within its dominions, it is not an independent nation. As was said by Chief Justice Marshall in *Schooner Exchange* v. *McFadden* (7 Cranch, 116, 136):

> The jurisdiction of the nation, within its own territory, is necessarily exclusive and absolute; it is susceptible of no limitation, not imposed by itself. Any restriction upon it, deriving validity from an external source, would imply a diminution of its sovereignty, to the extent of the restriction, and an investment of that sovereignty, to the same extent, in that power which could impose such restriction. All exceptions, therefore, to the full and complete power of a nation, within its own territories, must be traced up to the consent of the nation itself. They can flow from no other legitimate source.

If the United States never owned any property in Colorado and Wyoming, and all private rights in those States came from the States themselves, existed by virtue of the sovereign power of those States, and could be destroyed by that power, it could be said that the private rights here involved would stand or fall with the larger rights of the States. In such a case private rights in an interstate stream would be limited by the division made between the two States, upon the theory that the States had rights against each other *in invitum* and that the States, in granting rights to their citizens, had assumed to dispose of that which was not theirs to give. If either State, in the last analysis, owned

all of the rights it assumed to deal with, except as against the other State, it could by its laws allow its citizens to have vested rights in them, but to the extent that it would have to account to the other State it, of course, would, as against that other State, have nothing to grant.

The situation here is in fact far otherwise. The ungranted waters of the Laramie River, if there are any, are the property of the superior sovereign, the United States, and so are wholly removed from State control or the effect of litigation between the States. The water grants came from the United States, exist by virtue of the sovereign power of the United States, are protected by the Fourteenth amendment of the Constitution of the United States, and can only be destroyed by the exercise of the sovereign power of the people of the whole Nation.

The cases of *Kansas* v. *Colorado*, supra (206 U. S. 46), and *Rickey Land and Cattle Company* v. *Miller & Lux*, supra (218 U. S. 258), are not authorities to the contrary. In *Kansas* v. *Colorado*, the rights of the private persons and corporations, who were made defendants with the State of Colorado, were not considered; and it was said (p. 85) that if the cause failed against Colorado it would fail also against them. Similarly, in the *Rickey* case it was said (p. 261) that in a suit between two States over the waters of an interstate stream, if a private owner should derive any advantage from the decision, it would not be in his own right, but by reason of and subordinate to the rights of his State.

In neither of these cases were the rights of the United States as a proprietor before the court or in any way considered. Also, in neither of them were the rights of grantees of the United States as such taken into account or presented to the court for consideration. We respectfully submit that all that was in mind in those cases, so far as it affects the question here, was the situation that would result if private rights in nonnavigable waters came from the States and depended for their existence upon inherent State power.

In *Howell* v. *Johnson*, supra, 89 Fed. 557, 559, water rights in a stream flowing from Montana into Wyoming were involved. The district court said: "It is urged that in some way the State of Montana has some right in these waters in Sage Creek or some control over the same. It never purchased them. It never owned them." Again, the court said that to hold that rights in Montana were superior to a prior right in Wyoming, would be to "uphold the view that a State might interfere with the primary disposal of the land of the National Government," and "when a party has obtained title to property from the National Government, the State Government has no right to destroy that title, except under the power of eminent domain. The State of Montana can not step in, and say 'the right to the water of Sage Creek, which the plaintiff acquired under the laws of Congress, you can not exercise in this State.'"

In a case involving rights in this same stream (*Bean* v. *Morris*, 221 U. S., 485), this court recognized the im-

portance vested rights would have in a controversy between States. In that case the prior vested rights of Morris, an appropriator in Wyoming, were upheld against the rights of water users in Montana. The case was decided upon the principle that the two States would be presumed to be willing to ignore boundaries and permit overlapping rights, and the question of whether Morris was not protected by the Constitution, was not passed upon. However, the opinion, which was delivered by Mr. Justice Holmes keeps in view the importance that vested rights, protected by the Constitution, would have in a controversy between States. It says (p. 486):

> We know no reason to doubt, and we assume, that, subject to such rights as the lower State might be decided by this court to have, and to *vested private rights, if any, protected by the Constitution*, the State of Montana has full legislative power over Sage Creek while it flows within that State.

and again (p. 488):

> So it is unnecessary to consider whether Morris is not protected by the Constitution; for it seems superfluous to fall back upon the citadel until some attack drives him to that retreat.

The States' power to condemn private rights is immaterial here. It is not because a nation can acquire the rights of its subjects, by making just compensation, that its rights, as an independent sovereign power, include the lesser rights of its citizens. In our States the possession of the

power to condemn private property rights is perfectly consistent with the fact that such rights come from and are protected by another and superior sovereignty. In this case, the particular private rights in question can not stand or fall with the rights of the two States, because they come from the United States and are protected by the Fourteenth Amendment, which brushes the States aside and throws its mantle of protection over the individual directly.

(e) State equality, jurisdiction, or preservation does not demand that State lines shall control.

To admit the right of the United States to use its property in water regardless of the artificial boundaries created by State lines, is merely to say that the judgment of Congress and not that of the States is to control the use of the Federal property. That property is "constructively without the legal territorial jurisdiction of individual States in every respect, and for every purpose" (*McCulloch* v. *Maryland*, 4 Wheaton 316, 395). Its being so does not interfere with the jurisdiction of the States, everywhere within their boundaries, over all their proper subjects. It does not deny State powers as such, but simply limits the field of their operation. Those powers remain intact and are the same in all of the States, regardless of how much or how little Federal property may be within them, or what use the Federal Government makes of it. State police power, subject to the protection of private rights given by the Constitution, remains fully operative

over all persons and property subject thereto, including the Federal grantees and their property rights. This court said in *Van Brocklin* v. *Tennessee*, supra:

> We take it to be a point settled beyond all contradiction or question that the State has jurisdiction of all persons and things within its territory which do not belong to some other jurisdiction, such as the representatives of foreign governments, with their houses and effects, and property belonging to or in use of the Government of the United States. Coe v. Errol, 116 U. S. 517–524.

Disregarding State lines here does not interfere with equality between the States. It is true that the new States are admitted on an equal footing with the old, but that equality is one of powers, not of subjects upon which to exercise those powers. There may be more public land in one State than another, or a greater proportion of public land, and so less land under State control in one State than another, but no one would now argue, for instance, that State equality demands a State power to tax the Federal property. The Federal Government may reserve its land in one State, for forest purposes, for instance, and it may do so indefinitely (*Light* v. *United States* supra), while making no reservations in another. No inequality between the States is created thereby; nor is it by the Federal Government's using or granting its property in water for use on either side of a State line.

State preservation does not depend upon the States having the power to say where these water rights shall be used. The waters belonging to the Federal Government are no more essential to the existence and prosperity of the State than are the lands over which it flows and without control of which the water could not be obtained or used.

The possibility that the United States might so dispose of the waters of a stream as to work injustice, can not be considered here. (See *Stearns* v. *Minnesota*, 179 U. S. 242). Such possibilities are always inherent in the possession of ultimate power. The final right must rest somewhere, and, with regard to the Federal property, it rests in the Federal Congress. The safeguard is the participation of all of the States and all of the people in the determination of the Federal action.

Viewed as property, the public domain is strictly national. (*Irvine* v. *Marshall*, *supra*.) While there are references in some opinions to the holding of property by the United States in a "private capacity," or as an "ordinary proprietor" (see *Ft. Leavenworth Co.* v. *Lowe*, 114 U. S. 525, 526; *Ward* v. *Race Horse*, 163 U. S. 504, 514; *Chicago, R. I. & P. Ry. Co.* v. *McGlinn*, 114 U. S. 525, 547), these were merely convenient expressions to distinguish the general mass from property over which the Government has exclusive jurisdiction or property devoted to strictly Governmental purposes. Properly speaking, the United States never holds property in a private capacity, but always for public objects. (*Van*

Brocklin v. *Tennessee*, 117 U. S. 161.) It has been repeatedly held by this court that the public lands are held in trust for the benefit of all the people. *Light* v. *United States*, 320 U. S. 523, 537; *Causey* v. *United States*, 240 U. S. 399, 402. The circumstance that public lands and the waters on them are situate within a particular State can not give to that State or its people any greater power over them or interest in them as property than is shared by all the States and people of the country.

The very purpose of the people, in granting the express power we have been considering, was to insure that the disposition, control and management of the common estate should be vested in the legislature of the common Government. The power of Congress is absolutely exclusive in this field and it is so because it is the property of the whole people that is dealt with.

In *McCulloch* v. *Maryland*, *supra*, this court said (p. 427):

> If any one proposition could command the universal assent of mankind we might expect it would be this—that the Government of the Union, though limited in its powers, is supreme within its sphere of action. This would seem to result, necessarily, from its nature. It is the Government of all; its powers are delegated by all; it represents all, and acts for all. Though any one State may be willing to control its operations, no State is willing to allow others to control them. The Nation, on those subjects on which it can act, must necessarily bind its component parts. * * *

> It is of the very essence of supremacy to remove all obstacles to its action within its own sphere, *and so to modify every power vested in subordinate governments, as to exempt its own operations from their own influence.* This effect need not be stated in terms. It is so involved in the declaration of supremacy, so necessarily implied in it, that the expression of it could not make it more certain. We must, therefore, keep it in view while construing the Constitution.

And again in the same case (p. 431),

> Would the people of any one State trust those of another with a power to control the most insignificant operations of their State government? We know they would not. Why, then, should we suppose that the people of any one State should be willing to trust those of another with the power to control the operations of a government to which they have confided their most important and most valuable interests? In the legislature of the Union alone, are all represented. The legislature of the Union alone, therefore, can be trusted by the people with the power of controlling measures which concern all, in the confidence that it will not be abused.

"In other words," said this court in the case of *South Carolina*, 199 U.S. 437, 456, "We are to find in the Constitution itself the full protection to the Nation, and not to rest its sufficiency on either the generosity or the neglect of any State."

CONCLUSIONS AS TO PRINCIPLES GOVERNING THIS CONTROVERSY AND THEIR APPLICATION.

We respectfully submit that in view of the foregoing the principles that should govern the determination of this cause are as follows:

1. The substantial rights which exist in nonnavigable waters, while they are in their natural state, are rights of use. These rights of use are real property rights of the highest dignity and value under both the riparian and the appropriation systems. These rights at common law are part and parcel of the lands bordering on the waters in which they exist and they belong to the owners of such lands as incidents of their title to the lands themselves, and may be transferred with or without the land. A sole owner of all the riparian land may grant such rights as he pleases, making them absolute or relative as he sees fit and allowing their use within or without the watershed.

2. The United States, as the sole owner of the public domain, originally owned all of the waters flowing thereon, or, more accurately, all of the rights to their use, as a proprietor, and so could transfer them as it saw fit. The United States under the Act of 1866 grants these rights either as appropriation or riparian rights, or both, using the local laws as subordinate instrumentalities only. All rights not so granted still belong to the United States and may be reserved or otherwise disposed of as Congress wills.

3. The power of Congress over the property of the United States is without limitation and exclusive, and so is wholly free from State control. The States have no power over the innavigable waters within their borders, except the same power that they have over lands, namely, the police power and the power of eminent domain. These powers can not be exercised upon the property of the United States.

4. The power of the United States to use the water rights belonging to it or to permit their use by others was not controlled by territorial lines fixed or changing, and is not controlled by State lines. Ownership of a water right necessarily includes the ownership of the right to use water at a particular place, together with the right to have the water flow down to that place uninterfered with by persons above.

5. The Federal Government's grantees of water rights take title to those rights with all their incidents, as vested rights in real property, protected by the Fourteenth Amendment and the laws of Congress. Their rights can only be divested by due process of law and must be respected until so divested.

6. The States, either as the ultimate owners of property within their borders (except that belonging to the United States) or otherwise, own only such water rights as have been granted by the United States to them or to others for use on lands within their borders.

Applying these principles to the case at bar, we submit that the particular diversion made in Colorado and complained of by Wyoming should not

be enjoined unless it does or will interfere with prior appropriations, that is to say, prior grants by the Federal Government, of water in Wyoming; but if it does or will so interfere, it should be enjoined to that extent.

JOHN W. DAVIS,
Solicitor General.

FRANCIS J. KEARFUL,
Assistant Attorney General.

JOHN F. TRUESDELL,
ETHELBERT WARD,
Special Assistants
to the Attorney General.

DECEMBER, 1917.

O

Office Supreme Court, U. S.
FILED.
APR 7 1913
JAMES H. McKENNEY,
CLERK.

REPLICATION TO THE ANSWER OF DEFENDANT, THE STATE OF COLORADO

SUPREME COURT OF THE UNITED STATES

No. [redacted] Original

THE STATE OF WYOMING, COMPLAINANT,

v.

THE STATE OF COLORADO, THE CHEESLEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION,

DEFENDANTS.

IN EQUITY

In the Supreme Court of the United States

No. 8 ORIGINAL

THE STATE OF WYOMING,
Complainant,
vs.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, a municipal corporation, The Laramie Poudre Reservoirs and Irrigation Company, a corporation,
Defendants.

IN EQUITY

REPLICATION TO THE ANSWER OF DEFENDANT, THE STATE OF COLORADO

The complainant, The State of Wyoming, repliant, saving and reserving unto itself all and all manner of advantage of exception to the manifold insufficiencies of the answer of the defendant, The State of Colorado, for replication thereunto saith that it will aver and prove its bill of complaint herein to be true, certain and sufficient in the law to be answered unto, and that the said answer of the said defendant is uncertain, untrue and insufficient to be replied unto by this re-

pliant; without this, that any other matter or thing whatsoever in the said answer contained, material or effectual to be replied unto, confessed and avoided, traversed or denied, is true; all which matters and things this repliant is, and will be, ready to aver and prove as this honorable court shall direct, and humbly prays as in and by its said bill it hath already prayed.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

N. E. CORTHELL,
JOHN W. LACEY,
Of Counsel.

The Supreme Court, U. S.
APR 7 1913
JAMES H. MCKENNEY,

THE REPLICATION OF THE COMPLAINANT, THE STATE OF WYOMING, TO THE JOINT AND SEVERAL ANSWER OF THE DEFENDANTS, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY AND THE GREELEY-POUDRE IRRIGATION DISTRICT.

SUPREME COURT OF THE UNITED STATES

No. [redacted] 8

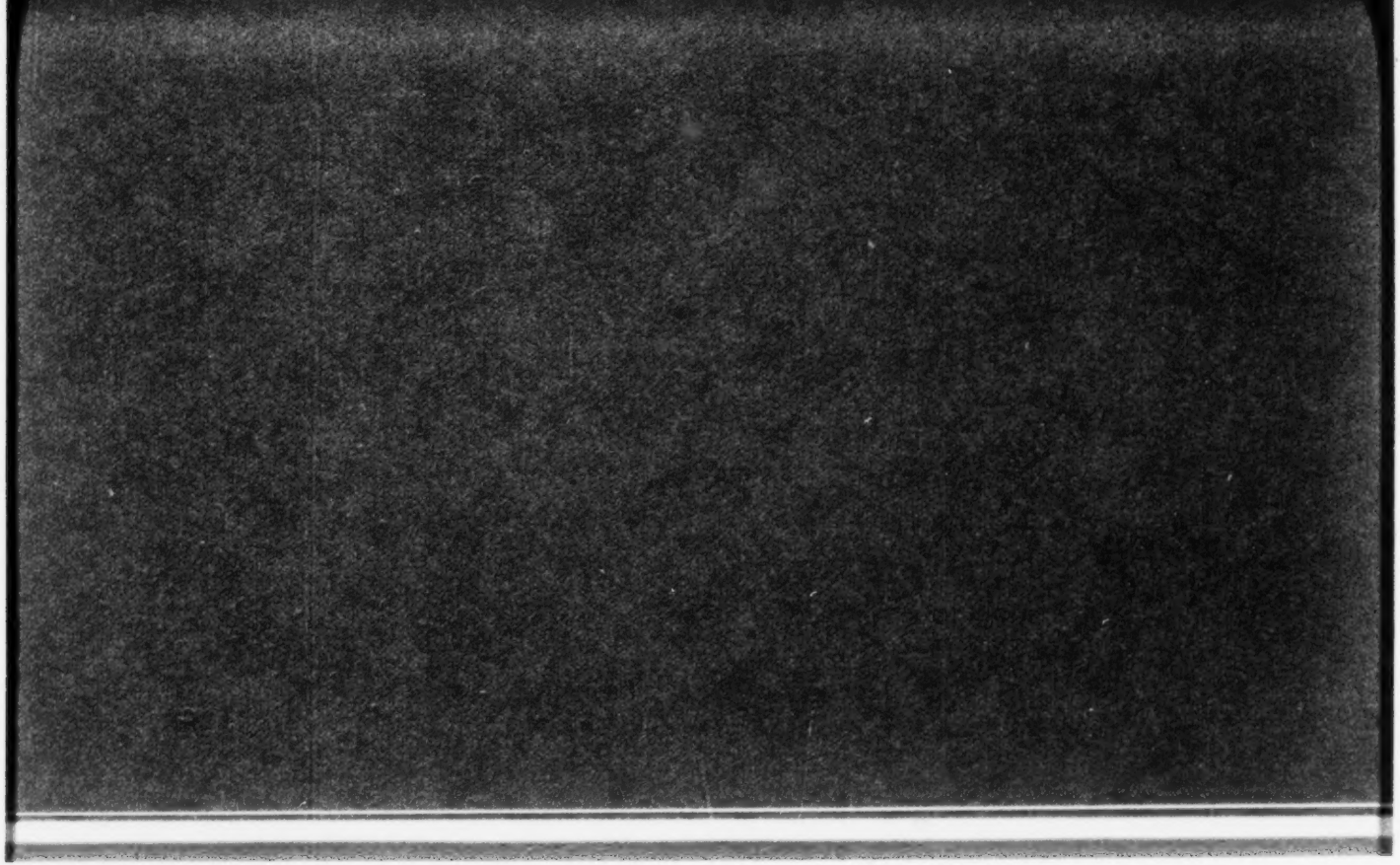
THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION,

DEFENDANTS.

IN EQUITY.



In the Supreme Court of the United States

No. 8 Original

THE STATE OF WYOMING,
Complainant,
vs.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, a municipal corporation, The Laramie Poudre Reservoirs and Irrigation Company, a corporation,
Defendants.

IN EQUITY

THE REPLICATION OF THE COMPLAINANT, THE STATE OF WYOMING, TO THE JOINT AND SEVERAL ANSWER OF THE DEFENDANTS, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY AND THE GREELEY-POUDRE IRRIGATION DISTRICT.

This repliant, The State of Wyoming, saving and reserving unto itself all and all manner of advantage of exception to the manifold insufficiencies of the joint and several answer of the defendants, The Laramie-Poudre Reservoirs and Irrigation Company and The Greeley-Poudre Irrigation District, to the bill of com-

plaint of this repliant, for replication thereunto saith that it will aver and prove its said bill to be true, certain and sufficient in the law to be answered unto, and that the said answer of the said defendants is uncertain, untrue and insufficient to be replied unto by this repliant; without this, that any other matter or thing whatsoever in the said answer contained, material or effectual to be replied unto, confessed and avoided, traversed or denied, is true; all which matters and things this repliant is, and will be, ready to aver and prove as this honorable court shall direct, and humbly prays as in and by its said bill it hath already prayed.

DOUGLAS A. PRESTON,
Attorney General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

N. E. CORTHELL,
JOHN W. LACEY,
Of Counsel.

IN THE

Supreme Court of the United States

NO. 7 5 3 ORIGINAL.

THE STATE OF WYOMING, *Complainant*,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, *Defendants*.

IN EQUITY.

APPLICATION FOR APPOINTMENT OF COMMISSIONER TO TAKE TESTIMONY.

DOUGLAS A. PRESTON,
Attorney-General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

FRED FARRAR,
Attorney-General of the State of Colorado and Solicitor for said State, Defendant.

CHARLES F. TEW,
D. E. CARPENTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.

JULIUS C. GUNTER,
Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

PRESS OF BYRON S. ADAMS, WASHINGTON, D. C.

IN THE

Supreme Court of the United States

No. 8. ORIGINAL.

THE STATE OF WYOMING, *Complainant*,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, *Defendants*.

IN EQUITY.

APPLICATION FOR APPOINTMENT OF COMMISSIONER TO TAKE TESTIMONY.

Come now the complainant and the defendants in the above entitled cause, by their respective attor-

neys, and move the Court that Clyde N. Watts, of Cheyenne, State of Wyoming, and Newton Garbutt, of Denver, State of Colorado, be appointed special commissioners to take the testimony in this cause as per stipulation hereto attached.

DOUGLAS A. PRESTON,
Attorney-General of the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

FRED FARRAR,
Attorney-General of the State of Colorado and Solicitor for said State, Defendant.

CHARLES F. TEW,
D. E. CARPENTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.

JULIUS C. GUNTER,
Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

IN THE

Supreme Court of the United States

No. 8. ORIGINAL.

THE STATE OF WYOMING, *Complainant*,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, *Defendants*.

IN EQUITY.

STIPULATION.

Subject to the order and consent of the Court, it is hereby stipulated by and between the complainant and defendants, by their respective attorneys, that Clyde M. Watts, of Cheyenne, State of Wyoming, be appointed a special commissioner to take and return the testimony in this cause, offered on behalf of the complainant.

That Newton Garbutt, of Denver, State of Colorado, be appointed a special commissioner to take

and return the testimony in this cause offered on behalf of the defendants, or any of them.

That each shall have the power of a Master in Chancery, as provided in the rules of this Court, but said commissioners shall not make any findings of fact or state any conclusions of law.

It is further stipulated that the taking of testimony on complainant's behalf shall begin on the 15th day of August, 1913, at such place as counsel for complainant may designate, ten days notice thereof to be given to counsel for defendants, and shall be concluded within one hundred days thereafter; and the taking of the testimony on behalf of the defendants shall commence on or before fifteen days after the conclusion of the testimony offered on behalf of the complainant and shall be concluded within one hundred days thereafter; and the testimony in rebuttal shall be commenced on or before ten days after the conclusion of the testimony offered on behalf of defendants, five days notice of the place being given, and shall be concluded within forty days thereafter.

The said commissioners shall receive, as agreed by the parties, as their sole compensation for all services and for all testimony taken and transcribed, the sum of fifteen cents per folio for the original transcript and the further sum of five cents per folio for each carbon copy thereof, together with actual and necessary traveling expenses incurred in the taking of the testimony as aforesaid. Dated this 26th day of May, 1913.

DOUGLAS A. PRESTON,
Attorney-General for the State of Wyoming and Solicitor and of Counsel for the Plaintiff.

FRED FARRAR,
Attorney-General of the State of Colorado and Solicitor for said State, Defendant

CHARLES F. TEW,
D. E. CARPENTER,
Solicitors for the Greeley-Poudre Irrigation District, Defendant.

JULIUS C. GUNTER,
Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

Supreme Court, U. S.
FILED.
APR 7 1919
JAMES H. McKENNEY,
Clerk.

APPLICATION FOR LEAVE TO FILE REPLICATIONS.

SUPREME COURT OF THE UNITED STATES

No. [redacted] ORIGINAL [redacted] 8

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION,

DEFENDANTS.

IN EQUITY

In the Supreme Court of the United States

No. 8 ORIGINAL

THE STATE OF WYOMING,
Complainant,
vs.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, a municipal corporation, The Laramie Poudre Reservoirs and Irrigation Company, a corporation,
Defendants.

IN EQUITY

APPLICATION FOR LEAVE TO FILE REPLICATIONS

Comes now the said complainant, The State of Wyoming, and hereby makes application to the said Honorable Court for leave to file its replication to the separate answer of the defendant, The State of Colorado, and its replication to the joint and several answer of the defendants, The Greeley-Poudre Irri-

gation District and The Laramie-Poudre Reservoi
and Irrigation Company, in said cause, and co
plainant will ever pray, etc.

DOUGLAS A. PRESTON,

Attorney General of the State of Wyomi
and Solicitor and of Counsel
for the Plainti

N. E. CORTHELL,
JOHN W. LACEY,

Of Counsel.

In the Supreme Court of the United States

No. 8 Original

THE STATE OF WYOMING,
Complainant,
vs.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, a municipal corporation, The Laramie Poudre Reservoirs and Irrigation Company, a corporation,
Defendants.

IN EQUITY

NOTICE

To The State of Colorado, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company,
Defendants.

You will please take notice that at the incoming of the Supreme Court of the United States at twelve o'clock M., at the Capitol Building, April 1, 1913,

or as soon thereafter as solicitors can be heard, th
above named complainant will appear by its solicitor
and present to said court an application for leave t
file its replication to the separate answer of the defend-
ant, the State of Colorado, and its replication to the
joint and several answer of the defendants, the Greeley-
Poudre Irrigation District and the Laramie Poudre
Reservoirs and Irrigation Company, in said cause:
when and where you may be present if you so desire.
A copy of which application is presented herewith.

DOUGLAS A. PRESTON,

Attorney General of the State of Wyoming
and Solicitor and of Counsel
for the Plaintiff.

N. E. CORTHELL,
JOHN W. LACEY,

Of Counsel.

STATE OF COLORADO,
County of Denver, } ss.

Service of the foregoing notice, by the delivery to me of a copy thereof with a copy of the foregoing application for Leave to File Replications, is hereby acknowledged, this _____ day of March, A. D. 1913.

_____

_____

_____

_____

_____

_____

Attorney General of the State of Colorado and Solicitor for said State,
Defendant.

_____

Solicitor for the Greeley-Poudre Irrigation District,
Defendant.

_____

Solicitor for the Laramie-Poudre Reservoirs and Irrigation Company,
Defendant.

Office Supreme Court, U. S.
FILED
JUN 4 1917
JAMES D. MAHER
CLERK

In the Supreme Court of the United States

OCTOBER TERM, 1[redacted] 1917

No. [redacted] 8

IN EQUITY.

THE STATE OF WYOMING,
Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS & IRRIGATION COMPANY,
Defendants.

MOTION TO ADVANCE CAUSE AND TO FIX TIME FOR FILING OF BRIEFS, AND NOTICE.

LESLIE E. HUBBARD,
Attorney General of the State of Colorado,
AND FRED FARRAR,
Solicitors for the Defendant, the State of Colorado.

JULIUS C. GUNTER,
Solicitor for the Defendant, The Laramie-Poudre Reservoirs & Irrigation Company.

DELPH E. CARPENTER,
Solicitor for the Defendant, The Greeley-Poudre Irrigation District.

The Clark QUICK-Printing Co., Lawrence 1332-34, Denver, Colo.

In the Supreme Court of the United States

OCTOBER TERM, 1916.

No. 7, ORIGINAL.

IN EQUITY.

THE STATE OF WYOMING,

Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS & IRRIGATION COMPANY,

Defendants.

MOTION TO ADVANCE CAUSE AND TO FIX TIME FOR FILING OF BRIEFS.

Come now the defendants herein, by their respective solicitors, and respectfully represent:

That on the 6th day of March, 1917, this Honorable Court ordered a re-argument of the above entitled cause, requesting counsel to direct their attention specifically to certain matters mentioned in said order, and instructed the Clerk to notify the Attorney General of the United States of such order for re-argument.

The defendants therefore respectfully move that this cause be advanced upon the docket and set for re-argument at a day as early as circumstances permit, and that a rule be entered fixing the time for filing the briefs herein, affording reasonable opportunity to the defendants to file briefs in reply to any that may be filed by the plaintiff and by the United States or any department of the Government.

Respectfully submitted,

LESLIE E. HUBBARD,
Attorney General of the State of Colorado,

AND FRED FARRAR,
Solicitors for the Defendant, the State of Colorado.

JULIUS C. GUNTER,
Solicitor for the Defendant, The Laramie-Poudre Reservoirs & Irrigation Company.

DELPH E. CARPENTER,
Solicitor for the Defendant, The Greeley-Poudre Irrigation District.

In the Supreme Court of the United States

OCTOBER TERM, 1916.

No. 7, ORIGINAL.

IN EQUITY.

THE STATE OF WYOMING,
Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS & IRRIGATION COMPANY,
Defendants.

NOTICE.

To the Honorable Thomas W. Gregory,
Attorney General of the United States,

and

To the Honorable Douglas A. Preston,
Attorney General of the State of Wyoming:

You are notified that on Monday, the 4th day of June, 1917, or as soon thereafter as counsel can be heard, the defendants herein will appear before the Supreme Court of the United States, at Washington, D. C., and ask leave to file and present a

motion herein, asking that this cause be advanced and set down for hearing, and that a rule be entered fixing the time for filing the briefs herein; a copy of which motion is hereunto attached.

Dated at Denver, Colorado, this 18th day of May, 1917.

LESLIE E. HUBBARD,
Attorney General of the State of Colorado,
AND FRED FARRAR,
Solicitors for the Defendant, the State of Colorado.

JULIUS C. GUNTER,
Solicitor for the Defendant, The Laramie-Poudre Reservoirs & Irrigation Company.

DELPH E. CARPENTER,
Solicitor for the Defendant, The Greeley-Poudre Irrigation District.

Supreme Court, U. S.
FILED
MAY 19 1916
JAMES D. MAHER
CLERK

NO. 7. ORIGINAL IN EQUITY. 1918

IN THE

SUPREME COURT

OF THE

UNITED STATES

THE STATE OF WYOMING,
Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, a corporation,
Defendants.

MOTION

DOUGLAS A. PRESTON,
Attorney General of Wyoming, of Counsel for Plaintiff.

FRED FARRAR,
Attorney General of Colorado, of Counsel for Defendant State of Colorado.

JULIUS C. GUNTER,
Attorney for Defendant Laramie-Poudre Reservoirs & Irrigation Company.

DELPH E. CARPENTER,
Attorney for Defendant Greeley-Poudre Irrigation District.

IN THE

SUPREME COURT

OF THE

UNITED STATES

THE STATE OF WYOMING,
Complainant.

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a Municipal Corporation, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, a corporation,
Defendants.

No. 7.
ORIGINAL IN EQUITY.

MOTION

Come now the above named parties by their respective counsel and show unto the court that the taking of evidence in said cause has been completed and that the parties have agreed upon an abstract thereof embracing such of the exhibits as may be readily reproduced, and to expedite the final hearing of said cause the parties do jointly move the court as follows:

1. That permission be granted to file herein for reference the original typewritten transcript of the evidence together with all exhibits introduced by the respective parties, and that the abstract of the testimony as agreed upon by the parties, together with the selected exhibits, be printed at the joint expense of the parties and filed herein in lieu of printing the entire transcript.

2. That an order be entered granting unto the plaintiff to and including July 15, 1916, within which to file a brief herein and granting unto the defendants to and including September 5, 1916, within which to file their briefs herein, and granting unto the plaintiff twenty days after the filing of the briefs on behalf of the defendants within which to file its reply brief.

3. That an order be entered herein advancing this cause upon the calendar and assigning it for argument upon the first day of the October, A. D. 1916, term of this court, or as soon thereafter within said term as to the court shall be convenient, and enlarging the time for oral argument to four hours upon each side.

DOUGLAS A. PRESTON,
Attorney General of Wyoming, of Counsel for Plaintiff.

FRED FARRAR,
Attorney General of Colorado, of Counsel for Defendant State of Colorado.

JULIUS C. GUNTER,
Attorney for Defendant Laramie-Poudre Reservoirs & Irrigation Company.

DELPH E. CARPENTER,
Attorney for Defendant Greeley-Poudre Irrigation District.

In the Supreme Court of the United States.

IN EQUITY.

NO. 20. ORIGINAL.

THE STATE OF WYOMING, Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, Defendants.

DEMURRER.

To the Honorable, the Judges of the Supreme Court of the United States:

The defendants, by protestation, not confessing or acknowledging all or any of the matters or things in the said bill of complaint contained to be true in such manner and

form as the same are therein set forth and alleged, demur to the said bill, and for cause of demurrer show:

I.

That said bill of complaint is wholly without equity, in that it does not state or show any such cause as doth or ought to entitle complainant to the relief sought or prayed for against these defendants or against either thereof, or to any relief whatever.

Wherefore, and for divers other good causes for demurrer appearing on the face of said bill, these defendants demur thereto and pray the judgment of this Honorable Court whether they or either of them shall be compelled to make further or any answer to said bill; and they humbly pray to be hence dismissed with their reasonable costs in this behalf sustained.

Attorney General of the State of Colorado, Defendant.

Solicitors for the Greeley-Poudre Irrigation District, Defendant.

Julius C. Hunter

.....

Charles A. Hayes

.....

Cogels Todd & Curran

.....

Solicitors for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

.....

.....

.....

.....

Of Counsel.

We hereby certify that we are solicitors and of counsel for each of the defendants above named, and that in our opinion the foregoing demurrer of said defendants respectively to the bill of complaint of the said State of Wyoming is well founded in point of law and proper to be filed in the above cause.

Barry Griffith

Julius C. Gunter

Charles D. Hazlett

Clyde E. Dawson

Solicitors and of Counsel for Defendants above named.

UNITED STATES OF AMERICA,
DISTRICT OF COLORADO, } ss.

Benjamin Griffith, being duly sworn, deposes and says that he is the Attorney General of the State of Colorado, one of the defendants named in the foregoing demurrer, and is authorized to verify the same on behalf of said defendant and the other defendants named, and that the foregoing demurrer is not interposed to delay the cause or any proceeding therein.

Benjamin Griffith

Subscribed and sworn to before me this 28th day of December, A. D. 1911.

My commission expires December 13, 1914

John B. Rote
Notary Public.

SUPREME COURT, U.S.
FILED
JAN 4 1937
CHARLES ELMORE CROPLEY
CLERK

No. 3, Original. In Equity.

In the Supreme Court of the United States

OCTOBER TERM, 1937

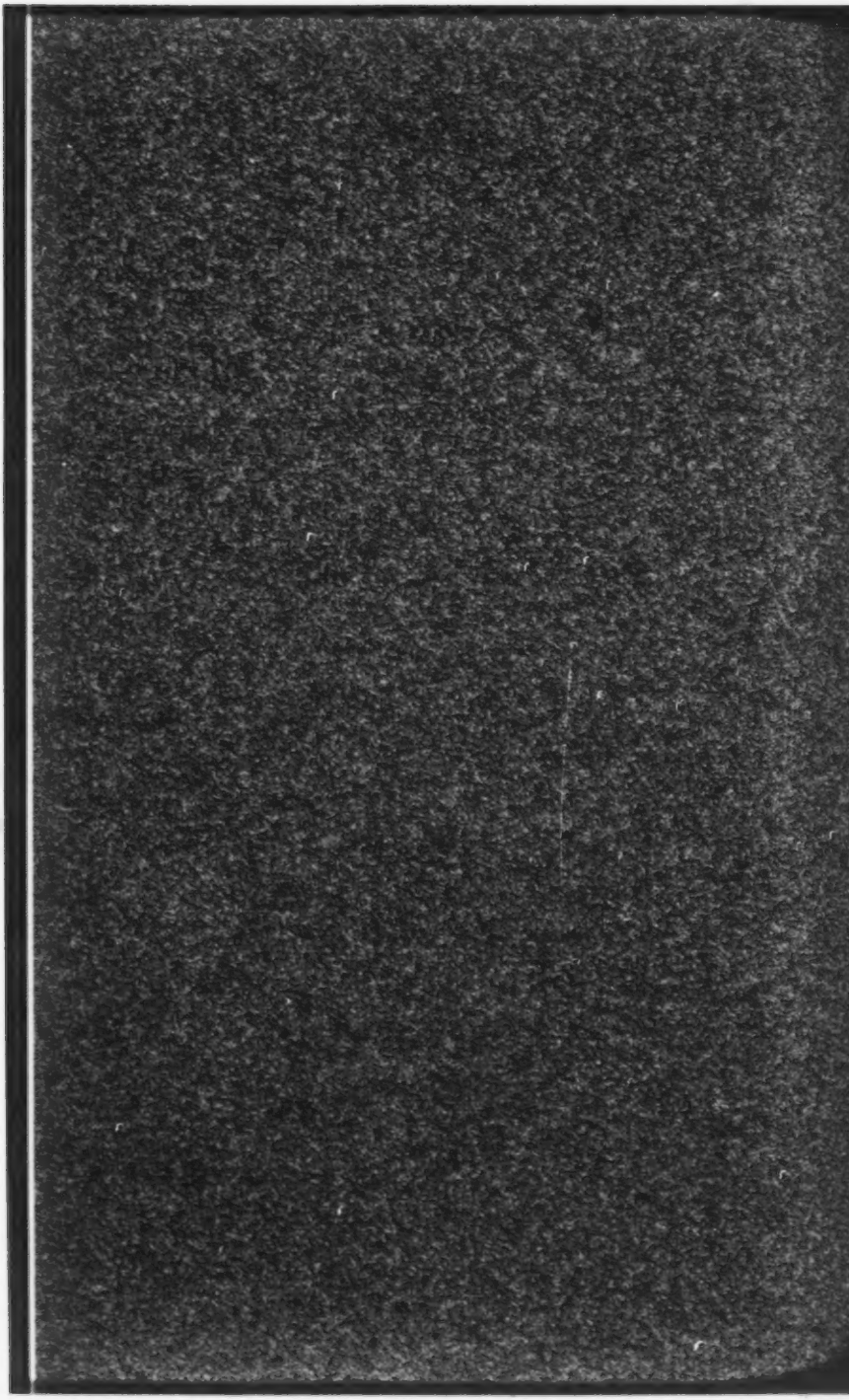
THE STATE OF WYOMING, COMPLAINANT,

v.

THE STATE OF COLORADO; THE COLORADO-BIG THOMPSON IRRIGATION DISTRICT; AND THE LARIMER COUNTY POUDRE RESERVOIR AND IRRIGATION COMPANY.

BRIEF FOR THE DEFENDANT STATE.

[illegible]



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The effect of these questions upon the public interests and governmental policies of the United States	4
The question of original ownership of innavigable waters fundamental in this controversy	5
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PART ONE. The United States retains its original plenary ownership of the right of use of innavigable waters in the Western States, except in so far as it has parted with it through acts of Congress; and this property, like the property in the public lands generally, is wholly immune from State interference or control. The State power affects only those rights which have been granted by Congress	6
Upon the acquisition of the territory now comprised within the Western States, the United States became vested with all property rights in that territory except vested private rights and such Indian rights as the United States might choose to recognize. Therefore, whatever property rights exist in water in that territory, whether the water be navigable or innavigable, belonged to the United States until the creation of the States, and furthermore, such rights are still Federal property, notwithstanding the creation of the States unless, first, they are of such a character as to go to the States upon their mere creation as such and because of the character of State sovereignty, or unless, second, they have been granted to the States or to private persons under acts of Congress	6
I.	
Property rights in navigable waters and their shores and beds become vested in the States on their creation as a part of their sovereignty, but the rule is different as to nonnavigable waters and their places of occurrence. The States take no property rights in them. Such waters are not *publici juris*, and title to their use is the same as title to land	7

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(1) Because of its fugitive nature, the only property rights which exist in water in its natural state are rights of use, the corpus being only susceptible of ownership while in possession. This corpus while in possession is personal property, but the right of use of the water in its natural state is a real property right of the highest dignity and value..... 7

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In the Supreme Court of the United States.

OCTOBER TERM, 1921.

THE STATE OF WYOMING, complainant, v. THE STATE OF COLORADO, THE Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company.	No. 3, Original. In equity.

BRIEF FOR THE UNITED STATES.

Reargument 1922.

(Supersedes former brief.)

Introductory statement of contentions of Wyoming and Colorado and position of United States.

Wyoming seeks an injunction prohibiting a certain specific diversion and use in Colorado of a part of the waters of the Laramie River, an interstate stream. Wyoming seeks to protect rights that it claims for itself as a sovereign State and rights that it claims on account of State ownership of riparian lands, and also the individual rights of its citizens. It denies

the right of Colorado to permit the waters in question to be taken beyond the watershed. It pleads the case in such a way that it can rely upon the pure doctrine of prior appropriation or upon the riparian doctrine, if the riparian doctrine should be upheld as between individuals or as between two States, or, as we take it, upon any rule of division that this court may decide to be the proper one between States.

Colorado in its answer says that the waters of the Laramie River rise in the mountains of Colorado; denies that they have been fully appropriated; alleges certain priorities in Colorado; and claims that there is ample water for all appropriations so far made in both States. Colorado, however, goes further and asserts that as a sovereign State it not only has a right to assert and urge the claims of its citizens but that it, in its sovereign capacity, is the ultimate owner of all of the waters within its territorial borders, as one of its natural resources, and may do with them as it will.

Colorado, as we understand it, also takes the position that if two States as against each other have rights *in invitum* in streams that flow through the lands of both, there should be applied the doctrine of a reasonable and equitable sharing by the two States of the benefits in the interstate stream, and that under that doctrine the 91,000 acre-feet of water that it claims on account of the particular diversion here complained of does not constitute an

unreasonable trespass upon Wyoming, because after this diversion is made there would be left a reasonable amount of water in the river for use in Wyoming.

Wyoming, in its brief on rehearing, takes the position, if we understand that brief properly, that priority of appropriation should govern between States as it does between individuals, with the exception that between States the uses ought to be confined to the watershed.

The contention of the Government is that the principles sought to be upheld by both Colorado and Wyoming, failing as they do, to recognize the proprietary rights of the United States in the waters of innavigable streams upon lands that at one time were all the property of the United States, and seeking a solution of the problem of interstate streams without taking into account such Federal ownership or the grants of water rights made under the acts of Congress, are unsound in law and opposed to the vital interests of the United States, and, if established, might be fatal to important Government policies and result in an almost inextricable confusion of water rights in such streams. The attitude of the executive branch of the Government, is briefly that the United States has not surrendered to the States or lost to them or parted in any way with its original right to use the surplus waters (those not appropriated by others under its own laws) of innavigable streams in the Western States; that the United States is and always has been, since

the cession of the territories now comprised in those States, the owner of all the unappropriated and surplus waters; that the appropriated waters there have been granted by the United States under its own laws, using local customs and State laws as subordinate instrumentalities only; that the rights of the States, both as the actual owners of lands granted to them and as the ultimate owners of the property of their citizens, so far as they may be said to be such owners, are confined to such water rights as have been granted by the United States to them or their citizens under the laws of Congress; and that controversies such as this should be decided upon the basis of such Federal grants, and without regard to State boundaries.

The effect of these questions upon the public interests and governmental policies of the United States.

We think it sufficient here to call attention to the vast areas of land still belonging to the United States; the fact that much of it is in the arid region where land without water to irrigate it, is of little value; the Federal reclamation policy, which depends upon Federal use of both land and water and often upon Federal use of interstate streams; the Federal Indian policy, where the Government's ability to protect its Indian wards depends largely upon its ownership and control of the waters on reservations and other Indian lands; and, finally, to the fact that if the water on these

public lands be held to belong to the States the Federal Government will be at the mercy of the States and be helpless as to these policies in a very real sense, because, while under our system the States are represented in and have a powerful influence upon the Federal Government, the United States is not in any way represented in the States, and both theoretically and as a practical matter can not control or even influence their action.

The question of original ownership of innavigable waters fundamental in this controversy.

We respectfully suggest the necessity of keeping separately in mind the two questions of, first, whether the United States or the States own the right of use of the innavigable waters in the Western States, and, second, the effect of a decision of that question upon the rights of these two opposing States in the waters of an interstate stream.

It is our contention that Federal ownership controls and offers a logical and workable solution of this question of rights between the States; but even if we should be wrong as to this, we deem it clear that the United States owns the right of use of the waters in and on its public lands within the States, just as it owns the lands themselves, and that such ownership should not be thrown in doubt by any decision as to the broader question of the rights between States.

ARGUMENT.

PART ONE.

The United States retains its original plenary ownership of the right of use of innavigable waters in the Western States, except in so far as it has parted with it through acts of Congress; and this property, like the property in the public lands generally, is wholly immune from State interference or control. The State power affects only those rights which have been granted by Congress.

Upon the acquisition of the territory now comprised within the Western States, the United States became vested with all property rights in that territory except vested private rights and such Indian rights as the United States might choose to recognize. Therefore, whatever property rights exist in water in that territory, whether the water be navigable or innavigable, belonged to the United States until the creation of the States; and, furthermore, such rights are still Federal property, notwithstanding the creation of the States unless, first, they are of such a character as to go to the States upon their mere creation as such and because of the character of State sovereignty, or unless, second, they have been granted to the States or to private persons under acts of Congress.

I.

Property rights in navigable waters and their shores and beds become vested in the States on their creation, as a part of their sovereignty, but the rule is different as to nonnavigable waters and their places of occurrence. The States take no property rights in them. Such waters are not *publici juris*, and title to their use is the same as title to land.

(1) Because of its fugitive nature, the only property rights which exist in water in its natural state are rights of use, the corpus being only susceptible of ownership while in possession. This corpus while in possession is personal property, but the right of use of the water in its natural state is a real property right of the highest dignity and value.

Failure to keep always in mind this first principle of the law of waters and to distinguish between ownership of the water itself and ownership of the right to use it has been the cause of confusion of thought in many of the cases, modern as well as ancient. The right to use water is one of the most substantial property rights known to the law and partakes in no way of the transitory character of the water itself which at any particular time makes up the stream in which the right exists. The law does not regard the water flowing in a stream (or properly, we think, any water out of possession) as being owned by those who have the right to use it, or, in fact, as being owned at all. The law does, of course, recognize an ownership in water itself when it is confined or treated as a commodity, as when, for example,

it is flowing in an irrigation ditch or is bottled for sale. It is then treated as personal property.

On the other hand, the rights which exist in connection with waters in their natural state—rights in waters flowing in a stream or in water of a pond—are rights of use.

> *Tyler* v. *Wilkinson*, 4 Mason 397.
> *Kent*, 3 Comm. (Marg.), p. 439.
> *Embrey* v. *Owen*, 6 Ex. 352, 20 L. J. Ex. 212.
> *Hargrave* v. *Cook*, 108 Calif. 72.

As the New York court puts it in *Smith* v. *Rochester*, 92 N. Y. 463, 480, "neither sovereign nor subject can have any greater than a usufructuary right therein."

Mr. Wiel, in his learned and exhaustive work on Water Rights, thus states the law in this respect:

> This usufructuary right, or "water right," is the substantial right with regard to flowing waters; is the right which is almost invariably the subject matter over which contracts are made and litigation arises. It is not an ownership in the water itself; it is merely a privilege to use the water, and hence purely *incorporeal*.
>
> *Wiel, Water Rights*, 3d ed., p. 755.

That this incorporeal right of use—this water right—is real property and that the title to it is of as high dignity as the title to land, is established beyond question in all jurisdictions in this country, so far as we know. There is no authority to the contrary that we are aware of and no difference in this respect between the riparian States and the so-called appropriation States.

Gardner v. *Newburgh*, 2 Johns. Ch. 162, 166.
Long, Irrigation, 2d ed. (1916), sec. 34, p. 70.
1 Wiel, Water Rights, 3d ed. (1911), sec. 711, p. 777 *et seq.*, and numerous cases cited, sec. 283, p. 298; sec. 285, p. 301;
2 Kinney, Irrigation, 2 ed. sec. 769, p. 1328.
Washburn, Easements, 4th ed., pp. 316, 317.
2 Washburn, Real Property, 6th ed., sec. 1284;
Insurance Co. v. *Childs*, 25 Colo, 360, 363.
Davis v. *Randall*, 44 Colo. 488, 492.

(2) Because of the necessity of protecting the public interests therein (mainly navigation and fishery) property rights in navigable waters in England belonged prima facie to the Crown, and in this country they belong prima facie to the municipal sovereignties, the States. The Federal Government, though having full control (under the commerce clause) for purposes of foreign and interstate navigation, has no right of property in such waters or their shores or beds except as it derives it from the States either by grant or under operation of State law.

This doctrine is too well understood to require lengthy discussion. (See *Shively* v. *Bowlby*, 152 U. S. 1, 15, 48, where its origin and limitations are explained with great care.) Because of the public importance of navigation and fishery, navigable waters were *publici juris* at common law. The lands being inseparable from the waters, were necessarily affected by the public interest also. The title, *jus privatum*, was in the Crown; the dominion,

jus publicum, was also vested in the sovereign, as the representative of the nation and for the public benefit. The title to the land was thus one of the royalties or sovereign rights which passed to the original States as an incident of sovereignty when they separated from England. (*Ib.*, 46, 48; *Hardin* v. *Jordan*, 140 U. S. 371, 381.) Where there were no States, the United States held this particular class of property in trust for States to be created, and the trust was executed automatically as the new States came.

Not only the land but the navigable waters themselves were *publici juris*. Whatever property right there was in them, and that, as we have said above, as to all waters out of possession, was merely a right of use, was *prima facie* in the Crown. Under our system, control of interstate and foreign commerce being one of the powers delegated to the Federal Government, the rights of the States and all rights derived from them, or permitted under their laws in such waters and their shores and beds, are taken subject to this Federal power. It follows that whatever injury of State or private interests results from the use by the Federal Government, for commerce purposes, of navigable waters and their beds, or their shores up to high-water mark, there is no invasion of legal rights. The State right and the private right come after and are subordinated to this superior Federal right. It follows further, of course, that any State or private use thus interfered with does not have to be paid for. The Federal Government is

simply using that which it has a right to use and to which use all other uses are subordinated.

United States v. *Chandler-Dunbar Co.*, 229 U. S. 53, 62.

So, also, we take it, with regard to rights of the States as against private persons, and even the Federal Government when that Government is not acting under the commerce clause. The property rights in the beds, in the shores up to high-water mark, and in the navigable waters themselves belong, *prima facie*, to the States, and it is for them to say through their legislatures and the decisions of their courts to what extent, if at all, private rights shall be granted or permitted and whether or not these rights shall be taken subject to future destruction without recompense for public State purposes (as they are for purposes of Federal commerce control) or shall be taken with the obligation of the States to pay therefor if they destroy them.

The right of the State and of the Federal Government in their respective fields extends, also, we understand, possibly in this same way, to the use of navigable waters even if that use impairs private uses of innavigable streams that flow from such navigable waters; and, furthermore, that private uses of innavigable waters which support navigable ones may be enjoined if it is shown that they interfere with navigation and perhaps if they interfere with other public uses of the waters where they are navigable.

United States v. *Rio Grande Dam & Irr. Co.*, 174 U. S. 690.

(3) The crux of the question we are examining is whether innavigable waters are *publici juris* like navigable waters. Ownership by the States depends upon showing that they are. Such waters are not *publici juris* and ownership of usufructuary rights therein rests upon the same basis and is of the same character as ownership of land.

Waters not navigable, include, of course, not only innavigable streams and ponds, whether surface or underground, but also diffused surface flows and waters percolating in the soil. Our question is whether these waters, of common right, so far as they are owned at all—that is, the usufructuary rights therein—are the property of the States in the sense that navigable waters are, or whether they, of common right, belong to private persons just as lands do.

In the first place, it is to be noted that it is now decided beyond any further possibility of question that the beds and shores of innavigable streams and lakes, even though they are meandered, are owned as ordinary upland is owned, and are *not owned by the States*. Title to such lands in the public land States comes from the United States and not from the States.[1]

Hardin v. *Shedd*, 190 U. S. 508.

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[1] **The fact that this court holds that the grantee of the upland from the United States takes to the thread of the stream or not in accordance with the State law, using such law as a rule of convenience merely, in no way weakens this statement. The title comes from the United States, and it is perfectly competent for Congress to change this rule of convenience applied to the grants of the United States if it sees fit.**

It needs no argument, we think, to show that the States, by virtue of their sovereignty, also have no title to the beds and shores of small unmeandered streams and ponds or to the lands in which underground streams, lakes, or percolating waters occur.

As to the property rights in these nonnavigable waters themselves it is to be observed, first, that diffused surface waters and all underground waters were originally looked upon by the law as part and parcel of the soil and as belonging to the owner thereof. The tendency now is to recognize these waters as distinct from the soil and as being susceptible of ownership when out of possession only as to usufructuary rights therein. Furthermore, the tendency is to treat such rights not only as interlocking with the rights in the streams and lakes which the underground waters support but also (even, we think, in the pure appropriation States) as belonging to the several owners of the lands which have access to them. See Wiel's Water Rights (3d ed.) for an elaborate discussion of the modern law of underground waters and particularly sections 1090 and 1124. We know of no claim even that rights of this character belong to or spring from the States.

Turning to the innavigable surface streams and lakes (and keeping in mind that the principle of exclusive private right applicable to them applies with even more force, if that is possible, to such minor bodies of water as diffused surface flows and percolating and underground waters) it will be seen

that in England it was recognized at least as early as Lord Hale's time that the proprietary right in the use and flow of such waters was not in the Crown. Unlike navigable waters they did not at common law belong *prima facie* or of common right to the Sovereign, but did so belong to private persons just as land did. The rule was and is the same in our original States, and so, following the same principle upon which this court decided that navigable waters and their shores and beds go to the new States, as well as to the original ones, as it is the States which under our system are the possessors of municipal sovereignty (*Pollard* v. *Hagan*, 3 How. 212, 229, and *Shively* v. *Bowlby*, 152 U. S. 1) we see that neither the new States nor the original thirteen have any property rights in nonnavigable waters by virtue of their sovereignty, or have any different kind of power whatever over them than they have over land.

> The State by virtue of its sovereignty is deemed the original grantor of all titles to real estate, and a conveyance by it of riparian rights upon nonnavigable streams vests its grantees, both mediate and remote, with all the rights which such owners can acquire against any grantor.
>
> The riparian owners of lands adjoining fresh water, non-navigable streams, take title, "*ad usque filum aquæ*," to the thread of the stream, and thereby acquire the right as incident to such title to the usufructuary enjoyment of the undiminished and undisturbed

flow of such water. "Fresh rivers of wha kind soever do of common right belong to the owners of the soil adjacent," is the expressive language of the common law and is of universal application. (*Clinton* v. *Myers*, 46 N. Y. 511; 7 Am. Rep. 373; *Chenango Bridge Co.* v. *Paige*, 83 N. Y. 178; 38 Am. Rep. 407.)

Smith v. *Rochester*, 92 N. Y. 463, 473.

See also:

Gardner v. *Newburgh*, 2 Johns. Ch. 162, 166.

Lord Hale's de Jure Maris with Judge Cowan's note to *Ex parte Jennings*, 6 Cowan, 536, 539–546.

Watuppa Reservoir Co. v. *Fall River*, 147 Mass. 548; 554, 555, 558, 561.

Home of Aged Women v. *Comm.*, 202 Mass. 422, 433–434.

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Barclay R. R. & Coal Co. v. *Ingham*, 36 Pa. St. 194, 200, et seq.

Angell on Water Courses, 6th ed. par. 2; also par. 535.

Gould on Waters, 3rd ed. par. 46.

Cobb v. *Davenport*, 32 N. J. Law 369, 378–380.

Simmons v. *Paterson*, 60 N. J. Eq. 385, 389.

Attorney General v. *Delaware & Bound Brook R. R. Co.*, 27 N. J. Eq. 631, 638.

Doremus v. *City of Paterson*, 65 N. J. Eq. 711, 712.

Contra in part:

McCarter v. *Hudson County Water Co.*, 70 N. J. Eq. 695.[1]

General expressions by some of the early writers, in which they failed to make the sharp distinction which the law now makes, and in reality always has made, between ownership of the water itself and ownership of the right to use it, and also the existence of prescriptive rights, for a time left some doubt as to whether water as such was not *publici juris* and also as to whether the riparian owner's right to divert the waters on which his land bordered was not dependent in some way upon actual appropriation.

Whatever doubt existed in that respect was put at rest in England by a series of cases of which *Mason* v. *Hill*, 5 Barn. & Adol. 1, decided by Lord Denman in 1833, was perhaps the most important. In this country the question had already been disposed of by Mr. Justice Story in *Tyler* v. *Wilkinson*,

[1] The arguments (p. 711) that if "the exercise of all rights of private ownership by all riparian owners still leaves the stream to remain as a running stream, there remains a residuum of common or public ownership that under our system rests in the State as a trustee for all the people," and that the riparian rights of private persons are narrowly limited, are, we contend, unsound and unsupported by other authorities. The rights of each riparian owner are alone limited by the equal rights of other riparian owners—not at all by rights existing in others, because there are none; the whole right of use of the stream belongs, and belongs exclusively, and completely, to the riparian owners taken together. Often the exercise of riparian rights does not leave any water in the stream at all, and when it does, the riparian owners' right to have the stream as thus left so run and not to be interfered with by anyone, the State included, who is not a riparian owner, is absolute. This case was affirmed by this court on other and broader grounds. (*Hudson County Water Co.* v. *McCarter*, 209 U. S. 349.)

This case as a New Jersey authority is only opposed to our position in part, because it recognizes the distinction between public and private waters, and recognizes that if the State has any proprietary rights in private waters they are subordinate, or at least only equal to private rights therein.

4, Mason 397. Since those cases, it has been settled that under the common law, both in England and in the United States, the usufructuary rights to innavigable waters belong to the owners of the land bordering on them; that the rights of such owners in the water are in no way dependent upon its use; that such waters are in no proper sense *publici juris*, as, for instance, navigable waters are; that the water right is part and parcel of the title to land itself; and that title to such usufructuary right has the same origin as the title to the land.

Baron Parke thus states the law:

> The law as to flowing water is now put on its right footing by a series of cases, beginning with that of *Wright* v. *Howard*, * * * followed by *Mason* v. *Hill*, * * * and ending with that of *Wood* v. *Waud*, * * * and is fully settled in the American Courts: see *3 Kent's Comm.*, Lect. 52, pp. 439–445.
>
> The right to have the stream to flow in its natural state without diminution or alteration is an incident to the property in the land through which it passes; but flowing water is *publici juris*, not in the sense that it is a *bonum vacans*, to which the first occupant may acquire an exclusive right, but that it is public and common in this sense only, that all may reasonably use it who have a right of access to it, that none can have any property in the water itself, except in the particular portion which he may choose to abstract from the stream and take into his possession, and that during the time of his possession only:

see *5 B. & Ad.* 24. But each proprietor of the adjacent land has the right to the usufruct of the stream which flows through it.

Embrey v. *Owen*, 6 Ex. 352, 368; 20 L. J. Ex. 212.

In *Tyler* v. *Wilkinson* the question was as to the right of a mill owner to use the waters of the River Pawtucket, at a point where it is innavigable, as against riparian owners. Mr. Justice Story, as Circuit Justice, took occasion to review the law, and in the opinion he rendered briefly covered the whole subject of the origin and nature of riparian rights in nonnavigable waters. The case is the leading one on the subject. Mr. Justice Story said that he had read over all the cases which were cited at the bar, or which were to be found in Mr. Angell's work on watercourses, or which his own auxiliary researches had enabled him to reach. In part the opinion is:

> The natural stream, existing by the bounty of Providence for the benefit of the land through which it flows, is an incident annexed, by operation of law, to the land itself. * * * * * * Mere priority of appropriation of running water, without such consent or grant [of the riparian owners], confers no exclusive right. It is not like the case of mere occupancy, where the first occupant takes by force of his priority of occupancy. That supposes no ownership already existing. and no right to the use already acquired. But our law annexes to the riparian proprietors the right to the use in common, as an incident to the land; and whoever seeks to found an exclusive use,

> must establish a rightful appropriation in some manner known and admitted by the law. Now, this may be either by a grant from all the proprietors, whose interest is affected by the particular appropriation, or by a long exclusive enjoyment, without interruption, which affords a just presumption of right. By our law, upon principles of public convenience, the term of twenty years of exclusive uninterrupted enjoyment has been held a conclusive presumption of a grant or right.
>
> *Tyler* v. *Wilkinson*, 4 Mason 397, 401.

Further, as to innavigable waters being *publici juris:* The question is disposed of in the passage just cited from *Tyler* v. *Wilkinson*, by placing the ownership of the waters in the owners of the riparian land as "an incident annexed, by operation of law, to the land itself." It is specifically disposed of in the passage we have just quoted from *Embrey* v. *Owen*. Lord Denman, in *Mason* v. *Hill*, considered it fully and came to the conclusion that there was no foundation in the common law, or in the civil law either, so far as he could find, for the idea that such waters are open to occupancy, or that they are *publici juris*, except in the sense that no one owns the corpus of the water while it flows in its natural state.

After referring to many expressions in the law to the effect that flowing waters are *publici juris*, and the passage in Blackstone (2 Comm. p. 18): "Water is a movable, wandering thing, and must of necessity continue common by the law of nature; so that I

can only have a temporary, transient, usufructuary property therein; wherefore, if a body of water runs out of my pond into another man's, I have no right to reclaim it," Lord Denman says:

> None of these dicta, when properly understood with reference to the cases in which they were cited, and the original authorities in the *Roman* law, from which the position that water is *publici juris* is deduced, ought to be considered as authorities, that the first occupier or first person who chooses to appropriate, a natural stream to a useful purpose, has a title against the owner of land below, and may deprive him of the benefit of the natural flow of water.
>
> * * * * *
>
> In the *Digest*, Book 43, tit. 13, in public rivers, whether navigable *or not*, it appears that everyone was forbidden to lower the water or narrow the course of the stream, or in any way to alter it, to the prejudice of those who dwelt near. Tit. 12 distinguishes between public and private rivers; and in section 4 it is said, that private rivers in no way differ from any other private place.
>
> From these authorities, it seems that the *Roman* law considered running water, not as a *bonum vacans*, in which anyone might acquire a property; but as public or common, *in this sense only*, that all might drink it, or apply it, to the necessary purposes of supporting life; and that no one had any property in the water itself, except in that particular portion, which he might have abstracted from the stream,

and of which he had the possession; and during the time of such possession only.

We think that no other interpretation ought to be put upon the passage in *Blackstone*, and that the dicta of the learned judges above referred to, in which water is said to be *publici juris*, are not to be understood in any other than this sense; and it appears to us that there is no authority in our law, nor, as far as we know, in the *Roman* law (which, however, is no authority in ours), that the first occupant (though he may be the proprietor of the land above) has any right, by diverting the stream, to deprive the owner of the land below, of the special benefit and advantage of the natural flow of water therein.

Mason v. *Hill*, 5 Barnewell & Adolphus, 1, 23, 24.

Lord Cockburn in a Scotch case said:

I know nothing more rudimental in our law, than that private rivers are the property of those through whose lands they flow. This property is qualified, no doubt, in various ways, in favour of the other heritors; the object being, that each may enjoy the stream in his turn. But there is no restriction in favour of strangers. It is solely on behalf of the other owners of the water-side ground. Nor is it a mere privilege of using the stream as it passes. It is a right of property in the stream itself. Accordingly, where a river runs its entire course through the land of a single person, he, as the sole proprietor, may do with it as he pleases; as a plurality of landowners may, if all their lands adjoin it, and they all agree. He or they may extinguish it, if they can. A river is, in

this respect, exactly like a private lake surrounded by one estate, which the landowner, if not restrained by distant heritors whose streams it may feed, may drain. The water being current or still, makes no difference on the legal principle.

Ferguson v. *Shirreff*, 6 Dunlop, 1355, 1374 (Scot's Rev. Reps.)

(4) Water rights in innavigable waters being vested rights in real property, the State has the same and no greater control over them than over vested rights in land. Regulation under the police power should not be confused, as it often is, with rights of property in the State or any denial of property rights in the individual.

Undoubtedly the States have the power to control individuals in their use of water. This right of the State may not be confined to the police power, but it can not go beyond that power and the right of eminent domain. Whatever the power is, it is limited by the provisions of the fourteenth amendment protecting vested rights. The power itself is the same as that which the State has over vested rights in lands. Water rights, as we have seen, under both the appropriation and the riparian doctrines, are vested rights in real property, which can be lost only by grant, condemnation, prescription, or abandonment.

The ways in which this power of the State is exercised, of course, will differ in accordance with the kind of property the use of which is to be affected or controlled. Thus, we have regulations limiting the use of land for the public good that would not be

at all applicable to water, and, *vice versa*, we have regulations concerning water that could not apply to land. Of this character are the administrative rules and the means of enforcing them, by which officers appointed by the courts, or provided for by statute, see to it that gates are opened and shut so that the waters will be apportioned to the various owners of rights therein, according to the decrees of the courts by which they have been defined and established. This is a clear exercise of the police power, and is so held by the courts.

Wiel, Water Rights, 3d ed., p. 196, 197:
Roberson v. *People*, 40 Colo. 119, 124.
Broad Run Co. v. *Duel Co.*, 47 Colo. 573, 579.
Combs v. *Farmers Co.*, 38 Colo. 420, 428.

(5) The argument based on the necessities of the arid region examined. It wrongly assumes that the riparian system is not suited to western conditions and that, therefore, the States can dispose of the Federal property in water.

Those who would have the Federal property in non-navigable waters held to be in the States argue that the riparian system which puts the title to the use of such waters in the owners of the lands which have access to them is not suited to western conditions. We think it sufficient here to point out that the main principle of the riparian system is equality of right between the riparian owners; that they among them own the entire right of use of the stream; that any proper use under the circumstances, including, of course, irrigation, is permitted; that rights exactly like

appropriation rights can be and frequently are created by grant or condemnation of rights of the riparian owners; that the appropriation system, so called, is not so much a system of owning and using rights as it is a means of acquiring them; that it is an open question whether the correlative rights of the riparian system are not better suited to an irrigation community than the sometimes more definite and less related appropriation rights; and finally, that both classes of rights are now being created out of and logically rest, under our theory, upon the original Federal ownership of riparian rights (as will be shown hereinafter more in detail) and that the argument for State ownership is merely one that it would be better to allow the States to dispose of this class of Federal property and is as applicable to lands as to water.

(6) The fundamental principle of water law, that the corpus of water can only be the subject of ownership while in possession, and that, therefore, water itself in its natural state is owned by no one, has no effect upon the question of whether the title to the usufructuary right therein belongs to the State as a part of its sovereignty.

Many of those who argue that the origin of water rights in nonnavigable waters is in the States try to find support from this principle, arguing that because the corpus of water out of possession is not property at all, being in the so-called negative community like air or animals *ferae naturae*, the ownership of the right of use—the real property right of value—must in some way belong to the State or have its origin in some sort of State ownership. Obviously the prin-

ciple applies to all waters and, equally obviously, it neither supports nor denies State ownership of the real property usufructuary right.

II.

Water rights now vested in others derive their existence, like titles to land, from the acts of Congress. All interest in water not so granted necessarily remains in the United States. The acts grant nothing to the States, and ratification of State constitutions asserting State ownership of water does not divest the United States of its property rights therein.

(1) The earliest acts of Congress affecting innavigable waters—They show full consciousness of power to deal with such waters on the public lands.

Section 2476 of the Revised Statutes provides:

> All navigable rivers, within the territory occupied by the public lands, shall remain and, be deemed public highways; and in all cases where the opposite banks of any streams *not navigable* belong to different persons, the *stream* and the bed thereof shall become common to both.

This section is but a continuation of early statutes on the subject (acts of May 18, 1796, 1 Stat. 468; March 3, 1803, § 17, 2 Stat. 235; Feb. 20, 1811, § 3, 2 Stat. 642; and March 3, 1811, § 12, 2 Stat, 666), and is referred to in *Railroad Co.* v. *Schurmeir*, 7 Wall. 272, 289; *Scott* v. *Lattig*, 227 U. S. 229, 242; and *Hardin* v. *Shedd*, 190 U. S. 508, 519.

These acts show that from the earliest times Congress has had clearly in mind the difference that

exists in the relation of the Federal Government to navigable and innavigable waters. They likewise show that Congress has been fully conscious of ownership in the United States of the innavigable waters on the public lands and of its own power to say how these waters shall be disposed of.

Those of the acts preceding R. S. 2476, which affected lands beyond the Northwest Territory (acts of Feb. 20, 1811, and Mar. 3, 1811), omitted the above clause referring to innavigable waters. Since the passage of the act of July 26, 1866, which we shall now discuss, the disposition of such waters on the public lands has been controlled by this latter act and by the local laws and customs used as its subordinate instrumentalities.

(2) History and nature of the act of July 26, 1866, granting water and mining rights and rights of way. Purpose and effect of its adoption of local laws and customs.

(a) The occasion of this legislation was the extensive occupation and exploitation of the public lands in the West following the discovery of gold in California. The need was to legalize appropriations of mineral land, rights of way, and water rights already made under local customs and laws, and to provide for the future acquisition of rights of the same character in the same manner.

The occasion and history of this legislation, with specific reference to water rights and waterways, are sufficiently shown by the opinions in—

Jennison v. *Kirk*, 98 U. S. 453.
Atchison v. *Peterson*, 20 Wall. 507.

Basey v. *Gallagher*, 20 Wall. 670.
Broder v. *Water Co.*, 101 U. S. 274.
See also:
1 Wiel on Water Rights, 3d ed., secs. 66 *et seq.*, 92 *et seq.*
1 Kinney on Irrigation and Water Rights, 2d ed., secs. 596 *et seq.*, 611 *et seq.*, 636 *et seq.*

Almost immediately upon the discovery of gold in 1848 a large population sprang up in California and Nevada and the other western Territories. Mining, milling, agriculture, and other industries quickly grew to great importance and large communities dependent upon these activities of the miners and settlers were established. The country thus so suddenly occupied was up to that time a vacant wilderness, most of which had been but lately acquired from Mexico. There was no general mining law, the lands were unsurveyed and there was no efficient statute under which the Government title to land of any character could be acquired. *Wiel, Water Rights*, 3d ed., p. 92.

The miners and settlers and the residents of the towns were alike technical trespassers on the lands of the United States. They took out the gold, set up mills for the reduction of ores, cut the timber, and engaged in agriculture. For all of these purposes the use of water was essential, and they diverted it from the streams. All this was done under orderly and firmly established codes of rules made by the miners' meetings in the various communities, the decisions of courts, and later by State and

territorial legislation. The law that thus grew up was purely a law of possessory rights made to regulate the acquisition and holding of the Government property by the miners and settlers among themselves and as against each other. It was all subject to the underlying rights and, at that time, unexercised powers of the United States as the owner of the property affected. As to mineral land, the vein or lode was recognized as the thing discovered, and the thing of value; and so the rules gave title to that rather than to so much land and allowed the following of the vein on its dip even though doing so involved going outside of the limits of the surface claim extending vertically downward. As to water, the lands from which it was taken, the lands occupied by the ditches and flumes, and the lands where it was used, whether for milling ores, washing the gold out of the gravel of the hillsides and stream beds, or for irrigation, were all until such occupancy vacant public lands.

If the miner or farmer felt free to appropriate the vein of mineral that he had discovered or the land that he wanted to farm, he felt equally free to take water for those purposes from the most convenient source. The fact that he thereby took the waters from another piece of Government land bordering on the stream made no difference under the circumstances. He could take that land, too, if he wanted it. The rules, therefore, permitted the diversion of water for any useful purpose and recognized the first appropriator's priority of right just as they recognized

the priority of the discoverer and first claimant of a vein of mineral. Throughout this period, during which these possessory rights had come to be of enormous value and had finally been held by the courts to have, between the appropriators, practically all the dignity of freeholds (*1 Wiel, Water Rights*, secs. 89 and 90, p. 97 *et seq.* and cases cited), it was realized that the underlying legal title was outstanding. The courts in the cases involving these rights were careful to refer to the paramount Government title. They usually did so by saying that the rights on which they were passing were good "except as against the United States." (*Wiel, Water Rights*, sec. 91, p. 102, and cases cited; *Atchison* v. *Peterson*, 20 Wall. 507, 510; *Basey* v. *Gallagher*, 20 Wall. 670, 681; and *Sturr* v. *Beck*, 133 U. S. 541, 552).

The uppermost question in everyone's mind was what Congress would do and what effect whatever action Congress might take would have upon these rights. When Congress provided a means for the acquisition of the Government title, would the Government's grant of mineral land cut off the right of the miner whose vein ran under that land from following it and abstracting the minerals? Would a grant of land over which a ditch or flume or road ran except a right of way for the benefit of the original builder and present occupier, and would a grant of riparian land or of all the riparian land on a stream carry with it the right to stop the use of water by appropriators who had taken it, often to a great distance, and put it to nonriparian uses? To meet this situation the act of

1866 and the supplementary act of 1870 were passed. Congress had already provided adequate means for the acquisition of the Government title to agricultural lands by passing the homestead act in 1862.

(b) These acts of 1866 and 1870 examined—Their interpretation by the courts.

The relation of these two acts to water rights and waterways was precisely the same as their relation to the mineral lands. The first act, July 26, 1866 (14 Stat. 251), was styled merely "An act granting the right of way to ditch and canal owners over the public lands, and for other purposes"; but it was in reality the first general mining law of the United States. Its first section declared that "the mineral lands *of the public domain*" should be free and open to exploration and occupation by citizens, etc., subject to such regulations as may be prescribed by law and subject also to the local customs or rules of miners in the several mining districts, *so far as the same may not be in conflict with the laws of the United States.*

Sections 2 to 4 provided for the locating, entering, and patenting of lode claims occupied and improved "according to the local custom or rules of miners" in the mining district "so extended laterally or otherwise as to conform to the local laws, customs, and rules of miners," giving them the right to follow the vein or lode to any depth "although it may enter the land adjoining, which land adjoining shall be sold subject to this condition" (sec. 2), authorizing the surveyor general to vary the form from rec-

tangular "to suit the circumstances of the country and the local rules, laws, and customs of miners," with a proviso that no location should exceed a certain length for each locator (sec. 4).

Section 5 provided:

> That as a further condition of sale, *in the absence of necessary legislation by Congress*, the local legislature of any State or Territory may provide rules for working mines involving easements, drainage, and other necessary means to their complete development; and those conditions shall be fully expressed in the patent.

Section 8:

> That the right of way for the construction of highways over public lands, *not reserved for public uses*, is hereby granted.

In section 9 we find substantially and almost in words R. S. section 2339. It was as follows:

> That whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes aforesaid is hereby acknowledged and confirmed: *Provided, however*, That whenever, after the passage of this act, any person or persons shall, in the construction of any ditch or canal, injure or damage the possession of any settler on the

> public domain, the party committing such injury or damage shall be liable to the party injured for such injury or damage.

Section 10 allowed settlers on nonmineral lands, which had been excluded from survey as mineral, to acquire them under the preemption and homestead laws.

The act of July 9, 1870 (16 Stat. 217), amended the act of 1866 by adding six new sections, numbered 12 to 17, inclusive. Section 12 extended the law, with certain modifications, to placer claims. Section 13 provided that where claims had been held and worked "for a period equal to the time prescribed by the statute of limitations for mining claims of the State or Territory where the same may be situated" the right to patent should be deemed established. Sections 14 to 16 dealt with land office procedure, fees, and surveys. Finally, section 17, which has been modified into R. S. section 2340, *supra*, declared:

> That none of the rights conferred by sections five, eight, and nine of the act to which this act is amendatory shall be abrogated by this act, and the same are hereby extended to all *public lands* affected by this act; and all patents granted, or preemption or homesteads allowed, shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water rights, *as may have been acquired under* or recognized by the ninth section of the act of which this act is amendatory.

The sections 5, 8, and 9 here referred to are the sections allowing local legislatures, in the absence of

legislation by Congress, to provide rules, "for working mines involving easements, drainage, and other necessary means to their complete development," the section granting rights of way over public lands for highways, and the section concerning water rights and ditches. R. S. 2339.

The mining features of this act were crude and were repealed and their place taken by the more detailed act of May 10, 1872 (17 Stat. 91.)

In this latter act, however, the policy adopted by the former of favoring local laws and granting mining rights in accordance therewith is adhered to. The water features of the original acts have been preserved and are still in force.

That the act of 1866 provides a means for the future acquisition of rights, water as well as mining is the settled holding of the courts. That it looks to the future as well as the past is made perfectly clear by the act of 1870 through the use of the words: "Such water rights, as may have been *acquired under* or recognized by the ninth section of the act of which this act is amendatory." Two classes of rights are under consideration and provided for: Rights existing prior to the passage of the act and rights acquired afterwards and so under the express authority of the act itself.

Jacob v. *Lorenz*, 98 Calif. 332, 335.

Beaver Brook v. *St. Vrain*, 6 Colo. App. 130, 138.

1 Wiel, Water Rights, 3d ed., sec. 99, p. 116.

Long, Irrigation, 2d ed., sec. 74, p. 134.

Without unduly extending this analysis or resorting to too extensive citations of authority, we wish to invite still further attention to certain of the salient features of this legislation and its interpretation, as it is, in our view, the foundation of all water rights in the Western States to-day and provides a solution and, we think, the only solution of the problem of interstate streams.

It will be seen that this act of 1866, while treating principally of mining, governs also water rights and rights of way for ditches, canals, and highways. These several subjects are handled together and in the same way. As to each the act gives the fundamental title to those who already had possessory rights, and provides a way by which grants of mining and water rights may be obtained in the future. Mineral lands are held open to "exploration and occupation," and he who occupies is given the right to take the other steps which lead to a grant. Water rights are *protected and preserved* to whomever has *possessed* them. Local laws, rules, and customs are used in both cases to define the right and provide the course that must be followed to acquire it. The mineralized vein is recognized by the act, as it was before by the customs of the miners, as being the thing appropriated, and so the right is given to follow it regardless of the surface limits of the claim extending vertically downward, which ordinarily define the extent of land holdings. In the field of water rights, again in accordance with local customs, the one who first "appropriates,"

even for use on nonriparian lands, is given the better right. Both as to mining and water, however, the rights granted are only such as any proprietor of the whole property involved could grant, and the rule of priority is only that which necessarily follows from successive conveyances of defined parts of a whole.

Further, it should be observed that under this act the proprietor, the United States, in a way holds its landed estate for conveyance in three classes—mineral rights, water rights, and what may be called, for convenience, ordinary land rights. It holds all of these rights for conveyance separately or together, as the case may be. Consequently, riparian rights pass or not under a patent of riparian land, generally speaking, according to whether or not the riparian doctrine or the appropriation doctrine is the rule in the locality where the land is situated. Congress has provided that it shall be otherwise in the Black Hills Forest Reserve in South Dakota (34 Stat. 233, 234).

It is well understood that the local rules, whether found in miners' customs, court decisions, or legislative acts, were adopted merely to supplement the particular provisions and fundamental conditions of the act, in order to fit it to local conditions, including local preferences, and avoid unnecessary complexity and volume in the act itself. This plan of adopting local laws or rules as the laws and rules of Congress is familiar enough. It is seen in the legislation defining crimes on reservations under exclusive jurisdiction of the General Government; in the con-

formity provisions governing the Federal courts in common-law cases; in various laws for the taking of affidavits, etc. Illustrations might be greatly multiplied.

As we have already said, the local laws, customs, etc., in respect of mining claims, retain their function under the mining law as it is to-day. They depend, of course, upon the express permission of Congress therein contained.

> State statutes in reference to mining rights upon the public domain must therefore be construed in subordination to the laws of Congress, as they are more in the nature of regulations under these laws than independent legislation.
>
> *Lindley on Mines*, 2d ed., sec. 249.

Quoted with approval in *Butte City Water Co.* v. *Baker*, 196 U. S. 125.

Their constitutionality, challenged in the case last cited, was upheld upon the ground that a delegation of authority to adopt "minor and subordinate regulations" concerning the disposition of the public domain is not a delegation of strictly legislative power. See also *Clason* v. *Matko*, 223 U. S. 646, 654.

It is somewhat astonishing to find the *Broder case* (101 U. S. 274) and *Jennison* v. *Kirk* (98 U. S. 453, 456) cited in Colorado's brief as authority for the idea that the act of 1866 recognized an independent title or power in the States. They hold exactly the reverse.

The act is a grant of rights belonging to the United States. This court in *Broder* v. *Water Co.*, *supra*, 101 U. S. 274, 275, construing the right of way part of the ninth section of the act says that the same is an "unequivocal grant." The Circuit Court for the District of Nevada in *Union Co.* v. *Ferris*, 2 Sawy. 176, 184, held:

> The policy of this enactment (sec. 9, act of 1866), so far at least as it relates to agricultural districts, may be doubtful but it is the law of the land, and the courts must carry out what appears to be the intention of the legislature (Congress) as therein expressed. And that, as indicated by the act, appears to be to grant to the owner of possessory rights to the use of water under the local customs, laws, and decisions, the absolute right to such use, which the government alone could grant.

The text writers so contrue it. (See *1 Wiel, Water Rights*, 3d ed., sec. 97, p. 113; sec. 155, p. 177 *et seq.*; *Long, Irrigation*, 2d ed., sec. 74, p. 134.)

The grant is made directly to the individual appropriator. It takes effect upon his bringing himself within its terms by complying with the local laws. No patent follows as in the case of mining claims, but the title passes by virtue of the statute itself and compliance with it, as is the case with grants of rights of way.

> The language of this act (act of 1866) makes the right a confirmation *in praesenti*, as to the claims included (referring to water rights), without any preliminary proceeding to obtain

> a title, as in the case of a mining claim. A grant conferred by act of Congress is the highest source of title known to our laws.
>
> *Yale, Mining and Water Rights*, p. 380.

The law of water rights in California and the numerous States which have followed her lead is based squarely upon the Federal title. These States are California, Kansas, Montana, North Dakota, South Dakota, Washington, Nebraska, Oregon, and possibly Oklahoma. (*1 Wiel, Water Rights*, 3d ed., p. 226.) Appropriation rights in those States are explicitly held to be derived from the United States by direct grant under this act. Riparian rights, which there exist side by side with rights by appropriation, are held by the courts to be derived from the United States under grants by it of riparian lands.

> It has never been held that the right to appropriate waters on the public lands of the United States was derived directly from the State of California as the owner of innavigable streams and their beds. And since the act of Congress (1866) granting or recognizing a property in the waters actually diverted and usefully applied on the public lands of the United States, such rights have always been claimed to be deraigned by private persons under the act of Congress, from the recognition accorded by the act, or from the acquiescence of the general government in previous appropriations made with its presumed sanction and approval.
>
> *Lux* v. *Haggin*, 69 Calif. 255, 338.

> An appropriator of water under these circumstances, and while the land which he subjects to his necessary uses continues to be a part of the public domain, is a licensee of the general government; but when such a part of the public domain passes into private ownership it is burdened by the easement granted by the United States to the appropriator, who holds his (water) rights against this land under an express grant.
>
> *Smith* v. *Hawkins*, 110 Calif. 122, 125.

The Supreme Court of Washington, referring to this act, said:

> It was for the purpose of protecting the rights of appropriators of water for beneficial uses on the public lands which had vested and accrued, by virtue of local customs, laws and decisions of the courts, that the ninth section of the act of Congress of July 26, 1866, the substance of which is included in section 2339 of the Revised Statutes, was enacted. It was apparent to congress, and indeed to everyone, that neither local customs nor state laws or decisions of state courts, could vest the title to public land or water in private individuals without the sanction of the owner, viz; the United States.
>
> *Benton* v. *Johncox*, 17 Wash. 277, 289.

In Oregon it is held that "an appropriation of water is a grant by the general government to the settler of the right to its use."

> *Morgan* v. *Shaw*, 47 Oreg. 333, 337.

A water right can therefore be acquired only by the grant, express or implied, of the

owner of the land and water. The right acquired by appropriation and user of the water on the public domain is founded in grant from the United States government as the owner of the land and water; such grant has been made by Congress.

Smith v. *Denniff*, 24 Mont. 20, 21.

See also *Barkley* v. *Tieleke*, 2 Mont. 59, 64.

To the same effect see:

Cruse v. *McCauley*, 96 Fed. 369, 373–374.

Howell v. *Johnson*, 89 Fed. 556, 558.

Colorado and the other pure appropriation States, and the Territory of Alaska (Alaska, Arizona, Colorado, Idaho, New Mexico, Nevada, Utah, and Wyoming; *1 Wiel, Water Rights*, 3d ed., p. 226), endeavor to find some basis for water rights other than the Federal title. The arguments advanced for their position we have already examined under a different head. In these States water rights are identical with appropriation rights in California and the other dual system States, and, of course, are derived, as they are there, from the United States by grants under this act, unless indeed the effectiveness of that legislation, so far as it covers water, came to an end upon the admission of the States, a proposition already herein considered and, we think, refuted.

(3) Subsequent acts of Congress contradict the theory that Federal ownership has been abdicated.

Since the act of 1866 there are a number of statutes reiterating the policy of Congress to permit the appropriation of water and leave it largely

within the control of the local regulations. These laws do not bear out the assertion that the Federal interest in nonnavigable water has been transferred to the States, and still less do they lend support to the theory advanced in Colorado's brief that Congress recognizes the States as having any ownership of or control over such water independent of a transfer from the Federal Government.

It is to be noticed that in these later declarations by Congress concerning water there is evident not only a consciousness of the power to deal with this subject without State intervention, but in some instances an actual exercise of the power itself. It is as impossible to gather from these acts that Congress intended by them to divest the United States of its interest in water as it is to obtain the impression that Congress in legislating believed it was without power in the matter. All of these acts merely adhere to the general principle of the act of 1866 as one of convenience. They favor the laws of the Territories quite as much as those of the States and in some instances they give rules independent of either. On this subject see the discussion and citations in *Kinney on Irrigation and Water Rights*, 2d ed., sec. 637.

The desert land law of March 3, 1877 (19 Stat. 377), contains this proviso:

> *Provided, however*, That the right to the use of water by the person so conducting the same, on or to any tract of desert land of six hundred and forty acres shall depend upon bona fide prior appropriation: and such right shall not

> exceed the amount of water actually appropriated, and necessarily used for the purpose of irrigation and reclamation: and all surplus water over and above such actual appropriation and use, together with the water of all, lakes, rivers and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights.

It has been suggested that this is an irrevocable "dedication" to the States, but a glance at the whole provision will convince one that it will not bear such a construction. The proviso makes no mention of the States and does not even refer to the local laws and customs. Congress itself undertakes to lay down the essential conditions of the water right which the desert entryman may acquire: It "shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation," and the free right of appropriation is made coextensive with the public lands in the States and Territories named. The claimed dedication to the States is no more than a declaration that it was not intended by the act to withhold from free appropriation and use by the public (as theretofore under the act of 1866) for "irrigation, mining, and manufacturing purposes" surplus water over and above such actual appropriation and use, under the act, and over and above that already held by virtue of "existing rights." The declaration is similar to that in the

mining law of 1872 (17 Stat. 91): "All valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and purchase, and the lands in which they are found to occupation and purchase * * *."

In both instances Congress states its present policy and leaves itself free to change it at will. The language of the desert-land law is that of a proprietor dealing with its own property.

The case of *Hough* v. *Porter*, 51 Oreg. 318, is sometimes cited as sustaining the theory that this act is a dedication of water to the States. The learned and exhaustive opinion of Mr. Justice King fully sustains, and, indeed, depends throughout, upon the proposition that the United States, as the owner of the public domain, is quite competent to dispose of the waters thereon, together with the land, or to dispose of each separately, or to dispose of one and retain the other. The question examined was whether various owners who had obtained patents for riparian lands from the United States *after* the desert-land law became effective had thus acquired full riparian rights in the waters, no reservation in that regard being expressed in the patents. The court holds that such rights (except for domestic and other purposes not named in the act) were withheld from disposition with the land by reason of this declaration of the desert-land law, which the opinion in some places treats as amounting to a

reservation by the Government and in others as a dedication by the Government to "the public." To hold that there was actually a dedication and that the Government had thus at one stroke parted with all its interest in the unappropriated waters was quite unnecessary to the decision; for, obviously, if the intent of the declaration was, as it may well have been (*Williams* v. *Altnow*, 51 Oreg. 275; *United States* v. *Rio Grande Dam Co.*, 174 U. S. 690; *Gutierres* v. *Land Co.*, 188 U. S. 545), to set the waters apart from the land for acquisition by appropriation only, subsequent land patents would not operate to give riparian rights, whatever might be their terms as drafted in the department.

See *1 Kinney, Irrigation*, pp. 1091, 1095.

It is this idea of the severance of the water from the land by Congress (see *Wiel, Water Rights*, p. 222) and the withholding of it for appropriation, we take it, that was said to be plausible in the reference to *Hough* v. *Porter* in *Boquillas Cattle Co.* v. *Curtis*, 213 U. S. 339, 344. The reference is as follows:

> The opinion that we have expressed makes it unnecessary to decide whether lands in the arid regions patented after the act of March 3, 1877, c. 107, 19 Stat. 377, are not accepted subject to the rule that priority of appropriation gives priority of right by virtue of that act construed with Rev. Stat. sec. 2339. The Supreme Court of Oregon has rendered a decision to that effect on plausible grounds.

Wholesale dedications by the Federal Government to the States are not to be implied or found in words perfectly consistent with a different intention. *United States* v. *Oregon & C. R. Co.*, 186 Fed. 861, 893; *Oregon Railway* v. *Oregonian Railway Co.*, 130 U. S. 1, 26; *Slidell* v. *Grandjean*, 111 U. S. 412, 437.

It should be noticed further that in this proviso Congress was careful to confine its legislation to water "*upon the public lands*" and "*not navigable*," showing that it fully realized the distinction the law makes between public and private waters and that the relation of the United States to innavigable waters is that of a proprietor.

The clause in the timber and stone act of June 3, 1878 (20 Stat. 89), as follows:

> That none of the rights conferred by the act approved July twenty-sixth, eighteen hundred and sixty-six, entitled "An act granting the right of way to ditch and canal owners over the public lands, and for other purposes," shall be abrogated by this act; and all patents granted shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water rights, as may have been acquired under and by the provisions of said act; and such rights shall be expressly reserved in any patent issued under this act—

protects the water rights and rights of way "conferred by" the act of 1866 and declares that all patents shall be subject to such rights "acquired under and by the provisions of said act." This is a clear

recognition that the source of water rights is the United States, and is very far from giving support to the idea that such rights are the issue of a State law, or that the power to grant them has been devolved to the States. It also shows that Congress had clearly in mind that "vested and accrued" water rights in the public-land States become such by virtue of the act of 1866 with the act of 1870, some of the language of which is used in this later legislation.

The act of March 3, 1891 (26 Stat. 1095, sec. 18), granting rights of way for irrigation purposes, declares that the privilege granted shall not be construed to interfere "with the control of water for irrigation and other purposes under authority of the respective States *or Territories*." This means the authority to control the appropriation of water on the public lands conferred by the act of 1866. The Territories are put on the same plane with the States.

Colorado's brief on rehearing (vol. 1, p. 122) points out that the act of August 18, 1894 (28 Stat. 422), known as the Carey Act, grants to public-land States each a million acres of land or so much as the State may cause to be irrigated, reclaimed, and occupied. We do not see what bearing the fact that under the act the State is to cause the lands to be irrigated has upon the questions here. The State receives the grant upon condition that it will reclaim the land in the manner provided by the act. It is required to cause it to be irrigated, reclaimed, occupied, and not less than 20 acres of each 160-acre tract cultivated

by actual settlers "as thoroughly as is required of citizens who may enter under the said desert-land law."

The forest-reserve legislation of June 4, 1897 (30 Stat. 11, 36), contains a clause which provides that—

> All waters on such reservations may be used for domestic, mining, milling, or irrigation purposes, under the laws of the State wherein such forest reservations are situated, or under the laws of the United States and the rules and regulations established thereunder.

Here the uses of water intended to be allowed are such as may be practiced consistently with the objects of the reservation and by ways authorized by Congress. This provision concerning their use is merely a modified reiteration of the consistent policy of Congress, to which we have already given some attention, to leave the matter of defining and controlling the uses of water as far as possible to the local laws.

There were persons "residing within the boundaries of such reservation" owning "property or homes" there. Others were permitted to enter for "proper and lawful purposes," including mining and milling, if they complied with the rules and regulations. *United States* v. *Grimaud*, 220 U. S. 506. The situation called for the use of water, and the object of the provision under discussion was to recognize the legitimacy of the use for the purposes specified,

if consistent with the laws of the State or other laws of the United States.

An act approved February 26, 1897 (29 Stat. 599), opened to use reservoir sites which had been reserved by the General Government, with the proviso that *charges* for the water should be "subject to the control and regulation of the respective States and Territories," etc.

On March 2, 1897, Congress passed a special act (29 Stat. 603) restoring to the public domain a reservoir site, theretofore reserved, and authorizing the Secretary of the Interior to sell it to whomever might buy it for the building and maintaining of a reservoir there. It contained a proviso that the act should not be construed to "deprive the State of Colorado of the control of the water in any reservoir which may be constructed on this site by any person or corporation or association, under the regulations provided by the State laws in such cases."

Under the first of these acts Congress rates the Territories and the States on a par and makes it clear that the reservoir owner will not be allowed to fix charges for the water he stores upon any claim that State and Territorial laws respecting such matters do not affect him. The second act preserves to the State of Colorado the regulative control of the water that may be stored in the reservoir. This act is quoted in Colorado's brief, volume 1, page 122, but how it can be considered a recognition of the State's inherent or acquired ownership of innavigable waters, we do not see.

The reclamation act of June 17, 1902 (32 Stat. 388), inaugurates a new policy by which the United States itself undertakes the development of its land and water resources in the arid States, although development by private enterprise or by State action (under the Carey Act, 28 Stat. 422) is not excluded. Consequently the right of appropriators under the act of 1866, through the subordinate instrumentality of the State laws, is carefully preserved. Money received from the sale of public lands is devoted to "the construction and maintenance of irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semiarid lands." Apart from any consideration of whether this policy would have been adopted if Congress had believed that the waters, indispensably necessary to make these undertakings a success, belonged to the States and so were subject to withdrawal by them at any time, the act shows that the water is assumed to be subject to the use and disposition of the Government. In section 5 it is provided that—

> No right to the use of water for land in private ownership shall be *sold* for a tract exceeding one hundred and sixty acres to any one landowner, and no such *sale* shall be made to any landowner unless he be an actual *bona fide* resident on such land * * * and no such right shall permanently attach until all payments therefor are made.

As rights by appropriation become vested only by beneficial use, it would seem from this that it

was not thought that the Government, by undertaking these projects, would become merely a public-ditch owner with no vested right in the water which the ditches would carry.

Section 8 is as follows:

> That nothing in this act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this Act, shall proceed in conformity with such laws, and nothing herein shall in any way affect any right of any State or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof: *Provided*, That the right to the use of water acquired under the provisions of this Act shall be appurtenant to the land irrigated and beneficial use shall be the basis, the measure, and the limit of the right.

The first part of this section is simply a recognition of vested rights acquired under the act of 1866, and a preservation of the existing systems of water law in the States and *Territories* which have grown up under that act. (See *Gutierres* v. *Albuquerque*, 188 U. S. 545, 552–554.) The direction of the Secretary of the Interior to "proceed in conformity with such laws," is meant like the conformity provisions in other federal statutes to harmonize fed-

eral activity with that which must, by compulsion of State law, go forward, if at all, under local procedure, deriving its authority from the Federal act of 1866. The concluding clause is significant: "That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right." Here again, we see that the State and Territorial laws are rated on a par and that Congress itself undertakes to create water rights and define them. A water right acquired by appropriation and beneficial use in irrigation is not usually appurtenant to the land irrigated. *1 Wiel, Water Rights*, 3d ed., sec.550.

Colorado's brief (vol. 1, p. 119 et seq.) cites the acts that we have been discussing, with the exception of those of May 10, 1872, June 3, 1878, and June 4, 1897, as showing that Congress in them has recognized and affirmed the proposition laid down in the brief that the States have full, and as we understand the brief, the same sovereign jurisdiction and control over all waters within their borders, innavigable as well as navigable. The distinction which the law makes between these two classes of waters is not discussed there or elsewhere in the brief, and no attempt is made to point out how these Federal statutes recognize any such doctrine or are in any way inconsistent with Federal proprietary ownership of the innavigable waters.

In concluding this topic we observe that the legislation of Congress with regard to water rights all

centers upon and is intended to preserve the policy adopted in the act of 1866 of granting the right to use the unreserved proprietary waters of the United States to individuals in accordance with local systems of water-right law.

The right-of-way parts of the act of 1866 under which appropriators of ways were granted easements over the public lands without formal action or coming into contact with Federal executive officers have, for the most part, given way to a more exact system created by the acts of 1891 (26 Stat. 1095) and 1901 (31 Stat. 790), considered by this court in the late case of *Utah Power & Light Co.* v. *United States*, 243 U. S. 389. These later laws in general adopted a plan for granting permits or licenses under executive regulation instead of easements without regulation and substituted direct dealing between the Federal Government and the grantee for the loose indirect process permitted by the act of 1866.

Had such a plan been adopted as to water rights, or had patents for these rights been given as in the case of mining rights, is it likely that the proprietary right of the Government to the waters would ever have been questioned, or at any rate questioned at a later period or more persistently than was its title to the public lands? It is the long continuance of subordinate State control, under a system that involves no recourse to the source of power, that has caused the fact that such control is subordinate, sometimes to be lost sight of.

(4) Ratification of State constitutions asserting State ownership of waters does not divest the United States of its property rights therein.

The provisions of the constitution of Colorado may be taken as fairly representative of those contained in the constitutions of the other States having provisions asserting ownership of water, and are as follows:

> The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the State, subject to appropriation as hereinafter provided.
>
> Colo. Constitution, Art. XVI, sec. 5.
>
> The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes.
>
> Colo. Constitution, Art. XVI, sec. 6.

The contention is that it was the duty of Congress when creating the States to see to it that their constitutions asserted no ownership in, and assumed no control over, property of the United States which it was not the intention of Congress to convey to the

States; and that if those constitutions when finally adopted contained provisions of that character they must be taken as effective congressional grants of such property to the States.

Considering the purpose to be accomplished and the part that Congress plays in creating a State, this seems an astonishing position to take. What Congress does is to bring into being a new State sovereignty to take a place with the others already existing. The purpose is the creation of a State and nothing more. If it grants property to the State at the same time, as it generally does, it does so specifically by an act of Congress.

The constitution may be supervised and reviewed by Congress or it may not. That of Colorado was not and that of Oklahoma was.

Mr. Justice Lurton, in speaking for this court of the Oklahoma constitution, said:

> A constitution thus supervised by Congress would, after all, be a constitution of a State, and, as such, subject to alteration and amendment by the State after admission. Its force would be that of a state constitution and not that of an act of Congress.
>
> *Coyle* v. *Smith*, 221 U. S. 559, 568.
>
> See also:
>
> *Ex parte Webb*, 225 U. S. 663, 690.
>
> *Wilcox* v. *McConnell*, 13 Peters, 498, 516.

Mr. Kinney, in his work on Irrigation, finds this argument for State ownership of water wholly without merit.

> *1 Kinney, Irrigation*, 2 ed., sec. 388, p. 660.

(5) The question whether the United States or the States own the water of innavigable streams in the West has never been directly passed upon by this court. The cases support Federal ownership.

As we have already shown, the California law of waters is based squarely upon the Federal title and the act of 1866; and the California cases, in this respect, are followed in the other States that have not adopted the pure appropriation system, while in those States which have adopted that system the courts for the most part deny the Federal title and seek to find the origin of all titles to water in the State. The question has never been directly passed upon by this court; however, in a number of cases this court has incidentally considered it and expressed the view that the United States has a title and right to the waters on its public lands wholly independent of State permission. In no case that we have found has this court given countenance to the contrary theory.

None of these cases lends support to the theory that the States have any inherent power to dispose of or affect the innavigable waters flowing on the public lands and all of them accord perfectly with the theory of water law, based upon the Federal title, that we have been maintaining. The dictum in the Rio Grande Dam case, placing limitations upon the States as to such waters, stands not only unmodified, but is supported by the later decisions. The text-book writers who discuss the subject at all, so far as we have found, are unanimous in their support

of the federal title. *Weil, Water Rights*, 3 ed., pp. 183, 184, 223; *2 Kinney, Irrigation*, 2 ed., sec. 640; *Long, Irrigation*, sec. 74, p. 134.

The cases are:

Atchison v. *Peterson*, 20 Wall. 507.
Basey v. *Gallagher*, 20 Wall. 670.
Sturr v. *Beck*, 133 U. S. 541.
United States v. *Rio Grande Dam and Irrigation Co.*, 174 U. S. 690, 704.
Gutierres v. *Albuquerque, etc., Co.*, 188 U. S. 545.
Kansas v. *Colorado*, 206 U. S. 46.
Winters v. *United States*, 207 U. S. 564.
Boquillas Land & Cattle Co. v. *Curtis*, 213 U. S. 339.

Kansas v. *Colorado, supra*, decided in 1907, is not an authority to the contrary of the position taken in *Rio Grande Dam & Irrigation Co.* v. *U. S.* The Government there sought to maintain its intervention upon the broad theory that because the policies of Colorado and Kansas, respecting the use of the waters of the Arkansas, were conflicting, and because neither State was competent to regulate that use outside of her own borders, the entire power of regulation must be held to reside in the United States. Such a Federal power was said to be essential to insure the reclamation of arid lands—not lands of the United States alone, but arid lands generally. This was claimed as an inherent power of sovereignty—a sort of national police power springing from the needs of the situation. The opinion, of course, concedes the power of the United States to control the dispo-

sition of its public domain. Its interest in the use of water upon its own lands or the advantageous reclamation, use, and disposition of its own lands, or its general proprietary interest in nonnavigable waters was not in issue.

(6) Upholding of State ownership would disintegrate the law and destroy Federal interests without working any practical good to the States.

The western States can show no grant of innavigable waters to them, so they can not be held to own or control such waters without putting the whole law in that field on a new foundation.

As we have already shown, there is no basis in the common law for the proposition that the sovereign owns innavigable waters or the usufructuary right to them because of the nature of water or otherwise; also, local conditions can not work a transfer of ownership from the United States to certain of the States without a distinction being made, which the law has never made, between the right to the use of water and between other things which are the subjects of ownership, or without giving to the arid States a power and field of jurisdiction that is denied to other States—without, in fact, working that very inequality between the States in order to avoid which rights in navigable waters were held by this court to be vested in these same new States.

Water law in the dual-system States is incapable of explanation or of being put upon any logical

basis if common-law principles and their sure result, Federal ownership, are to be abandoned in favor of any principles that can support ownership or power in the States. Furthermore, as we have seen, the appropriation system in Colorado and the States that follow her lead rests as a matter of history and with logical completeness upon the same principles that that system rests upon in California, where it originated.

It certainly is an astonishing proposition that the owner of most of the land in which these waters are or over which they flow lost title to the right to use them at some period, near or remote, upon the mere admission of the States. The common law considered these estates in land and water as one. They could be separated, as we have seen; but normally and originally they belonged together. These particular lands were practically useless without the water, and certainly the water was useless without the land. Furthermore, access to the water could not be obtained without the landowner's permission. To say that under these circumstances the owner of all the land had no interest in the water, or that it would be desirable that one sovereign should own the land as a proprietor and that another sovereign should own the use of the water as a royalty or otherwise would be a *reductio ad absurdum*.

Besides these objections based upon the law, there is this very important practical objection to

State ownership of innavigable water—that while working no practical good to the States, because the liberality of Congress has fully taken care of appropriations within them according to their own laws, it would put the Federal Government, as the proprietor of vast areas of land, at the mercy of the States, and so would disastrously affect its great reclamation, Indian, and other Government policies.

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The controversy, as one involving an interstate stream, should be decided upon the basis of the Federal ownership of lands and waters, thereby confining the ownership of the States, as ultimate proprietors, to such water rights as have been or may be granted to the respective States for themselves or for use in connection with the lands within their borders.

(1) In practice the Federal Government disregards State lines in the use and control of waters for its own purposes, and State lines have been equally disregarded in the grant and acquisition and use of private water rights in the Western States, so a division of water between the States making State lines controlling would interfere with the Federal use of water and seriously modify or destroy existing vested rights. These rights being grants from the paramount Federal sovereignty should be upheld as against the claim that the States which enjoy a quasi sovereignty only should be treated in this respect as independent nations and the waters be divided between them on that basis and in disregard of the rights of the Federal Government and of the Federal grants.

Under our theory of the Federal Government's original proprietary right to the use of innavigable waters occuring in and flowing over its lands, and that all private rights to such waters have been derived by grant from the Federal Government,

we contend that there is no room at all for a division of the waters of interstate streams between States so long as such waters are Federal property or even if they have been granted, except in strict recognition of such grants.

Many of the Government's reclamation projects, in fact, by far the greater number, we understand, depend largely, if not wholly, upon the waters of interstate streams. These projects have been undertaken and the settlers under them have gone ahead upon the assumption that the water rights of the projects would not be subject to readjustment because of the existence of any overlying paramount power that could be invoked by the States. Similarly private water rights, whether acquired as riparian rights or by appropriation, have been acquired and, as we contend, granted by the Federal Government in the same way. Many of the most valuable of these grants were made while the States were Territories, and some of them doubtless before the Territories even took the boundaries that were finally adopted when they became States.

We have here on the one hand the Federal Government, the paramount sovereign, owning and granting property rights of the highest dignity and value in a subject-matter, that necessarily reaches over and disregards State lines. The grant of a right, whether riparian or appropriation in character, in the lower State, immediately below the upper State's line, to be of any real value must carry with it a right in the flow of the stream that

reaches up into and limits uses in the higher State. The rights so granted are protected by the Constitution of the United States and, by Federal law, are specifically required to be excepted from all patents made thereafter by the Government itself. (16 Stat. 217, sec. 17.) Opposing this situation, we have, on the other hand, the idea that because the States in which these grants are made enjoy many attributes of sovereignty, these Federal grants should be limited. The contention of the States is that the Federal Government can not decide, even though all of the lands and the use of the water are its property, and even though it is itself a sovereign, the extent of the rights it grants in this property, which necessarily must transcend State lines, but that their extent is subject to be determined by a future adjudication between the States alone. Their contention is, further, that that adjudication should be made upon the theory that the States are in this regard independent nations.

We are, of course, familiar with the concept that the sovereign of a political State has a title and right of ownership to all of the property within that State which is behind and superior to the rights of its citizens, and that necessarily that full sovereign, in a controversy with another sovereign, may speak the last word with regard to all of the property in the State. It follows from this, of course, that the citizen's title in such case stands or falls with that of his sovereign. If his sovereign has to give up property

rights to the other sovereign, the citizen, of course, must suffer.

This principle we contend should not apply with regard to our Commonwealths. They are the ultimate owners of all within their borders only in a limited sense. Another and superior sovereignty, the United States, sees to it, through constitutional provisions of its own, that property and personal rights of the citizens of those Commonwealths, who are also its own citizens, are duly protected. It seems to us that under these circumstances these rights of individuals must be considered in any controversy between our States, and that the rights granted by the Federal Government to its citizens and the citizens of the Commonwealths should stand as against any theory of what a proper division would be if they did not exist. Our Commonwealths are not sufficiently sovereign to require any such readjustments as would be required if they were fully sovereign, or to demand any such overriding of the power of Congress to make final disposition of the Federal property.

State equality would not be impaired by a solution upholding these Federal grants. What is required by the principle of States equality is an equality of powers, not an equality of subjects upon which to exercise them. The Federal Government may exhaust its mines or forests within a State or otherwise dispose of its property there as it will, regardless of whether or not such disposition limits the field within which that particular State might otherwise exercise powers which it undoubtedly enjoys

equally with all of the other States. To confine the States' jurisdiction, as we contend it should be confined, to rights in nonnavigable waters which have been granted by the Federal Government directly to those States or for use on lands within their borders would, under these principles, in no way limit the jurisdiction of the States anywhere within their boundaries over all the proper subjects of State power and control.

(2) **The contentions of the States are not in accord with fundamental ideas of either State sovereignty or water law and are impracticable.**

Both of the States in this suit disregard the peculiar situation created by the fact that under our system titles to property often do not spring from the organs of municipal sovereignty, the States. They disregard the further fact already referred to by us that our States are not truly sovereign and that property rights in them are protected by another and higher sovereignty, the United States. It is for these reasons that the attempt in this suit to ignore the Federal title to the innavigable waters which have not yet been granted and the effect of Federal origin and Federal protection of property rights upon such of them as have been granted, leads to false reasoning and wrong conclusions.

Taking the attitude just referred to, both States are seeking a solution based upon the idea that the States are full sovereigns and that they face each other with regard to this stream just as they would if they were not Commonwealths of our Union but were independent members of the family of nations.

Colorado's first contention, that she may use the waters within her boundaries wholly regardless of the effect upon the flow of the stream in the lower State, would be untenable even if the two States were in truth, full sovereigns. If they were such sovereigns, a use of that character would be so repugnant to natural ideas of justice as to warrant the lower State to resort to war to put a stop to it. (See *Missouri* v. *Illinois*, 200 U. S. 496.) The proper division of the waters or the benefits of the stream is a justiciable matter to be determined by this court and was so held in *Kansas* v. *Colorado*, 206 U. S. 46.

The second contention of Colorado we regard as also untenable. It is that a division of the waters of the stream should be made between the two States upon some theory of an equitable enjoyment by each State of the benefits of the common resource. This doubtless would be the correct general principle to go on, however difficult of application it might be, if the States really were, and so were to be treated, as independent nations. State sovereignty is not, as we have said, of that high character, however, and that fact and the existence of the Federal origin and Federal protection of titles to water rights preclude such a solution absolutely and as a matter of law. The consideration just stated, we contend, settles the matter. However, we wish to point out that even if that were not the case it would be a very difficult thing to do and would be opposed to our fundamental ideas of water law to make an apportionment of this or any other interstate stream upon such

a basis as Colorado suggests. On the one hand, it is hard to see how existing private rights could be adequately protected unless the division between the States were made, as we contend it should be, exclusively upon the basis of the Federal origin of such rights. And on the other hand it is equally hard to see upon what theory of water law the general principles of the riparian doctrine could be disregarded if the two States were to be taken as in truth facing each other as full sovereigns and, therefore, as true, ultimate landowners of all riparian lands and of other things capable of ownership within their boundaries.

It is to be noted that Colorado in her briefs carefully refrains from saying just how the division should be made under her own theory or upon what principles except the very vague one of general fairness. She seems to contend strenuously for a proprietary ownership in herself of innavigable waters within her borders and for the upholding of the appropriation system there; but as against her sister States, into whose lands the waters falling on her mountains ultimately flow, she desires to have full riparian rights, so that she can develop her own lands in the future, slow or fast as she pleases, and retain a large ownership in the water in any event.

To our minds the upholding of such a doctrine would go far to lock up the resources of the West; and here we think the existence of the Federal title and the fact that the States are not full, independent sovereignties offer both a logical and a practical solution.

Wyoming contends that a division should be made between the States in accordance with the priority of appropriations made by their respective citizens, but with the modification that the use of the water should be confined to the lands within the watershed.

We are clear that making the watershed a controlling factor would be unwise. Often indeed it is essential for the proper development of the State that it be possible to take water far beyond any such confines. This is often necessary for city water supplies, to name only one of many important uses, and we see no reason why any such limitation should be placed upon the use by a State of any part of a stream that might be awarded to it.

Wyoming's argument for a division on the basis of prior appropriation disregarding the State line would not be in accord with our fundamental ideas of water law if we were to ignore the Federal title and its effect and were to adhere to the theory that the States in this regard are to be treated as full independent sovereignties. As such sovereignties how could their situation as riparian owners be ignored and they be confined in their rights in the stream to water that they had already appropriated, and, as to the surplus waters, be given merely a right to engage in a race to make further appropriations?

The fact that their laws recognize priority of appropriation as governing the rights of their citizens can have no bearing. These laws in neither instance were made to govern the State itself as

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In the Supreme Court of the United States

OCTOBER TERM, 1916

IN EQUITY

THE STATE OF WYOMING, Complainant,

vs.

THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, and the Laramie-Poudre Reservoirs and Irrigation Company,

Defendants

Supplemental Brief on Behalf of the Plaintiff

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Number 7 — Original

THE STATE OF WYOMING, Complainant,

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THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company, Defendants

IN EQUITY

Supplemental Brief on Behalf of the Plaintiff

Statement of the Case

This is a suit by the State of Wyoming against the State of Colorado and two individual defendants incorporated under the laws of that State, seeking to prevent the diversion of certain waters from the Laramie River. This river has its source in Colorado and flows into Wyoming.

The contention of the plaintiff is that she owns lands in the valley of the Laramie River watered by that stream, and also that she and her citizens since

1865 and prior to any right to any of the waters of the stream in the defendants, or either of them, appropriated and used in the irrigation of large amounts of land and in the development and maintenance of large communities the waters in controversy; and that the defendants, without right as against the rights of the plaintiff and her citizens, is threatening to take a large amount of the waters of the stream so as to deprive the plaintiff and her citizens of the use thereof, to the great and irreparable injury and damage of the plaintiff and her citizens.

The contention of Colorado is three-fold:

A. That there is an abundance of unappropriated water in the stream, and that she will take only from the surplus.

B. That the State of Colorado is entitled to an equitable division of the water, and that the amount she intends to take is not more than her equitable share.

C. That the waters at the place where they are to be taken are found within the boundaries of Colorado, and that she as a sovereign is entitled to take any waters found within her borders without regard to any rights of any other State or person.

The facts contended for in the first proposition are disputed by the plaintiff; likewise the facts and the principle of law as contended for in the second, and the principle of law contended for in the third.

The case has already been argued before this Court, and we will content ourselves with this brief statement of the controversy here, and will elaborate the facts more at length in the discussion of the evi-

dence in that portion of the brief devoted to the argument.

Throughout this brief all references to pages upon which evidence appears are to the marginal page numbers.

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I. AMOUNT OF WATER TO BE TAKEN BY COLORADO

By the bill of complaint it is charged that the defendants intend to divert 100,000 acre feet of water

per annum from the Laramie River, and throughout the case the defendants have admitted that they intend to take all of the water they can divert (p. 2120), but this amount is claimed to be less than 100,000 acre feet. On page 144 of Vol. I of the original brief for defendants, it is said: "Colorado in this suit insists upon her claim to divert 91,000 acre feet of water of this interstate stream." It is probably true, however, that this amount is derived from the testimony of the State Engineer of Colorado, Mr. Field, who concluded from his examination of stream flow records (p. 3424) that the total average annual flow near the Colorado tunnel is 77,000 acre feet; that about 74 per cent. of this amount can be diverted into the tunnel, making an average annual diversion of 56,000 acre feet; that this is exclusive of the amount that can be secured through extending the West Side Collection Ditch to McIntyre Creek, an extension which is not only possible, but is a part of the "suggested plan". Mr. Field concluded that this extension would divert on an average 15,000 acre feet per annum, or 75 per cent. of the water in McIntyre Creek (p. 3425) making a total average diversion through the tunnel of 71,000 acre feet. In addition to this amount, Colorado, its witness says, is already diverting an average of 20,000 acre feet per year from the Laramie River into the Poudre, being 18,000 acre feet through the Skyline Ditch and 2,000 acre feet through the Divide or Wilson Supply Ditch (p. 3426). The Skyline Ditch was commenced in 1891 (p. 2205), and the Divide Ditch was constructed several years later, defendants' Exhibit 24 (p. 3398), in which this ditch is designated "Sand Creek Ditch", showing that water was carried through it in 1902. This makes the total of 91,000 acre feet.

It must be borne in mind, however, that these amounts are estimated for years in which there is an average runoff, and as stated by Mr. Field (p. 3401), the amount diverted yearly will be more constant than the flow of the stream, there being a higher percentage diverted in years of small flow than in years of large flow, on account of the pressure for water. This is well illustrated by the diversion through the Skyline Ditch, as shown on defendants' Exhibit 124 (p. 3398), from which we take the following table:

Table Showing Discharge in Acre Feet of the Poudre River, Skyline Ditch and Divide Ditch, April to October, and Percentage of Poudre Discharge as Compared to Thirty-Year Average

Year	Net Poudre Discharge	Percentage of Average	Skyline Ditch Discharge	Divide Ditch Discharge
1899	388,591	131	17,699	.....
1900	474,573	160	18,657	.....
1901	339,155	114	23,805	.....
1902	151,636	51	22,124	1,925
1903	345,150	116	26,114	1,713
1904	315,437	106	23,434	6,810
1905	361,652	122	13,291	0
1906	279,974	94	16,693	5,004
1907	386,224	130	15,024	5,400
1908	252,843	85	17,958	2,092
1909	486,002	163	12,725	0
1910	157,514	53	16,435	783
1911	205,611	69	19,085	4,418
1912	297,722	100	20,986	2,157
1913	217,959	73	14,639	0

It is shown here that in 1901, when the flow of the Poudre River reached 114 per cent. of its average, the amount diverted through the Skyline was 23,805

acre feet, and in the following year when the flow of the Poudre was only 51 per cent., the amount diverted through the Skyline was 22,124 acre feet. In 1907 the Poudre flow was 130 per cent., and the Skyline diversion only 15,024 acre feet. In the following year the Poudre flow was 85 per cent., and the Skyline diversion rose to 17,958 acre feet. In 1909, when the Poudre flow was 163 per cent., the Skyline diversion was 12,725 acre feet, and in the following year when the flow of the Poudre was only 53 per cent., the Skyline took 16,435 acre feet; and in 1911, another year of small flow, equaling only 69 per cent. of the average, there was diverted through the Skyline 19,085 acre feet, within 1,000 acre feet of the amount taken in 1912, which had a flow almost fifty per cent. greater. The diversion through the Skyline canal is estimated by Mr. Field (p. 3422) as being 75½ per cent. of the total amount of water susceptible of diversion through that ditch. In a general way the Divide Ditch, which on Exhibit 124 is designated as the Sand Creek Ditch, exemplifies the same practice, although this is a smaller ditch and the water it furnishes to the Poudre Valley is of less importance to the system with which it is connected than is the water carried through the Skyline Ditch, and it appears that there were three years in which no water at all was diverted through this ditch. The amounts diverted, however, run as high as 6,810 acre feet in 1904, which was a year said to be but little above the average in stream flow, and was 4,418 acre feet in 1911, a year of only 69 per cent. of the average flow. This exhibit demonstrates two things, first, that Mr. Field's estimate of 18,000 acre feet for the Skyline and 2,000 acre feet for the Divide as being the average annual diversion, is very much too

low, and second, that if the year 1912 was "normal" both on the Poudre and on the Laramie, as contended by him, and the Skyline Ditch diverted 20,986 acre feet in 1912 and 19,085 acre feet in 1911, which was very much below an average year, then the amount diverted through these mountain ditches in years of small flow must be practically 100 per cent. of the amount of water available for diversion, a conclusion in exact accord with Mr. Field's statement (p. 3401) to which reference has already been made, that in years of scarcity of water the percentage diverted from the foreign watershed would be proportionately greater than in years of plenty.

Our conclusion with respect to the amount of water that Colorado will divert from the Laramie River into the watershed of the Poudre, is:

1. That under conditions existing prior to 1913, the amount would in average years exceed 91,000 acre feet, as contended by Colorado, by at least 4,000 acre feet, the estimate for both the Skyline and the Divide ditches being 2,000 acre feet too low, as shown by their records set forth in defendants' Exhibit No. 124.

2. That the constantly increasing pressure for water in the Poudre Valley will certainly cause added efforts to divert water from the Laramie both earlier and later in the season, and with less loss, as by concreting portions where leakage is excessive, as is to be done in the Poudre Valley (p. 1869), so that even in average years the amount diverted will be much more than 75 per cent. of the amount available, and will increase the amount in average years from 95,000 acre feet to a much larger amount, the extent of the

increase being, of course, wholly problematical, but the fact of the increase certain.

3. That in years of low flow and of greatest need of lower Wyoming appropriators, the proportion of the amount diverted by Colorado will rise to practically 100 per cent. of the flow of the stream at the diversion works.

II. AREA OF LAND RECLAIMED IN WYOMING

We divide this discussion under several heads:

(a) Area of Wyoming land already irrigated under ditches having a conceded priority over Colorado diversion.

(b) Area not yet actually irrigated, for which rights are claimed under ditches themselves of conceded priority.

(c) Area lying under ditches of disputed priority; with which is correlated a discussion of the evidence upon which Colorado bases its claim of priority of August, 1902, for the Greeley-Poudre system.

(a) The evidence offered by Wyoming upon this point consists almost wholly of the testimony of a great many witnesses, each of whom testified as to the amount of land irrigated from a ditch owned by him or with which he was quite familiar. We conceive that these witnesses are better able to testify with certainty than could third persons or engineers not

personally familiar with the use of the water, and who in making plane table surveys necessarily depended upon the conclusion of a rodman as to the limits of the irrigated area, because a very large part of the acreage, particularly upon the Laramie Plains, was utilized as pasture and hay was not cut therefrom, and it is obviously difficult for an outsider to ascertain definitely the limits of the land upon which water is applied in this manner. Not only does the conflict between the witnesses for Wyoming and the engineers who made a survey for Colorado illustrate this fact, but the same thing is shown in the testimony with respect to the area of the land irrigated in the Laramie Valley in Colorado. J. A. Whiting, a civil engineer employed by Wyoming, surveyed the Colorado ditches in 1910, there being six in his party, and ten days being devoted to the work (p. 1266). The total acreage of all land lying between the ditches and the river was found to be 1856.64 acres, of which 567.6 acres consisted of land largely covered by willows (p. 1270.) The engineer for the Greeley-Poudre Irrigation District, which had purchased many of these Laramie Valley ranches, (p. 3460), John R. Wortham, who was familiar with the ditches and the irrigation therefrom, made a survey also, and testified that the total acreage was 4250 acres (p. 3457). Both Mr. Wortham and Mr. Whiting are competent, honest engineers, and we have no reason to doubt the good faith of either, but the one was not familiar with the ditches and the use of water therefrom; the other was. For the same reason the evidence of the Wyoming witnesses with respect to irrigation in Wyoming shows a much larger acreage than does the testimony of the Colorado engineers, although the disparity is not nearly so great as in the

case of the Colorado land. We have summarized the testimony of the Wyoming witnesses as follows:

1. Ditches from Main River

Riverside Ditch No. 1 and the King Ditch had been constructed prior to 1880; Riverside Ditch No. 2 was constructed in 1884 by enlarging the Gramm Ditch, constructed in 1882 or 1883; the Caldwell & Gardinier Ditch was built prior to 1886, and from that time the four ditches irrigated upon the Riverside and King ranches about 13,500 acres. (pp. 278-9, 324-5.)

Murphy Ditch, built in 1877 or 1878, irrigates about 80 acres, (pp. 409-10).

Last Chance and Fisher Ditches, built in 1884, and the O. Sodergreen Ditch, built in 1878 and enlarged in 1884, irrigate 800 acres, (pp. 410-11).

Mansfield's O. N. Ditch constructed in 1884 or 1885 irrigates about 640 acres, (p. 411).

Hammond North and South Ditches, built in 1885 or 1886, irrigate 160 acres, (p. 412).

Smith No. 1 and No. 2 Ditches, built in the '80s, irrigate 80 acres, (p. 412).

Lund's North Line Ditch, built in the '80s, irrigates about 320 acres, (p. 412).

Burg's Ditch, constructed in the '80s, irrigates more than 200 acres, (p. 413).

Central Ditch irrigates 50 acres, (p. 413).

Sodergreen No. 1 and No. 2 Ditches were constructed in the '80s and irrigate between 300 and 400 acres, (p. 414).

O. G. Ditch was built about 1887 and irrigates 640 acres, (p. 414).

Sodergreen South Ditch was built in 1887 and irrigates between 40 acres and 50 acres, (p. 415).

Island Ditch built before 1880 and irrigates 80 acres, (p. 416).

Heidrick Ditch constructed in the '80s and irrigates 160 acres, (p. 416).

Parker Ditch constructed about 1896 and irrigates 1650 acres, (pp. 416, 417).

Popp and Pahlow extended the Last Chance Ditch in the early '90s and irrigated therefrom 1,120 acres, (pp. 417-8.)

Sodergreen High Line Ditch was surveyed in 1907 and completed about 1910 and irrigates from 4,000 to 5,000 acres, (pp. 418-9); as the priority of this ditch is not conceded, being subsequent to 1902, this acreage is omitted from the recapitulation at the end of this review of the evidence.

Bush & Holliday Ditch was built several years prior to 1898, and irrigates 890 or 900 acres, (pp. 499-501); this land was irrigated prior to 1888, (p. 528).

Sutherland irrigated 50 or 60 acres by means of an overflow dam constructed in 1890, (p. 529).

The Bilderback Ditch was constructed prior to 1878, (p. 531), and was developed into the Dowlin Ditch, irrigating on the Heart Ranch 3,100 or 3,200 acres, (pp. 531, 534, 555).

Walcott Ditch constructed on Heart Ranch, across river from Dowlin Ditch, prior to 1888, and irrigated additional 550 or 600 acres, (pp. 535-6).

A number of small ditches constructed below Laramie City in the '70s and '80s, near ranch of witness Fitch, irrigated in Township 16, Range 73, 500 acres;

in Township 17, Range 73, 75 acres; and in Township 17, Range 74, 3,000 acres, (pp. 569-573).

Oasis Ditch was constructed in 1884, (p. 589); in 1910 an engineer determined by survey that the area lying under ditch with recognized water right was 11,246 acres, (p. 608); he did not survey actually irrigated acreage, but estimated that it was probably 75 per cent. of the total, (p. 618); while a witness who had charge of lands under the ditch in 1900 or 1901 testified whole area was irrigated excepting high spots averaging about 50 acres to the section, (p. 957).

Cooper Lake Ditch irrigates 750 acres, (p. 619-620).

LeRoy Grant Ditch irrigates 887 acres, (p. 730); the ditch was originally known as the Hutton Pick-up Ditch and was built in the '80s, (p. 718).

Fischer Ditch was constructed in 1887, (p. 750), and reconstructed in 1888, (p. 750); the surveyor who surveyed it in 1906 or 1907 testified it irrigates about 3,000 acres, (pp. 731-2).

The Pioneer Canal Company was organized in 1878, and the canal first constructed in 1878 and 1879, and enlarged in 1885, (p. 916). The company owning the works acts only as a carrier, the lands being owned by persons buying annual water rights, (p. 884). In 1913, the year the testimony was taken, the plaintiff's engineer made a reconnaissance of the area under the canal and ascertained that the acreage irrigated in that year was 11,486 acres, (p. 824), this being corrected later to 11,556 acres, (p. 844), and he testified that his examination showed that in former years a greater acreage had been irrigated, (p. 825), being at least 2,000 acres more, (p. 828). The superintendent of the canal, Titus, testified that ten or twelve years

before 1913 he had made a map of the irrigated area, which was then 17,000 or 18,000 acres, and that this amount of land was irrigated each year up until 1912, when between 19,000 and 20,000 acres was irrigated, this being the largest amount ever irrigated under the canal, (pp. 863-4), which covers an irrigable acreage of between 35,000 and 50,000 acres, (p. 865).

Biddick Ditch was built in 1897 and irrigates 578 acres, (p. 903-4).

All of the above ditches divert water from the principal stream above its junction with the Little Laramie River; the following divert water from the Laramie River below the mouth of the Little Laramie River:

Boughton Ditch, constructed in 1884, irrigates more than 7,000 acres, (pp. 748-9).

The Gillespie-Dunn and Dunn Ditches were built in 1887 or 1888; the Ione Lake Ditch in 1890; they irrigate respectively 140 acres, 190 acres and 620 acres, (pp. 704-5).

The Wyoming Development Company's system, supplying water to the Wheatland colony, was commenced in 1883 and prior to 1885 there had been expended on Canal No. 1 alone the sum of $142,210.94, (p. 1291). The expenditures prior to 1902 were as follows: (pp. 1291-2):

Canal No. 1	$143,601.76
Canal No. 2	34,819.11
Canal No. 3	44,355.28
Reservoir No. 2	115,541.56
Tunnel	138,311.66
Diversion Dam	1,835.27
Laterals	4,178.42
General expenditures (not including advertising and commissions on sales)	156,075.17
Total	$638,718.23

In 1894, when settlers were first secured, 2,000 acres were irrigated, and in 1900 this had grown to 10,000 acres, (p. 70); in 1913, when the evidence was taken in this case, the area irrigated in the original project was 33544 acres, (p. 168). This does not include the area irrigated in the Bordeaux project, the priority of which is contested, being in that year 1,004 acres, (p. 168).

Dodge Ditch, built in 1894, irrigates 120 acres, the Dodge South Side Ditch, built in 1906, irrigates 93 acres, (p. 669); the latter is not included in the recapitulation, its priority being disputed.

Cramer Ditch, built about 1900, irrigates 220 acres, (p. 696-7)

McGill Ditch, completed in 1882, irrigates 705 acres, (p. 1294).

Cross T. Ditch No. 2, completed in 1884, irrigates 468 acres, (p. 120).

Scissors Ditch was constructed before 1880 and irrigates more than 250 acres, (p. 120).

Laramie River Ditch No. 1 was in use in 1881, and irrigates 800 acres, (p. 121).

Cross T. Ditch No. 1 was built in 1884 or 1885 and irrigates 90 to 100 acres, (p. 122).

The A. N. Spencer Ditches were built about 1890 and irrigate between 700 and 800 acres, (p. 123, p. 144).

Phillips Ditch, built 1890, irrigates 30 or 40 acres, (p. 125).

Uva Ditch, built in 1890, irrigates 200 acres, (p. 125).

Yates Ditch, built prior to 1900, irrigates 100 acres, (p. 132).

McCormick and Bright Ditch, built in '90s, irrigates between 300 and 400 acres, (p. 135).

The witness Whitney testified that a number of other small ditches were constructed along the lower portion of the Laramie River in the '90s, including the Gallagher, Reitz, Thompson, Ryan and Combination ditches, (pp. 122, 123, 124, 136, 143), but the acreages irrigated are not shown.

2. Ditches from Tributaries

The area irrigated from Sand Creek and its tributaries under ditches constructed prior to 1902 (p. 902), is 5,898 acres, (pp. 898-9).

The engineer of the plaintiff determined the irrigated acreage upon the Little Laramie River and its tributaries below the mountains (the mountain ditches not being included) by a reconnaissance made in October, 1913, as follows: Little Laramie River, 45,899 acres; Seven Mile Creek, 1,527 acres; Four Mile Creek,

a tributary of Seven Mile Creek, 918 acres; total, 48,344, (pp. 982-3). The lands found to be irrigated are listed in the schedule commencing p. 995. He found lands which had been irrigated in previous years, but not in 1913. (p. 984.) A subsequent witness testified that there had been but little change in irrigated acreage in 20 years, and only two small ditches, with total of 240 acres under them, constructed since 1903.

No other evidence was offered by Wyoming with respect to the irrigation from the tributaries of the Laramie. By Exhibits H, N, and O, adjudicating these streams, hereinafter referred to in detail, the large number of small appropriations from these tributaries is shown, but we consider proof of exact area irrigated upon those tributaries unimportant in this case, for certainly Colorado cannot force us to abandon to that State the stream from which our major appropriations are made merely because in some other source we might conceivably find water to irrigate the lands we have reclaimed by use of the water of the Laramie; another reason for omitting reference to these other tributaries is that with the exception of one or two very small creeks near Laramie City, these remaining tributaries lie below the Laramie Plains and the Wheatland No. 2 Reservoir and could not be used to supply any of the Wyoming appropriations particularly in question.

Recapitulation of Irrigated Area

Name of Ditch	Acres	
Riverside No. 1, Riverside No. 2, King, and Caldwell & Gardinier	13,500	
Murphy	80	
Last Chance, Fisher, O. Sodergreen	800	
O. N.	640	
Hammond North and South	160	
Smith No. 1 and No. 2	80	
Lund North Line	320	
Burg, more than	200	
Central	50	
Sodergreen No. 1 and No. 2, between	300	and 400
O. G.	640	
Sodergreen South, between	40	and 50
Island	80	
Heidrick	160	
Parker	1,650	
Popp & Pahlow extension of Last Chance	1,120	
Sodergreen High Line, commenced in 1907, not included, more than	4,000	
Bush & Holliday	800	or 900
Sutherland	50	or 60
Bilderback-Dowlin	3,100	or 3,200
Walcott	550	or 600
Township 16, Range 73	500	
Township 17, Range 73	75	
Township 17, Range 74	3,000	
Oasis, 75 per cent. of 11,246 acres	7,430	
Cooper Lake	750	
LeRoy Grant	887	
Fischer	3,000	
Pioneer Canal, in 1913	11,556*	
Biddick	578	
Total above Little Laramie River	52,186	

* *Much more in former years.*

Name of Ditch	Acres	
Boughton, more than	7,000	
Gillespie-Dunn	140	
Dunn	190	
Ione Lake	620	
Wyoming Development Co. system	33,544	
Bordeaux, not included, 1,004		
Dodge	120	
Dodge South Side, not included, 93		
Cramer	220	
McGill	705	
Cross T. No. 2	468	
Scissors	250	
Laramie River No. 1	800	
Cross T. No. 1	90	or 100
A. N. Spencer	700	or 800
Phillips	30	or 40
Uva	200	
Yates	100	
McCormick & Bright	300	or 400
Gallagher, Reitz, Thompson, Ryan, and Combination, acreage not stated.		
Total below Little Laramie River	45,669	

Total irrigated from Laramie River ..... 97,855 acres
Total irrigated from Little Laramie River 48,344 acres
Total irrigated from Sand Creek ..... 5,898 acres

(b) In addition to the land already irrigated under prior rights in Wyoming, there is a very large acreage lying under the old ditches and intended to be irrigated therefrom, upon which water has not yet been applied. Colorado's State Engineer, Mr. Field, said (p. 3637), "As ascertained from the plane table survey, the amount of land actually irrigated was less than 50 per cent. of the amount lying under the old ditches." M. R. Johnston, formerly manager of

the Wheatland irrigation system, which is below the Laramie Plains area, testified (p. 69) that the Wheatland system was commenced in 1883, and the area to be reclaimed consists of about 60,000 acres, of which about one-half has been irrigated. This is a colonization project, and the extension of the use of the water depended upon the rapidity of the settlement, which in turn is of course wholly dependent upon economic principles and cannot be hastened by the efforts either of the State or of the management.

The plaintiff offered in evidence copies of three decrees adjudicating rights to the use of water of the Laramie River and its tributaries in Wyoming, not for the purpose of proving thereby that so much water had been appropriated, because the decrees could not have that effect against the State of Colorado or its citizens who were not parties to the proceedings, but for the purpose of confirming the competent evidence, which had been introduced with respect to practically all of the ditches covered by the decrees, and to show that the State of Wyoming had itself recognized the validity of these claims. The decrees likewise show the amount of land which Wyoming citizens have intended to reclaim under ditches of conceded priority, and the right to increase the area irrigated under these old priorities until the entire area for the reclamation of which the ditch was constructed has been reclaimed, is recognized by these decrees.

The three decrees are Exhibits H, O, and N, and have been printed and bound together and filed with the original exhibits, their length making it inadvisable to reproduce them in the printed record. Exhibit N is a decree of the district court of Laramie County, Wyoming, of December 27, 1912, and covers the

Laramie River and all of its tributaries excepting Soldier Creek, Little Laramie River, and Chugwater Creek, which had been adjudicated previously in separate proceedings. The proceedings in which the decree was entered were commenced before the Board of Control of Wyoming, a quasi-judicial body having by constitutional provision jurisdiction to adjudicate all water rights, with provision for an appeal to the district courts from its decrees. The proceedings were commenced before 1900, and accordingly all of the priorities are of a date earlier than 1900, with the exception of one which has a priority dated 1900; the decree itself provides (p. 47 of Exhibit N) that it shall not affect any ditch constructed under permit the date of completion of which did not expire prior to May 25, 1900.

Exhibit O is a decree of the Board of Control dated March 26, 1892, adjudicating the appropriations from Soldier Creek, a small tributary of the Laramie River near Laramie City. Exhibit H is a decree of the Board of Control dated May 5, 1892, adjudicating appropriations from the Little Laramie River, the one large tributary of the Laramie River upon the Laramie Plains, and entering the Laramie River about fifteen miles below Laramie City, and below the much larger part of the area irrigated upon the Laramie Plains.

We did not offer in evidence the decree of the Board of Control adjudicating Chugwater Creek, this creek being omitted from consideration because it enters the Laramie River but a few miles above its mouth, lies below the Wheatland district, has a large amount of land irrigated from it, and is not presented by any witness as a possible means of supply for any of the lands irrigated from the Laramie River, (pp. 4378-9).

In no better way can we show the gradual character of the development of the territory tributary to the Laramie River, the increase of the irrigated area and the great number of small appropriators upon whom individually and each for himself would fall the burden of constructing expensive reservoirs if Colorado should divert water from this river, than by tabulating the appropriations as adjudicated by the Laramie River decree. Although the decree does not so divide them, we have separated the ditches into groups, the first those lying above the mouth of the Little Laramie River, and the second those lying below the junction of the Laramie and Little Laramie Rivers.

Abstract of Exhibit N, Laramie River Adjudication

1. Ditches Above Junction with Little Laramie River

Date of Priority	Name of Ditch	Acres
1868	Dowlin	3,428
1877	Abbott	1,245
1877	Murphy	80
1879	Pioneer	49,030
1881	King	3,233
1881	Abbott & Coleman	415
1883	Riverside No. 1	1,501
1883	J. B.	120
1883	Caldwell & Gardinier	1,553
	Carried forward	60,605

	Brought forward	60,605
1883	Bamforth	280
1883	Riverside No. 2	1,589
1884	Sodergreen	366
1884	O. M.	528
1884	Riverside No. 2, additional	2,479
1884	Pioneer, 2d appropriation	
1885	Hammond South	45
1885	Smith No. 1	68
1885	Smith No. 2	30
1885	North Lund	150
1885	Burg	106
1885	Caldwell & Gardinier, additional	925
1886	Central	45
1886	Sodergreen No. 1	281
1886	King, additional	306
1886	Oasis	1,305
1886	O. G.	617
1887	Fischer	121
1887	Sodergreen South	16
1887	South	50
1887	Island	25
1887	Sodergreen No. 2	55
1887	Hammond North	107
1887	Fischer	79
1888	James & Norton	205
1888	South Lund	165
1889	Heidrick	58
1890	Oasis, additional	4,520
1892	Haley & Hoge	2,008
1892	Parker	382
1895	Fischer, additional	2,220
1895	Bush & Holliday	500
1895	Parker Enlargement	1,180
1896	Last Chance	400
1896	Cole	253
1897	Last Chance, additional	675
1897	Biddick	140
	Total above Little Laramie River	82,884

2. Ditches Below Junction with Little Laramie River

Date of Priority	Name of Ditch	Acres
1878	Scissors	236
1879	Laramie No. 1	920
1881	Cross T. No. 2	155
1882	McGill No. 1	705
1883	Wyo. Development Co. System	58,813
1883	Bilderback	1,117
1883	Sipple	100
1884	Cooper Lake	770
1884	Boughton	7,882
1884	Cross T. No. 1	90
1887	Dunn	247
1888	Gallagher	54
1888	Spencer No. 2	236
1888	Spencer No. 1	237
1889	Dunn & Gillespie	140
1890	Ione	620
1891	Bright & Sutherland	543
1891	Combination	172
1891	Ft. Laramie	433
1894	Cramer	196
1896	Reitz No. 1	67
1896	Reitz No. 2	57
1896	Bettleyoun & Fleet	90
1896	Thompson Enlargement	92
1896	Ryan	170
1897	Ritterling	59
1897	Phillips	30
1898	Uva	240
1899	Van Ortwick	50
	Total below Little Laramie River	73,521

3. Ditches from Minor Tributaries of Laramie River

Name of Creek	Acres
Five Mile Creek	3,073
Willow Creek	1,760
Willow Creek Tributaries	250
Sand Creek	4,871
Sand Creek Tributaries	415
Fox Creek	377
Harney Creek	965
Harney Creek tributaries	270
Shell Creek and tributaries	790
North Laramie River	2,324
North Laramie River tributaries	1,288
Slate Creek and tributaries	193
McFarlane Creek and tributaries	183
Sybille Creek	3,654
Sybille Creek tributaries	2,439
Other small streams	1,018
Total	23,870

The appropriations with priority before 1892 from Soldier Creek as adjudicated by the decree Exhibit O, total 1180 acres.

The appropriations earlier than 1892 in priority from the Little Laramie River, as adjudicated by the decree Exhibit H, number 130 and have a total of 48,356 acres. Of this great number of appropriations, one is for 4,120 acres, one for 3,200 acres, and no others for more than 2,000 acres.

Summary of Adjudicated Rights

From Laramie River prior to 1900	156,405	acres
From minor tributaries of Laramie River prior to 1900	23,870	acres
From Little Laramie River prior to 1892	48,356	acres
From Soldier Creek prior to 1892	1,180	acres
Total adjudicated rights exclusive of Chugwater Creek	229,811	acres
Deduct duplications where same land appears under two ditches (p. 3353)	6,339	acres
Net area	223,472	acres

The process of reclamation of arid land is shown by history, but we find in the record abundant testimony about the practice in Colorado, which differs in no way from that in any other irrigated country. The Colorado expert, Professor Carpenter, describes this universal irrigation practice as applied in the Poudre Valley as follows (p. 2314-15):

> "Water flowing in Cache la Poudre River as it passes out of mountains and begins to enter canals now serves much larger area than formerly. In 1870 it served ten thousand acres; in 1880 probably not more than three or four times that quantity; in 1890, about 130,000 acres. It now serves 260,000 acres. The same stream flow serves the latter acreage that served the first acreage given. The water stored in reservoirs is merely part of the stream flow, so that the peak part of the flow has since decreased, is stored in reservoirs as has also the waste at other times. The acreage served has been very much increased. For all purposes it is substantially the same water now as it was twenty or thirty years ago, with these changes in methods of use, matters of econ-

omy and conserving water. The struggle over water and pinching caused by shortage is much less than it was twenty-five years ago. * * In case of each of these ditches the land, especially near headgate, became more or less saturated. The ground water came near enough to surface so that it needed very little irrigation, and perhaps needed drainage instead of irrigation. That land, if not abandoned, was in situation where it would not need irrigation. They then transferred right to use that water to other lands lower down, and so ditch did not run any more water but it brought under cultivation more lands towards lower end of ditch. Did not increase its demand on stream in making extended reclamation. This extension was by means of extension of drain ditch or by formation of lateral companies, and laterals which might run out 5, 8, or 10 miles and were in effect an extension of main ditch. By this means this land has been brought under cultivation, and has had the effect of largely increasing the total acreage. These were mutual ditches, so that owners living near head who owned ditch stock have nearly all divested themselves of that stock."

And in this process, which is so largely dependent upon the raising of the water plane, the users of the Poudre Valley have stored in the subsoil in the course of thirty years, approximately 3,000,000 acre feet of water (p. 2312). Wyoming, by the adjudication decrees above discussed, has recognized the general principle of irrigation practice and has protected its citizens in their right to divert water for the irrigation of the area under ditch and to extend the use over this land as the one parcel becomes saturated and requires less water. Exactly the same practice is recognized in Colorado under a somewhat different form, for there

an appropriator is given the right to take all of the water he has sought to appropriate, irrespective of the area to be irrigated, and as he finds it possible to irrigate this area with a small amount of water he can sell a portion of the water to another, and it is contended that this very practice is largely responsible for the extensive development of the Poudre Valley (p. 2316).

C. THE CONTESTED PRIORITIES

As we understand the order directing re-argument, the Court desires a presentation of the facts upon the increase, if any, in the extent of the use of water in Colorado and Wyoming between the time when the Tunnel Project was commenced and the time when this suit was commenced.

Elsewhere in this brief we have undertaken to show by references to the evidence that the combined use of water in both States, at least as early as 1901, and thenceforth, extended to the entire flow of the stream and its tributaries in each of the thirteen years —1901-1913 inclusive—except in 1909 and possibly a small amount released from the Wyoming Development Company's No. 2 Reservoir as a precautionary measure in 1907. No more definite data are available as the quantities were not measured during that period, except in the years 1912 and 1913. The data of the measurements in these two years are set forth in final form in plaintiff's Exhibits T-3, T-4, T-5, T-6, T-7 and T-8 inclusive (4283-4296).

Particulars as to the ditches and lands in connection with which water was used within the Valley in

Colorado are set forth in the Testimony of J. A. Whiting (1266-1275) and John R. Wortham (3454-3463), and in the Exhibits offered by these witnesses in connection with their testimony. These Exhibits were not printed in the Abstract but are found in connection with the transcript. It is not suggested that any of this irrigation began after 1900, and we understand that all of the irrigation in the Laramie Valley in Colorado passes unquestioned as being of old and established priorities. In addition to this irrigation, the diversions of the Skyline Ditch and the Divide or Wilson Supply Ditch out of the valley for irrigation elsewhere in Colorado, occurred prior to 1902. These diversions are elsewhere discussed and are not involved in this controversy.

Elsewhere in this brief we have brought together the data afforded by the evidence relating to the ditches taken out and the lands irrigated prior to 1900 or at latest 1902. As shown in that connection it so happens that the Decree of the District Court in Wyoming in the proceedings to determine priorities of right to the use of the water of the Big Laramie River and its tributaries (excepting the Little Laramie and Soldier Creek, which had been previously adjudicated), were based upon evidence taken in 1902 and prior thereto, so that the Decree had relation to the appropriations and use of water as they existed in and prior to that year.

A copy of this decree was put in evidence as Exhibit N (1042) and a copy of the Little Laramie Decree, made in 1892, was introduced as Exhibit H (1318). These Exhibits are not printed in the abstract but accompany the transcript and have been abstracted in this brief.

The plaintiff's proof in this case is not rested upon

these Decrees, which, of course, are not conclusive as against the defendants herein, who were not parties to the proceedings. The plaintiff has shown in substance the same facts by the independent original testimony of witnesses produced in this cause, reference to which testimony has heretofore been made.

The question of additional use is doubtless suggested by the construction which has taken place since the works above mentioned were put in use, and more specifically since the Tunnel Project of the defendants was commenced, and the period to which this discussion is directed extends from that date to May 29, 1911, when suit was brought. In the answer of the defendant State it is alleged (printed p. 30) that on August 25, 1902, the Laramie-Poudre Reservoir & Irrigation Company and its predecessors in title made an appropriation of 1235 second feet of water from the Laramie River, and that there was then abundant water in the river to satisfy all prior appropriations in Colorado and Wyoming. In the Joint Answer of the defendants, Laramie-Poudre Reservoir & Irrigation Company and Greeley-Poudre Irrigation District (printed pages 38-39), it is alleged that on August 25, 1902, the District and its predecessors in title "by commencement of the construction initiated its rights to the diversion for the purpose of irrigation and domestic use through the Tunnel mentioned in the Bill of Complaint to 1235 second feet of water" etc.

Further (printed page 44) it is alleged "that since such initiation, the defendants and their predecessors in title have diligently, by continuous work and expenditure on the construction of an extensive irrigation system, preserved the rights so initiated. Defendants aver that in perfecting the rights so initiated, the de-

fendants and their predecessors in title conceived an extensive irrigation system, consisting of collection ditches, tunnel reservoirs, and other reservoirs on the upper reaches of the Laramie River, a tunnel over 2½ miles in length, now entirely completed, and extending from the Laramie River through the mountain range, constituting the eastern boundary of the watershed of said stream", etc.

The defendants, therefore, by their pleadings and in the subsequent conduct of the case have selected August 25, 1902, as the significant date of commencement of their work. On the other hand, it is the understanding of the plaintiff (and we think shown by the evidence) that the Tunnel Project was not in fact commenced until very late in the year 1909, and a considerable time after the commencement of the principal works in Wyoming over which the defendants claim priority.

The period under discussion then may be considered in the view of the defendants to extend from August 25, 1902 to May 29, 1911, while in the view of the plaintiffs it extends only from about December 1, 1909 to May 29, 1911.

It is to be remembered that the evidence shows that the defendants' work is still incomplete. The time when it will be possible to divert and apply the water to the beneficial use intended cannot be certainly known until that is an accomplished fact. When this has been done the question will arise whether the defendants under the doctrine of "relation" can claim priority of appropriation prior to the time of application to beneficial use, and if so, for how remote a period back of that time. Under the rules universally laid down by the Courts dealing with rights of priority

by appropriation the right of the defendants must date from the time of applying the water to the beneficial use intended unless it is shown that by diligent prosecution of its work the defendants are in a position to claim rights by relation as of the date of the commencement of such work. This burden the defendants have undertaken to sustain from August 25, 1902.

2 Kinney on Irrigation, 1266-1299.
1 Wiel on Water Rights, 423-434.

Another fact which enters into the discussion of this question has relation to the character of the competitive works undertaken in Wyoming during the period to be discussed. These works (taking the period to extend from 1902 to 1911) include only the following works of any significance:

1. The Bordeaux and Sybille units of the Wyoming Development Company's system.
2. The Lake Hattie and Stewart Canal units of the Laramie Water Company.
3. The King Ditch and Hutton Lake unit of the Denver-Laramie Realty Company.
4. The James Lake unit of the James Lake Irrigation Company.
5. The Sodergreen High Line Ditch.

Other than these works it appears that the constructions in Wyoming since 1902 are insignificant. A review of the evidence shows only a few small ditches constructed during the period.

The Dodge South Side Ditch built in 1906 irrigates ninety-three acres (Marginal p. 669). The Dunn Ex-

tension Ditch, started in 1906-1908 and completed in 1910, irrigates 125 acres (pp. 705, 706).

Edward Hicks testified that he thinks only two small ditches have been taken out of the Little Laramie River since 1888, one by Chris Anderson, irrigating 160 acres, and one by Dwight Smith, irrigating about 80 acres (p. 1104).

John W. Ernest testified that the additional irrigation on the Little Laramie River (aside from the James Lake system) since 1898 would amount to about 1500 to 1600 acres (p. 1118).

E. D. Titus testified that he knew of no ditches of size or importance taking water from the Little Laramie constructed within the last fifteen years, except Lake Hattie and Lake James Ditches, and that there were not many small ditches (pp. 1138-1152).

M. C. Brown testified that the irrigation development on the Laramie Plains took place mostly between 1870 and 1900, and that the increase since 1900 has not been large (1181).

R. J. Cowper testified that all ditches of Soldier Creek were made between 1870 and 1889 (1203).

Asmus Franzen testified that all the land under the Boughton Ditch was irrigated as early as 1889 (p. 1207).

James Hardman enumerated the ditches on Sand Creek with the dates of construction showing that the latest ditch was constructed in 1901. (pp. 889-902).

Numerous other witnesses testified concerning particular ditches and a careful examination of their testimony does not disclose reference to any other ditches constructed since 1900, except the five larger works enumerated above.

These enumerated works with possibly one excep-

tion are simply extensions or additions to works which were in existence many years prior to 1902.

1. The Bordeaux and Sybille Units of the Wyoming Development Company's System

The Wyoming Development Company's system (see map attached to defendants' Answer) takes water from the Laramie River at a single point in Sec. 36, Tp. 23, R. 72, whence it is conveyed by tunnel into Blue Grass Creek, running down that creek and Sybille Creek, into which it flows, to a point in Sec. 13, Tp. 22, R. 70, whence it is taken out in Canal No. 1, extending in a general easterly direction. The Sybille unit of the Wyoming Development Company taps this flow in Blue Grass Creek in Sec. 21, Tp. 22, R. 70, and extends in a general northerly direction, irrigating lands between the ditch and Sybille Creek. The Bordeaux unit is an extension of Canal No. 1 from a point in Sec. 23, Tp. 23, R. 68 southeasterly to the vicinity of Chugwater Creek. Neither of these units makes any new diversion from the Laramie River or its tributaries. Both of them take water appropriated through the tunnel from the Laramie River, and by means of Reservoir No. 2, both of which were completed prior to 1902.

M. R. Johnston describes this system as constructed prior to 1888 (pp. 15, 25, 21-22), stating that only about 30,000 acres out of 60,000 acre tract originally contemplated had as yet been brought under irrigation (p. 69), and that in 1911 only about 450 acres were irrigated under the Bordeaux unit which was surveyed in February 1904 and on which construction began in

June, 1907, and was completed in June 1908, the surveys for the Sybille unit being commenced in August, 1907, and construction in 1910 (pp. 108, 109).

J. A. Elliott testified that the Bordeaux tract consisted of 10,000 acres, of which 1004 acres was irrigated in 1912, consuming 3060 acre feet, and that the Sybille Tract consisted of about 30,000 acres (pp. 168, 170).

2. The Lake Hattie System

The Lake Hattie construction consists of the Lake Hattie Inlet Ditch, taking water from the Big Laramie River, the Stewart Ditch, taking water immediately from the Little Laramie River, the Lake Hattie Reservoir, the Outlet Canal, and its branches, the North and South Canals. On the map attached to the Answer the locations of these several units are shown. Water is diverted from the Big Laramie River through the enlarged Pioneer Canal (dating from 1879), in Sec. 36, Tp. 14, R. 77, and carried for a distance of about three miles through the Pioneer and thence from a point in Sec. 21, Tp. 14, R. 76, the Lake Hattie Supply (Inlet) Canal conveys the water into the Lake Hattie Reservoir. The Outlet Canal and its branches extend from the eastern end of the Lake Hattie Reservoir in a general easterly direction as indicated on the map. The Stewart Canal takes water from the Little Laramie River in Sec. 1, Tp. 15, R. 77 and conveys it southerly to the Lake Hattie Reservoir.

In substance this diversion from the Big Laramie River was in contemplation as early as 1884, and was outlined by surveys substantially following the line of the constructed works and made in 1884, 1885, 1886,

1887, 1889, 1890, 1891, 1892, 1893, 1897, 1898, 1906 1907, 1908 as shown by the testimony of Charles Bel lamy (pp. 751, 769, 770), S. C. Downey (pp. 915-918 927-940), H. N. Roach (pp. 966-968, 970, 972-975) R. D. Stewart (pp. 977-978), previous to the final sur vey made by Z. E. Sevison in 1908-1909, (pp. 645-646) who found the stakes of the prior surveys (p. 650) so that if the taking of thought, the making of inter mittent surveys, the search for capital and capitalist (p. 947) and other activities incident to promotion may be considered such diligent prosecution of th work of construction as would entitle the promoter to the benefit of the doctrine of relation, the Lak Hattie enterprise might be considered to date from 1884.

In the view of the plaintiff, however, these histori particulars are only valuable to show the connectio between the works of the Lake Hattie system, as finally realized, and the original Pioneer Canal enterpris projected and constructed in 1879 and the followin years, and in substantial use for many years prior t the conception of the Greeley-Poudre Tunnel Project In another connection we discuss the position of thi and other later units of construction in connectio with old and established systems as the exercise of th right and custom so generally followed in the Poudr Valley as shown by the defendants' witnesses and s typical of irrigation development generally. For th present we are considering this new work only as origin ating in the beginning of construction in July, 1909 in competition for priority with the Tunnel Project o which construction was actually begun near the end c that year.

It is shown by the testimony of Mr. Sevison tha

actual construction on the Lake Hattie work was begun July 17, 1909, and prosecuted with great diligence and that the works were put in operation early in 1912 (pp. 646-649) or possibly in 1911 (p. 663); and by the testimony of Lyman E. Bishop that $944,000 had been expended prior to December 1, 1910, and a total of $1,418,000 up to the date of his testimony, water being first taken into the Reservoir early in July, 1911, (pp. 773, 779, 787). About 700 acres of new land was irrigated from this system in 1913 (p. 826).

3. The King Ditch and Hutton Lakes Reservoir

The King Ditch is an old ditch built and in operation since 1879 (p. 278). It was enlarged and extended in 1908-1911 to fill Hutton Lake as a reservoir.

Testimony of J. A. Winkler (pp. 278, 283, 283, 308, 309, 311).

As indicated on the defendants' map, water is taken out of the Laramie River, in Sec. 3, Tp. 13, R. 76, and conducted through the old ditch to the eastward for several miles, the extension not being shown on the defendants' map, but appearing in the plaintiff's map, Exhibit G. The water is conveyed to Hutton and Creighton Lakes in Tp. 14, R. 74, which have been converted into a reservoir. It does not appear that any considerable irrigation has taken place under this new construction, except in Sec. 4, Tp. 13, R. 75 (pp. 310-311). As indicated by the map, the acreage of land actually underlying this extension is comparatively small, and is largely irrigated already from other ditches so that this work will of necessity be used chiefly for the purpose of holding back the

flood waters for crops requiring later irrigation, and for exchange purposes.

4. The James Lake System

This system is essentially the enlargement and extension of the Bellamy Ditch taking water from the Little Laramie River in Sec. 2, Tp. 15, R. 77 and conveying it through the old ditch northerly and easterly to a point in Sec. 32, Tp. 17, R. 76, whence it is conveyed by the Lake James Supply Ditch into Seven Mile Creek and flows into the old bed of Lake James, previously without an outlet. The water is stored in this reservoir and diverted thence through an outlet ditch with two branches serving a body of land lying west of the Big Laramie below its junction with the Little Laramie. Z. E. Sevison made the survey for the works of this system, which was constructed 1908-1911, portions being completed and put in use in July, 1909, (pp. 631-644). Some 1500 acres had been irrigated under this system, of which 515 acres were in tillage in 1913 (pp. 991-992).

5. The Sodergreen High Line Ditch

This ditch does not appear on the defendants' map, or appears only as a short unnamed ditch, leaving the Laramie River on the north side in Sec. 36, Tp. 14, R. 77. It was surveyed in November, 1907, and construction work commenced on it in February or March following. It is about nine miles in length and serves a tract of several sections of land partly above and partly below the Lake Hattie Inlet Canal. The

ditch has been in use since 1911 (pp. 445-453). This ditch is really a revival of the Murphy-Collins Ditch, an old project begun many years ago, but the connection is not clear from the testimony and we suppose the Sodergreen Ditch will have to be considered as a new and independent construction. The ditch covers about 4000 acres.

A general view of the defendants' map thus discloses that these new constructions of 1900-1912 in Wyoming with the exception of the Sodergreen High Line Ditch, are designed and adapted to serve only lands which lay under the potential flow of the older works of unquestioned priority, and which could have been irrigated in every instance through distributing laterals from the older works. The reservoirs serve chiefly three purposes: First: To intercept and store at comparatively high levels water which could formerly be stored only at a lower level, where the radius of use was much shorter. Second: To carry over from the flood water period of May-June to the period of scarcity, July-August, the water formerly applied directly from the stream to the irrigation of native hay and pasture so as to make the same supply available for tilled crops of greater value requiring later seasonal irrigation. Third: To increase the re-use of water, which being applied on lands in the upper part of the valley, returns to some extent in the seepage flow for re-use lower down the stream. These are the familiar incidents of the typical irrigation development so elaborately described by the expert witnesses for the defendants.

6. The Colorado Tunnel Project

The defendants seem to question the right of the plaintiff and its citizens to this typical irrigation development—a right which the defendants have claimed and so freely exercised themselves for a long period of years, and to which they attribute in very large measure the progress and prosperity of the Poudre Valley; and they oppose this development in Wyoming with a claim of priority for the Greeley-Poudre Tunnel diversion project, which it is the object of this proceeding to prevent.

A sweeping claim is put forward to priority as of August 25, 1902, as a single system for the congeries of projects beginning with the Link Lake Ditch and Feeders filing of October 15, 1902, made by Wallace A. Link and Abraham I. Akin. Successive filings in May and October, 1904, September, 1906, July and September, 1908, and January, 1909, being Numbers 57, 1417, 1722, 3049, 4912, 5170, 5448 and 5453 in the office series of the State Engineer of Colorado, copies of which are among the Exhibits put in evidence by the plaintiff in this case, must be taken as, in the main, forming the basis of the defendants' claim to priority by "relation" from the date of the first survey of the first project in August, 1902, for the aggregate of the parts of the present plan to divert 70,000 acre feet or more per annum from the Laramie watershed to the Poudre watershed.

An analysis of the various projects as defined in the official filings thus made from time to time discloses the purposes of the defendants and their predecessors to divert from the Laramie watershed by three quite different and wholly independent routes and means:

1. The Link Lake Ditch and Feeders, subsequently designated as Upper Rawah Ditch, to collect water from a limited area on the western head waters of the Laramie and convey it to and through the Skyline Ditch over the Divide into Chambers Lake, an expansion of the Poudre River.

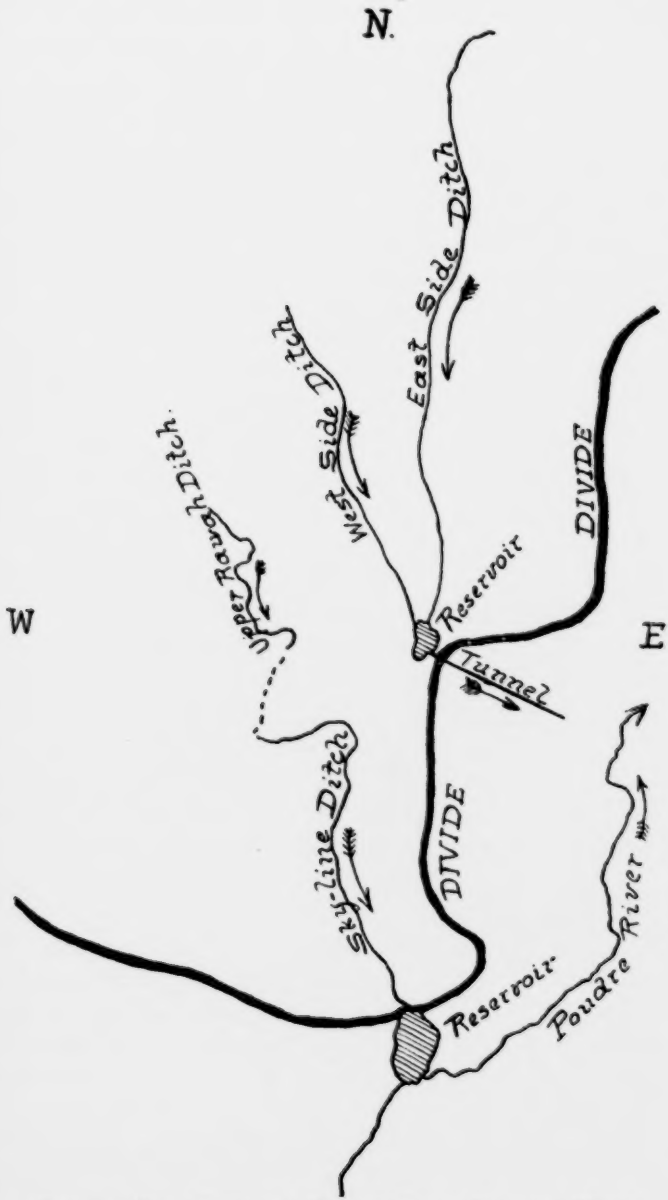
2. The Laramie River, Sand Creek and Lone Tree Ditch (in connection with the Reservoir near Glendevey) designed to collect the waters of the Laramie at a point near the southeastern corner of Township 10, Range 76, and carry them by canal north into Wyoming, then east across Shell Creek and Sand Creek, and south into a branch of the North Fork of the Poudre in Colorado.

3. Two collecting ditches (the East Side Ditch and the West Side Ditch), to gather water from both sides of the head waters of the Laramie and convey it with as little fall as practicable in a southerly direction to the main stream, and thence through a tunnel to a branch of the Poudre.

The defendants' map attached to the Answer significantly omits to show the proposed Laramie River, Sand Creek and Lone Tree Ditch with its Reservoir (sometimes called the Detour Ditch), but does show with other laterals the particulars of the Skyline and Tunnel diversions. The Detour Ditch was the last of the projected diversions to be surveyed and filed in the series of filings made in the office of the State Engineer, and so far as any public declaration was concerned, represented the final decision of the promoters to adopt that method of diversion rather than any of the others previously placed on record. We may for the present, however, dismiss the Detour Ditch diver-

sion from consideration since nothing has been done upon it in the way of construction, and according to the testimony introduced by the defendants it has been definitely and finally abandoned as impracticable.

This leaves for present consideration the two general methods of diversion of those enumerated above, which we may conveniently call the Skyline extension and the Tunnel. In order to aid in distinguishing these two methods of diversion from each other we have traced their essential units from the map attached to the Answer, and the accompanying sketch is made from such tracing.



SKETCH OF UPPER PORTION OF GREELEY-POUDRE DIVERSION WORKS
Showing Two Independent Methods of conveying water from the Laramie to the Poudre by the constructions begun by the defendants.

That these two proposed diversions have naturally and properly speaking no connection with each other is obvious from an inspection. The significance of this visible difference or dissociation will be understood when attention is called to the fact that all of the work done by the defendants and their predecessors prior to the very late months of 1909, having for its object the diversion of Laramie River water, was done upon the Skyline Extension and none upon the Tunnel project. The two projects had the one common purpose of diverting water from the Laramie to the Poudre. They are not, however, at all comparable in the magnitude of their respective works, the extent of territory drained, the cost of construction, or the volume of water to be realized; the most that can be said—indeed, the most that the defendants attempt to say, as we understand it—is that the Skyline Extension could be inexpensively and quickly made, and would furnish a revenue from which the Tunnel works could later be constructed and the principal diversion made.

The testimony of the witnesses offered by the defendants to show the origin, history and progress of the plans to divert water from the Laramie, were adroitly and industriously marshalled to blend together in seeming unity all of the various and variant projects as parts of the single diversion now undertaken. When analyzed, however, it clearly appears that from the time of the commencement of actual construction on the Tunnel diversion works in the latter part of 1909, nothing has been done on the Skyline Extension. On the other hand, prior to the latter part of 1909 all of the work of construction was done upon the Skyline Extension and none upon the Tunnel project. Along with the Detour Ditch, the Skyline Extension appears

to have been consigned to the scrap heap as soon as the promoters were really prepared to go ahead with the Tunnel diversion.

Moreover, the work upon the Skyline Extension, such as was performed, was intermittent, and in comparison with the ambitious plans of the promoters, insignificant in amount and cost. Such construction as was done, although certain portions of the project are said to have been completed, was never put in use, though it is claimed to have been in condition for use at least as early as 1907 and probably in part in 1904.

As the evidence offered by the defendants in support of these projects was quite voluminous, and as they appear to attach much importance to it, we here set forth at some length references to the material portions. It will be found to deal very largely with successive surveys, protracted over a period of more than seven years; with inquiries as to the source and volume of water supply which seem to have comprehended investigations at every source except the one most obvious and convincing source—the examination of the streams and the measurement of the water; with search for an available body of land and of prospective purchasers to market the supply; with the pursuit of capital and capitalists to furnish the means of construction; and with negotiations for carriage, franchises or other rights to convey and distribute the water after it should finally be delivered into the Poudre.

Wallace Link is the witness to whom is assigned the credit for discovering the projects. Link received his inspiration in 1897. While hunting deer he observed that the Divide was narrow and the Poudre considerably lower than the Laramie in that vicinity, and estimated that a mile and a half tunnel would divert

a considerable supply of water (pp. 1929, 1930). Link was then ranching in the Upper Laramie Valley in Colorado, and he subsequently sold out and settled under the Fossil Creek Reservoir about five miles southeast of Fort Collins on the south side of the Poudre River and there became acquainted with Abraham Akin, to whom in 1902 he disclosed his plan. (pp. 1930-1931). In speaking of the project Link says:

> "We adopted a method by which we were to build a part of the system first and employ the same to demonstrate the flow which was obtainable, and also to assist in making money for further promotion. After our first trip to Link Lakes and over that country we thought that the first thing to do would be to build this Ditch and connect it up with the Skyline Ditch, as this being a unit of the whole *would retain our franchise and as well give us revenue to proceed in the construction of the work.* It was the cheaper part as well as the best revenue earner of the whole proposition. The idea was to connect with the Skyline Ditch and turn it into the Chambers Lake and into the Poudre." (p. 1932-1933). * * * * "My plan in developing this work was to commence near the point of intersection with the Skyline Ditch and extend the line of that ditch northwesterly as funds for that purpose were obtained, in order to tap the drainage lying above the ditch line, and to carry the water from that area through the Skyline Ditch into the Valley. * * * We originally planned to use some of the water diverted through the Upper Rawah Ditch and Skyline Ditch into the Poudre River works, either directly or through an exchange system, and to sell the rest of it for a supplemental supply for other lands, and thereby secure funds to help work out the rest of the Laramie River diversion system, including the Tunnel. This plan has not been

carried out, and no water was sold at any time." (pp. 1994-1996).

Link and Akin viewed the ground in July and commenced a survey August 25, 1902, of the Link Lake Ditch, later called the Upper Rawah Ditch (pp. 1934-1935). The filing based on this survey was made October 15, 1902, and is exemplified in Plaintiff's Exhibit N, which is not printed in the Abstract but is filed with the original transcript. (p. 1835).

Throughout the testimony of Link (pp. 1920-1924, 1936-1939, 1941-1944, 1958, 1960), as well as in the testimony of the witnesses, Wortham, Hedke and Duval, much space is taken for the purpose of showing the difficulties of terrain, climate, situation, etc., in prosecuting construction work on the head waters of the Laramie. Attention is called, however, to the fact that this testimony (more particularly that of Link) applied to the site of the Skyline Extension, that is the Upper Rawah Ditch, and not to the locality of the lower works connected with the Tunnel diversion proper, which is located near the floor of the valley at a much lower altitude. The promoters chose the work presenting these special difficulties and directed their efforts to that work at the intervals when it was under prosecution from 1902 to 1909.

In 1903 Link worked on a road leading from the floor of the Valley to the elevated region of the Skyline Extension project. (pp. 1941-1945). In March, 1904, Link and his associates made a preliminary survey of the Tunnel site, and in May began the final surveys for the Tunnel and connecting works under Zac T. Duval, who also re-located the Upper Rawah Ditch. (pp. 1947-1952). After describing this work Link

states that "all surveys of all ditches now in course of construction were completed during the Summer of 1904." (p. 1952). * * * "Surveys for the system were entirely completed in 1904 (p. 1990)." Construction work was commenced in 1904 and about 6000 lineal feet of excavation done on the Upper Rawah Ditch, the total amount expended for surveying and construction that year being $13,000 to $14,000. (pp. 1953-1959.)

In 1905 no construction work was done, and the surveying appears to have been limited to an estimate of the construction done during the preceding year (p. 1964). In 1906 Link states that the work of financing, surveying and planning was going on continually. In that year he disposed of his interest and ceased to be connected with the projects (p. 1965). "No further work was done in 1905 or 1906." (p. 1996). In a summary review of the progress of the enterprises during the period of his connection with them, Link says:

> "Mr. Hibbard had the duty of finding capital for the enterprise, and up to the time I sold out, he had not succeeded in finding it. When I was in the enterprise we had not considered any $5,000,000 expenditure. We had counted only on the cost of the Laramie River project, and we had not gone into the Poudre Valley end of the matter, and when I sold out I had no interests in the projects upon the Poudre River, my interest being confined to the plan for diverting water from the Laramie River.
>
> The cost of the work which I had planned was estimated at about $2,000,000. In 1903 no money was expended on clearing; in 1904 about $14,000 was expended on construction work and clearing, but not including surveys, and no money was expended on construction work in 1905. I cannot

say as to 1906. I do not know how much was spent on engineering in those two years. Up to the close of 1906 the entire amount expended on construction work was $14,000, but this does not include expenses of roads and cost of transportation, moving, and establishing camps, all of which I believe should be included in construction work, and which would bring the total expenditures in the mountains up to $18,000 or perhaps $20,000. This work was practically all done on the Upper Rawah and Link ditches. No considerable amount was expended on the Lower Rawah or the West Side ditches nor on the tunnel or reservoir, but about $1,300 or $1,400 was expended on the East Fork Reservoir." (pp. 1987-1989).

It is to be noted that the East Fork Reservoir mentioned was definitely abandoned and is not a part of the present system. (p. 1820).

Link explains that they had an arrangement with the owners of the Skyline to carry for a percentage the water to be supplied by the Upper Rawah Extension. The Skyline Ditch had a capacity of only about 130 second feet, which during May and June was fully taken up in carrying its own water, so that none of the new supply could be carried through it during that time, but would have to be carried outside of that period. (p. 2002). Yet the Upper Rawah Ditch, as is elsewhere shown in the testimony, was planned to carry 224 second feet. It is contended, we understand, that this fact shows that the Upper Rawah Ditch was planned as a part of the Tunnel system. Inasmuch, however, as only about one-sixth of that ditch has been completed (p. 2005) and the ditch was never put in use, and so far as construction was concerned appears to have been definitely abandoned in 1907,

a much more probable explanation would be that the Upper Rawah Ditch was planned with an excessive capacity to compensate for the exceptionally large seepage loss expected, and to guard against the destruction of the ditch from overflow, which the testimony indicates did occur in 1905 or 1906, or to store flood water in the projected East Fork Reservoir (later abandoned) to propitiate lower appropriators on the Laramie River for the diversion of their flow during the latter part of the irrigation season.

The testimony of Abraham I. Akin generally corroborates that of Link for the period during which they were associated together from 1902 to 1906. (pp. 2038-2041, 2049, 2052, 2070, 2072). Akin, however, continued as an interested party after Link sold out. Speaking of the Laramie River diversions he says:

> "There was no construction work done in that country in 1905 nor in 1906, and I cannot give any approximate statement of the amount expended upon work in the Laramie Valley in 1907. In 1908 there were four men employed in the Valley repairing the ditch, these men going up there in June and staying until after the tunnel was commenced in December, 1909. These men looked after the ranches on the river, cared for the road up the river, kept the ditch in repair, and after December, 1909, commenced clearing the right of way for the diversion ditches on the Laramie River. Until December, 1909, these men did no construction work." (pp. 2072, 2073).

Charles R. Hedke, who was the engineer employed by the promoters from 1907 until February, 1911, testified voluminously concerning surveys, water supply and distribution investigations, the campaign for cap-

ital, negotiations with other ditch and reservoir owners, and the development and progress of plans to secure water from the Poudre River drainage proper. He has much to say euphemistically of the progress in construction. On this subject his testimony is exceedingly mystifying, vague and baffling so far as any attempt is made to distinguish or specify what was done on the Laramie River diversion projects, from what was done on the Poudre Valley system and on general promotion work. A careful review of his testimony, however, brings into relief certain salient facts. He testifies that in 1905 and 1906 no work was done that he knows of in the Laramie Valley (pp. 1793-1794); that in 1907 about three miles of excavation was done on the Upper Rawah Ditch (pp. 1794, 1795) at a cost of about $47,000 (pp. 1754-1757), but that no other construction work was done in the Laramie Valley (pp. 1794, 1795). In the Summer of 1908,

> "The construction work in the Laramie Valley consisted of the completion of some small portions of the upper Rawah Ditch. We had a small number of men up there all summer, but I cannot say how many were employed nor for how long. I do not suppose the amount expended for that work exceeded several thousand dollars. Some incompleted sections of the ditch were finished, loose boulders and slides were taken out of the ditch and overflow sections made and a measuring device was put in and some clearing was done. No other work was done in the Laramie Valley in 1908, and I do not believe that any work has been done upon the upper Rawah Ditch since that time." (p. 1798).

> "No construction work was commenced in

1909 prior to the making of the contract between the Greeley-Poudre irrigation district and the Laramie-Poudre Reservoirs and Irrigation Company. Appropriations were then made for the construction of the tunnel. Camps were built and a power plant was built, and a few days after Thanksgiving Day or about December first, 1909, actual construction work commenced on the tunnel. I am not able to recall definitely, but I believe that some work was done upon the ditches in the Laramie Valley in 1909.

"Construction work was commenced on the East Side Collection Ditch in the Laramie Valley in 1910, commencing about May first, I believe, as early as the men could get in. Work on the West Side Collection Ditch had commenced before that time, and I believe they worked upon tunnels along that ditch some time during the winter of 1909 and 1910. The roads were kept open so that supplies could be carried in for that work, and there were perhaps 30 or 40 men engaged in it, and I believe that force was maintained throughout the winter, supplies being hauled in from the railroad in Wyoming, about 65 miles, I believe.

"The work on the East and West Side Collection ditches continued until October 1st, 1910, and I believe a little was done after that date on the West Side Ditch." * * * (pp. 1800-1802).

"The work was pushed in 1910 on the mountain system with all the men that could be obtained, and was closed down on October 1st, 1910, after which time work was performed only on the east end of the tunnel, excepting for the construction of several hundred feet of tunnel work upon the West Side Collection Ditch, which was performed by a few contractors in the winter of 1910-11. In February, 1911, I severed my connections with the Company, and no more work

was done under my supervision and observation (pp. 1805-1806). * * * *

"*Prior to October, 1909, all the work that was done in the Laramie Valley was done upon the upper Rawah Ditch, and all that was done in 1909 or later was upon the lower West Side Ditch and the East Side Ditch.* The reason for this was that in the early course of this project it was thought necessary to secure some current revenue immediately, and in 1906 a carriage right through the Skyline Ditch, and the construction work on the upper Rawah Ditch was undertaken so as to secure a property from which this current revenue could be derived, through the ten year period in which the major system would be constructed, but in 1909 the general contract was let which provided for the immediate construction of the whole system which would result in an immediate revenue *so that it was no longer necessary to carry on the upper Rawah project.* The idea leading to its early construction was abandoned, but the line itself was not abandoned, it being still intended under the general contract of 1909 to complete that work.

"The upper Rawah ditch may be considered an extension of the Skyline Ditch, and was originally planned to collect the water from above the ditch and deliver it into the Skyline Ditch, for the purpose of assisting in the development of the larger proposition on the Laramie. *It was only a means to an end.* It would carry it over the watershed into Chambers Lake. The surveys were made with this end in view, and also with the end in view to use the upper Rawah Ditch to carry water into the west fork of the Laramie River above the tunnel whenever the tunnel should be constructed." * * * * * *

"The upper Rawah Ditch, if completed, would drain a watershed containing from ten to twelve square miles, which is about one-sixth of the area

drained by the system now under construction." (1808-1811).

Zac T. Duval was engaged in the surveys of 1904, which he describes, as well as the construction in progress that year and the changes made subsequently in the plans prepared by him. In 1905 he made a survey of another tunnel thus completing the 1904 survey. (pp. 1882-1897). Duval, at some length, describes the conditions rendering the work difficult. (pp. 1895-1897). He states that the elevation of the upper Rawah Ditch is 1700 to 1800 feet higher than the elevation of the tunnel and its connecting ditches. (p. 1895).

John R. Wortham became the engineer of the Greeley-Poudre Irrigation District in June, 1909, and continued to act up to the time of taking of testimony (pp. 1606, 2099). The District was organized in April, 1909, the construction contract dated September 8, 1909, and ratified and the bonds voted by the District in October, 1909. Construction of the power line to furnish power for the tunnel construction commenced the latter part of October. Preliminary excavation began about Thanksgiving Day, and the first shot in the Tunnel proper was fired on Christmas Day, 1909. This witness also states

> "The only work performed upon the system prior to my connection with it which could be noted upon my inspection was the work upon the Upper Rawah Ditch and the work upon the Canal in the Poudre Valley, although there might have been some money spent on maintenance and operation" (p. 2099-2101). * * * *

> "Excavation on the East Side Collection

Ditch commenced about April, 1910, and on the West Side Collection Ditch about the first of December, 1909, and work was stopped on both ditches on October 1st, 1910." (p. 2126).

The witness states that the East Side Ditch is 43½ per cent. completed, and the West Side Ditch, 48½ per cent., while the approach to the tunnel at the upper end is 79 per cent. completed. (pp. 2124-2126).

D. A. Camfield shows how the funds were provided for the construction of the tunnel system. He became interested in the Laramie-Poudre Reservoirs & Irrigation Company in the fall of 1908 (pp. 2159-2170), and spent $15,000 in the fall of 1908 and the spring and summer of 1909 to find a route for a ditch around the mountains (Laramie River, Sand Creek and Lone Tree Ditch). He organized the District in April, 1909 (p. 2170), and the contract for construction was dated September 8, 1909; the work was proceeded with that fall (p. 2161), the bonds having been sold on payments to begin in March, 1910 (p. 2162).

The foregoing references are believed to cover all of the material evidence relating to the plans, surveys and construction pertinent to the Laramie River diversion projects. A large part of the testimony of the same witnesses and others is devoted to projects for the collection and diversion of water from the flow of the Poudre River and its tributaries, and some of the tributaries of the South Platte. Much of the testimony of the witnesses named is devoted to showing the protracted and strenuous efforts to secure capital for these constructions—excuses for not prosecuting the work, rather than facts showing such prosecution. It is not believed that these efforts can be regarded as a substi-

tute for the diligent prosecution of the construction work, which alone could support the claim of priority by relation to any date prior to the commencement of actual construction about December 1st, 1909.

2 Kinney on Irrigation, 1276.
Cole vs. Logan, 24 Ore. 304.
Rio Puerco Irrig. Co. vs. Jastro, 19 N. M. 149.

In the latter case the court said:

"The authorities all agree that the mere lack of means with which to prosecute the work is not a sufficient excuse for delay."

In Cole vs. Logan, the court said:

"It would be a most dangerous doctrine to hold that ill health or pecuniary inability of a claimant of a water privilege will dispense with the necessity of actual appropriation within a reasonable time, or the diligence which is usually required in the prosecution of the work necessary for the purpose. We find no recognition of such a doctrine in the law; nor are we disposed to adopt it as the rule to govern cases of this kind."

Nor are the defendants in any better position on the facts with respect to the voluminous excuses offered in the testimony concerning the climatic and topographical difficulties surrounding the work. Most of the testimony on this subject was directed as we have shown to the special conditions surrounding the upper Rawah Ditch on account of its great elevation and inaccessibility. These conditions, however, would not apply or applied only in a much less degree to the work on

the tunnel proper and its connecting ditches—the real tunnel diversion system.

It is not to be overlooked that when this latter work really was begun, it was commenced at the beginning of winter in 1909, and that work was prosecuted continuously and with great vigor as the witnesses show throughout that winter, and on the tunnel throughout the winter of 1910 and 1911. Mr. Link testifies with reference to the accessibility of this work, and that a road was constructed in 1876 the entire length of the Valley, which was subsequently used by ranchmen, and usually is open during the winter (pp. 1990-1991). As Link himself lived on a ranch in the upper Laramie Valley in Colorado for many years, his testimony on this subject was doubtless given advisedly and may be relied upon.

However, the plaintiff introduced further evidence on this subject of a convincing nature. R. D. Stewart was Chief Engineer and Superintendent of the Laramie, Hahn's Peak & Pacific Railway Company from 1902 on. This railroad extends across the same range of mountains near the Colorado-Wyoming line at an elevation of 9200 feet. Construction was prosecuted on this work during the winters of 1909-'10 and 1910-'11, and to some extent in the winter of 1908-'09. The witness has been on the Laramie River headwaters and thinks that even on the Skyline Ditch location it would be entirely practicable to carry on rock work during the winter season. (pp. 4380-4381). In January, 1914, the railroad hauled up a car or two of outfit for work on the Greeley-Poudre Tunnel (p. 4384). For years prior to the building of the railroad over the mountains, freight was hauled over the mountains every winter. (p. 4387). George Trabing was for eight years con-

tractor on the stage line crossing the same range of mountains between Laramie and Walden, Colorado. This was a daily line which ran regularly each winter and did not miss a trip in the last twelve years. The road was generally travelled and freight hauled over it through the winter. There was also a stage line running up the Laramie River from Jelm to Gleneyre and a postoffice beyond at Glendevey. This line ran three times a week and did not miss a trip. The witness had been at Chambers Lake (near the Laramie-Poudre divide) and found a good road running all the way up the river, which he thinks would be practicable to travel with sleds in the winter season. (pp. 4388-4390).

N. K. Boswell has lived in the Laramie Valley since 1868 and since 1869 has owned a ranch on the river at the Wyoming-Colorado line. There is a well-travelled road running up the river to the Chambers Lake district which has been travelled a great many years. Logging and timber cutting was done there in '67 and '68. The river valley is pretty well settled for about twenty miles above the Wyoming line and through the winter season people haul in supplies, etc. There is nothing to prevent communication to the tunnel in the winter season. (pp. 4398-4400).

The evidence on both sides then concurs on the material physical facts pertaining to the region where the diversion works connected with the tunnel were to be constructed. Plainly the claim is incredible that physical obstacles prevented this work from being done immediately after the so-called final surveys were made in 1904. The major part of it was actually done largely during the winter of 1909-10. There is no reason of this character why it could not as well have

been done in the winter of 1904-05, or in 1905-06. What is said by the witnesses concerning the lack of means on the part of the promoters to do this work prior to 1909-10 is supported by what they actually did in the comparatively insignificant construction on the Upper Rawah Ditch to adapt a cheap expedient for diverting water to earn revenue in the hope that they might thus be enabled at some future time to construct the tunnel works.

7. The Detour Canal

We have already directed attention to the series of filings made in 1902-1909 setting forth the varying plans for diversions from the Laramie. Plaintiff's Exhibits N, O, P, Q, R, S, and T were introduced (pp. 1835-1839), and are to be found with the transcript but are not printed with the abstract. These Exhibits are certified copies from the office of the State Engineer of Colorado of the various filings made by the Colorado promoters.

Exhibit N, filed Oct. 15, 1902, as already stated, represents the survey of the original Link Lake Ditch and Feeders, subsequently designated as the Upper Rawah Ditch.

Exhibit O, filed May 9, 1904, represents the East Fork Ditch and Reservoir which, as described by the defendants' witnesses, forms no part of the present enterprise. It was planned to take water from the West Fork to the East Fork above the Tunnel site and store it there in a reservoir.

Exhibit P, filed October 6, 1904, represents the original conception of the Tunnel Diversion with its feeders.

Exhibit Q, filed September 24, 1906, shows a greatly modified plan of this project.

Exhibit R, filed July 8, 1908, represents the Laramie River Reservoir, which it was designed to construct in the river channel at a point near Glendevey some miles below the present tunnel location.

Exhibit S, filed September 28, 1908, represents the Laramie River, Sand Creek and Lone Tree Ditch (Detour Canal) which, as already described, was to carry the water from the Laramie River reservoir just mentioned around the mountains into a branch of the Poudre, and thus avoid the tunnel altogether. (pp. 1835-1839).

Exhibit T, filed January 8, 1909, represents the omnibus plan of all the systems and all the projects as then conceived.

It will be found from an examination of these maps and the descriptive matter connected with them that the successive filings thus made from year to year were attempted to be tacked on the original filings made in 1902, claiming all prior surveys and filings as parts of the system, and professing to be amendments of the original plan without loss of the claim of priority. The evidence of the defendants' witnesses as to the good faith of these filings is conflicting. Indeed it is obvious from a comparison of the plans that they were alternative and inconsistent. A mere conspectus of the aggregate of these plans refutes the claim that they were all made in good faith to be constructed as parts of a single system.

Mr. Hedke first says (p. 1834) that:

> "From time to time as surveys were made of different propositions of irrigation system, maps and

field notes were filed in the office of the State Engineer which represented plans of the company at the time of the filings as proposed by each individual unit."

Yet immediately afterward, the same witness said (p. 1839):

"It was never intended to construct all the works shown upon these maps. The maps cover and bring together all the previous filings, and show all the different means of accomplishing the same general end—the irrigation of the land in the Greeley-Poudre District. Many investigations were made to determine the best means of accomplishing this end, and these were incorporated in the various filings and in this map (Exhibit T, filed January 8, 1909), which was the last filing made by the company. Both the Tunnel and Sand Creek Ditch, which runs through Wyoming, and the Glendevey Reservoir, are shown on this map. It was known at the time the map was filed that the cost of the Sand Creek Ditch was prohibitive and that no possible relations could be brought about which would make it feasible. It was included in this map because at all times there were interests adverse to this system. The interests seeking to obtain some foothold in the Company so that it was necessary to protect what was done by filings, so that if the matter should come up in the future there would be record evidence of what was at one time covered."

Yet although this witness says that it was known when the last map was filed that the Sand Creek Ditch would not be constructed, the witness, Camfield, as already mentioned above, at least strongly implies in his testimony that the survey of the Sand Creek Ditch,

which was begun in the fall of 1908 and continued through the spring and summer of 1909 at a cost of about $15,000, was made in good faith to find the possible route for an actual ditch around the mountains to avoid the tunnel and cover more land. (p. 2170).

It seems to us to be plainly deducible from all of the evidence that the Laramie River Tunnel Diversion project which was said to have originated in 1902 and to have become fixed and definite by the final surveys of 1904, cannot be regarded as an enterprise conceived and begun in 1902 and prosecuted with diligence to completion so as to give the defendants the benefit of the doctrine of relation which would establish its priority as of 1902 against other diversions begun and prosecuted with all diligence to completion and put in use in the intermediate period. We do not know of any rule or custom, and we are not able to find any authority, to support such a claim. In point of fact we think the inference is plain and irresistible that such work as was performed on this project between October, 1909, and 1911 was directly attributable to the large construction work undertaken on the Laramie River in Wyoming early in the year 1909 and prosecuted with all possible diligence to completion. Having dallied with their project for seven years with only fitful and wholly inadequate efforts to complete or use any part of it, the defendants could not fairly ask that the people in the valley of the Laramie should await their action indefinitely. If the citizens of Wyoming were chargeable at all with notice of what was contemplated in Colorado, they were also entitled to take into consideration that the long contemplation without substantial action or fruition rendered the Colorado diversions extremely indefinite and uncertain.

8. The Poudre Valley System

An important element in the claims of the defendant promoters yet remains to be considered. We refer to what is often spoken of in the testimony as the Poudre Valley system or Poudre Valley diversion, which fills a large place in the project for the irrigation of the lands in the Poudre Valley District as now outlined and explained by the defendant promoters. In its final form it is described as the Plains Division of their works. It is described in detail by Mr. Wortham (pp. 1699-1711). It is made up of many units, more or less completed and to some extent in use, designed and adapted to collect water from the Poudre River and its tributaries and tributaries of the South Platte below the junction and convey it to the Greeley-Poudre District lands. The parent trunk is the Poudre Valley Canal, which was commenced about 1901 or 1902 with the single design of diverting water from the natural flow of the Poudre at a high point above the plains and above other ditches, and conveying it eastward for an indefinite distance to water lands lying north and east of the river. (pp. 1735-1737). The witness, Hedke, was connected with this project long before he became connected with any of the Laramie River Diversion schemes. As late as 1904 it was being repaired and reconstructed, but was still unfinished (pp. 1739-1741). Negotiations subsequently took place between the promoters of the Laramie Diversion projects and the owners of the Poudre Valley Ditch, the exact nature of which it is difficult to trace in all respects, but in December, 1909, as Mr. Camfield testifies, the Laramie-Poudre Company purchased the shares in the Poudre Valley Ditch which were owned by the North Poudre

Company, completing the payments in January or February, 1910. (pp. 2162, 2172). As this testimony is quite specific and definite and as Mr. Camfield was the principal organizer of the District, and the chief promoter of its enterprises, his testimony as to the time when this transaction took place is probably to be taken rather than that of Mr. Hedke, who states that the purchase was made in 1908 (p. 1789). The Poudre Valley Ditch did not then serve any lands within the present Greeley-Poudre District (p. 1786). Indeed, it does not seem to have been designed for any particular purpose except to secure and store surplus water of the Poudre (pp. 1735-1737) and in 1904 was badly washed out by the flood waters (pp. 1739-1740).

We are considering with some minuteness the Poudre Valley Ditch as it represents the origin of the project to secure and use the waters of the Poudre River, and its tributaries. On the defendants' map this ditch appears as taking its departure from the Poudre River near the middle of Township 8, Range 70, and extending thence easterly to a connection with the series of Reservoirs north and northeast of Ft. Collins, and some distance from the Greeley-Poudre lands. As the present project is described in the testimony above cited all of the Laramie River waters as well as the waters of the Poudre must pass through this ditch; and it appears to be an indispensable link to connect the Laramie River Diversion works with the Greeley-Poudre lands or with the Poudre Valley system, so-called, of ditches and reservoirs. As the rights of the defendants in this ditch were not acquired until December, 1909, (p. 2172), it would appear that the Laramie diversion projects could not have been wedded to the Poudre Valley diversion projects or to the Greeley-Poudre lands before that time.

Other facts established by the defendants' testimony corroborate this conclusion, and indicate very clearly that the promoters who sold their projects to the District under the contract of September 8, 1909, and agreed to complete the construction, regarded the Laramie diversion projects as separate and distinct from the Poudre Diversion projects and reserved to themselves the option to complete and turn over the latter without assuming any responsibility for the former. The witness Hedke testified on this subject as follows:

> "The Greeley-Poudre Irrigation District's system is divided into two general divisions, the 'Mountain Division', and the 'Plains Division', and by Paragraph 15 of the general contract of 1909 it was provided, 'that the work of completion to be done by the Company, meaning the construction work, hereunder, shall for the purposes of this contract be classified into two divisions, namely, 'The Laramie River Division', and 'The Plains Division', and each of said general divisions may and shall for the purposes of this contract and for the payments to be made hereunder be further divided both numerically and by name designated as hereinafter set forth; and relative hereto, it is mutually understood and agreed that this contract shall be taken and held to be *severable* as to said mentioned divisions and sub-divisions hereinafter described as aforesaid, and *not entire* as to the whole; and the Company shall be paid for each part of the contract, payment upon the entire contract price for construction work as set forth in the following schedules, and if work as described in schedule No. 1 shall be completed and sold to the District, then that schedule shall be followed and if the works described in schedule No. 2 shall be completed and sold to the District, then

that schedule shall be followed; provided, that upon each monthly estimate upon any of the uncompleted portions of the works to be completed and sold to the District hereunder there shall be paid to the Company 85 per cent. of the estimate thereon for the work done and materials furnished during the month upon which such estimate is based, and the remaining 15 per cent. shall be retained until the completion of the works upon which such estimate is made, and the amount to be estimated and paid shall be such amount as the value of the amount done shall bear to the total amount to be done upon the work upon which the estimate is based." (p. 1820).

The witness then enumerates the units of the Plains Division and says:

"This system has two distinct and independent sources of supply; that from the Laramie River and that from the Poudre River basin and the tributaries of the South Platte, and it was so designed that the Poudre Valley Canal could divert water from the Poudre River and also from the northern tributaries of the Poudre intercepted by the canal and from the tributaries of the South Platte as far east as Crow Creek and intercepted by the canal wherever there was surplus water. We estimated that the amount of water available outside of the Laramie River source would be between 80,000 and 100,000 acre feet per annum as an average. * * * * * The Poudre Valley Canal diverts water from the main Cache la Poudre River in Section 15, Township 8, Range 70, and is designed, with its extensions, to carry all of the water supply to the lands of the Greeley-Poudre Irrigation District. Its point of diversion is such that it can divert all of the surplus waters of the Cache la Poudre River, the

Big South Fork and its tributaries, the Little South Fork and its tributaries, the North Fork and its tributaries, and the other tributaries of the main stream above the point of diversion. It also intercepts and collects the waters of Hook and Moore Creek, Park Creek, Box Elder Creek, Sand Creek, Coal Creek, Rattle Snake Creek, Lone Tree Creek, Little Owl Creek, Robinson Creek, Owl Creek, Eastman Creek, another Coal Creek, Wild Horse Creek, another Sand Creek, and Crow Creek, as well as all other unnamed creeks and channels west of Crow Creek draining a portion of southern Wyoming and all that portion of northern Colorado lying north of the Poudre River and within its drainage basin, and also that portion of northern Colorado and Wyoming lying north of the South Platte River and west of Crow Creek." (pp. 1821-1822).

Both Mr. Hedke and Mr. Wortham testified in effect that of the two sources of supply that from the Laramie River was more certain and dependable than that from the Poudre and its tributaries. Their testimony, however, clearly indicates that this distinction was conferred upon the Laramie for the reason that the defendants counted on diverting all of the flow of that stream which they could intercept, without regard to the rights of appropriators below, while in diverting from the Poudre and its tributaries, they would be constrained to respect the rights of prior appropriators. (pp. 2083-2085, 2121). They see nothing inequitable in diverting Laramie River water regardless of the rights of others and carrying it a distance of 190 miles from its source with the consequent great waste of one-third (pp. 1828-1829, 1851), in preference to utilizing the waters of the Poudre which were their original and primary reliance.

The linking up of the Laramie River projects with the Poudre River projects then seems to have been a late realization of the defendants. It is ingeniously pressed in the presentation of their case as an early development tending to consolidate and perfect its appropriation from the Laramie River from the date of the first filing. Work on the Poudre project is thus made to do duty for the Laramie project, and a semblance of diligence in construction is thus created for a combination which could have had no tangible existence until the latter part of 1909, long after the latest date when the Wyoming appropriations could possibly be said to have taken effect.

It is interesting to throw upon this picture the light of the testimony of Wallace Link as to the scope of his project in 1902. Speaking of that period he says:

> "At that time we did not know upon what land we should use the water. We first had in mind the use of a part of the water upon land in the neighborhood where my farm was located (south of the Poudre). There is a general feeling on the part of the owners of land under all of the ditches in the Poudre Valley that more water is needed, and generally speaking, it was the shortage of water in the valley that led me to consider this proposition. My idea was to obtain a supplemental supply in addition to the water furnished from the Poudre River, and to use this, if there was enough, upon other lands." (pp. 1983-1984).

Again he testifies:

> "It was recognized by me and by my associates that it would be necessary to locate ditches and works upon plains of Poudre Valley as well as to construct ditches in mountains.

"Poudre Valley Ditch had been constructed out of mouth of Poudre Canon in 1902. I have viewed lands that might be served from extension of this canal." (p. 1961).

Further he testifies:

"We originally planned to use some of the water diverted through the Upper Rawah Ditch and Skyline Ditch into the Poudre River ourselves, either directly or through an exchange system, and to sell the rest of it for a supplemental supply for other lands, and thereby secure funds to help work out the rest of the Laramie River diversion system, including the tunnel. This plan has not been carried out, and no water was sold at any time." (p. 1996).

Still further he testifies:

"We estimated that it would cost us $30,000 to construct a ditch which we surveyed in 1905, which we called the High Line Ditch, covering lands on the south side of the Poudre River and south of Fort Collins. The construction of this ditch was not still in contemplation at the time I severed my connections with the enterprise. The other possible construction work in the Poudre Valley which we contemplated was the extension of the Poudre Valley Ditch, which Mr. Hedke and I surveyed in 1905 and 1906, but the survey of which was not completed while I was interested in the project." (pp. 2008-2009).

Finally Link testifies:

"When I spoke of the water being turned into Poudre Valley to supplement supplies there, I did

not mean it was to be applied to lands already irrigated. It was intended for new lands as well as supplemental supplies for old lands. It was not necessary at the outset to choose the particular area on which the water should go. There is large area of arid land in Poudre Valley fitted for agricultural purposes. There is demand for water as soon as it is obtainable by any possible arrangement. As new waters are obtained, old ditches are sometimes extended to cover lands possible of reclamation at their lower ends. Ditches sometimes are built to take in new areas. The supply of land fitted for agriculture by irrigation is very great. When we did our work in 1902 we knew there was a large area which could be served by ditch on south side of river. They have since covered a portion of this area through the Louden Ditch. We also figured on something like 17,000 acres south of river, and so had Mr. Tenney and Mr. Duvall survey ditch around about Pleasant Valley Ditch. * * * We also knew there was area which could be reached by ditch on north side of Poudre River and lying above the irrigated area of the valley." (pp. 2026-2027).

Upon the whole showing the conclusion is reasonable, indeed inevitable, that in August, 1902, the only work contemplated presently to be done was the extension of the Skyline Ditch; that the method by which the diversion was to be made was not by the tunnel but by open ditch over the divide; that the purpose to which the water was to be applied was wholly speculative and undetermined; that at least for some years the promoters were spying out the land for a possible market for the Laramie water and in this search considered from time to time many different potential uses; that whenever a decision may have been

finally reached by them as to the best market available, and whatever course the negotiations may have taken, the plan was not made final or definite until December, 1909, when they procured the controlling interest in the Poudre Valley Ditch, and the right to carry water through that channel to the Greeley-Poudre lands which had then been decided upon.

9. The Equality of Right in the Typical Development.

Reverting now to a subject suggested in connection with the new works in Wyoming, and especially in discussing the Lake Hattie System, we wish to direct attention to the fact that Colorado is denying to Wyoming an important right which she herself has freely exercised, and in the results of which she takes a special and particular pride.

Prof. L. G. Carpenter in different portions of his testimony dwells at great length upon the history and analysis of the extension of irrigation over the lands of the Poudre Valley from the earliest times. This development he says is typical of all irrigation development and is the natural and inevitable process observed wherever irrigation has been successfully practiced. He speaks of the period prior to 1870 when sporadic construction of individual small ditches taking water from the Poudre River and spreading it over comparatively small individual holdings brought under irrigation perhaps an aggregate of 10,000 acres; of the period from 1870 to 1880, when community or company ditches began to appear, merging some of the small appropriations and extending the cultivation to perhaps 80,000 acres; of the era when foreign capital was enlisted in larger constructions between 1880 and 1890, bringing

the aggregate area up to 135,000 acres; of the development of the reservoir system and the importation of water from other streams from 1890 to the present time when some 260,000 to 275,000 acres are served (pp. 1438-1443, 2259-2294, 2314-2316). The witness describes the gradual filling up of the interstices of the soil and subsoil through irrigation, the consequent return flow through seepage, and the spreading of a given quantity of water over additional land as the soil becomes filled and the water table rises, the requirements of a particular tract growing less from year to year, the extension of ditches and laterals to keep pace with this progress and the consequent increase in economy of use and the duty of water as irrigation develops (pp. 2317-2339, 2376-2379, 3007-3022). Mr. Armstrong reviews the irrigation development in the Poudre Valley in a similar way. (pp. 2457-2460). Mr. Camfield relates his extended experience of the same general effect (pp. 2139, 2150, 2151, 2154).

Prof. Carpenter contrasts the Colorado practice in this respect with that of Wyoming, which he is pleased to present as a rigid, unscientific, uneconomical system. (pp. 2315-2317, 2337). Needless to say we think the witness misunderstands the effect of the Wyoming system and practice. Whether this is true or not it is clear that the implication from his testimony and the argument based upon it by the defendants in this case would deny to Wyoming the benefits of a practice which is followed in Colorado, and which is said to be typical and universal in all successful irrigation development.

We think this contention denies the principle which this court has often declared, and which it expressly applied in the case of Kansas vs. Colorado, 206 U. S.

46, 97, where it was said that "one cardinal rule underlying all the relations of States to each other is that of equality of right. Each State stands on the same level with all the rest." And to paraphrase another expression in the same opinion (p. 104) as Colorado thus recognizes the right of appropriators to extend the use of the waters of a stream for the purposes of irrigation of other and additional lands, as this becomes possible with the saturation of the soil, she cannot complain if the same rule is administered between herself and a sister State. In other words, Colorado cannot consistently deny to Wyoming a right which she recognizes and enjoys for herself in determining the scope and limitations of the rights of an appropriator.

It needs only the substitution of names in the testimony of the Colorado expert witnesses to show that the process now going on in the Laramie Valley in Wyoming is in substance the same process which has created the wealth and enhanced the prosperity of the Poudre Valley. It is a process of economy, of increased use and production, of diminishing waste and raising the duty of water, and of developing the agriculture of the Laramie Valley in Wyoming toward the same end which has proved in Colorado to be of the highest benefit to the community. Without increasing the burden upon the stream, without infringing the rights of other appropriators, and without injury to anyone, but with benefit to all, the construction of reservoirs and the extension of ditches and the increased acreage of the irrigation in Wyoming, is proceeding in the natural and typical way which the defendants' witnesses have described. We think it would follow then that even if the later constructions in Wyoming were not prior to the proposed diversion in Colorado, the

defendants could not complain that they were being injured in any way by the use of these works, since no additional burden is laid upon the stream.

III. WYOMING PRIOR APPROPRIATORS HAVE ALREADY EXPERIENCED SHORTAGE OF WATER WHICH ANY DIVERSION BY COLORADO WILL NECESSARILY INCREASE.

It is shown without any dispute that the Wyoming appropriators of conceded priority have for many years actually used the entire flow of the Laramie River and have suffered a shortage of water repeatedly. The proposed added diversion in Colorado could, of course, have no other effect than to make this shortage more serious.

The ranchmen and farmers in Wyoming were questioned as to their experience in securing water, and all bore the same testimony—that they have not had enough water after the high water period. With respect to the Riverside ranch, a few miles above Laramie City, Winkler says (p. 282): "I don't think they are getting as much water as they did two or three years ago—don't have the results, don't have the hay there they usually have."

Benson, in discussing the same large ranch, testified (p. 326): "There was a shortage of water this summer, and usually a shortage in previous years during the latter part of the irrigation season. The ditches on this ranch while I was there were kept cleaned out and in good condition to run water. We run them to capacity when we could get the water."

Rickard, the owner of the Bush and Holliday

ditch above Laramie, testified (p. 502): "I have been short of water several years since I have been there. I did not have half enough this last season. The shortage was in the river. When there is lots of snow in the mountains we have plenty of water, but in some winters there is not much snow; then we are short of water. We were short of water in 1902, short in 1903, very short; this year we didn't have half enough. In other years we were a little short, but it wasn't so bad. There have only been two years when we had plenty. In all the other years we were more or less short."

John Biddick testified about the irrigation of his land under the Biddick ditch below Laramie and above the mouth of the Little Laramie: "It was not irrigated this year. There wasn't any water in the ditch this year. They took it all from us. The river wasn't high enough to irrigate any." (p. 905). "My land is largely pasture and has been during the past few years. We have been short of water; that is the reason." (p. 909). "I don't know who took my water this summer. In 1912, there wasn't any water then worth mentioning. In 1911 we had a little water." (p. 909).

W. P. Schott had owned a ranch above Laramie only four years, and thus relates his experience (p. 4137): "Had difficulty in getting water two years out of four, the gates being closed down by the water commissioner upon complaint of the Wheatland project, in consequence of which I lost about 3,000 bushels of oats in 1913. In 1912 we had water and got good crops. In 1911 the water commissioner closed down my gate for Hans Olson, when we were going to use the water for oats, and we didn't get much of a yield."

Andrew Popp had the same experience, testifying (p. 4194): "Have had good crops and some poor ones, too, especially when the water supply got cut off, which was done twice in three years. Three years ago (witness was testifying in 1914) the water commissioner put a notice on the headgate that it was closed under order of the water commissioner. We got out of water and didn't raise any alfalfa at all. The next year we got water and raised some alfalfa. Last year they shut off the water the first of July." All of the other witnesses confirmed these statements, and a similar situation was shown to exist upon the Little Laramie River. (Ingham, p. 1082; Ernest, p. 1120).

The Wheatland project has had the advantage of a reservoir with a capacity of more than 80,000 acre feet, with only a little over half of the 60,000 acre tract under cultivation; diversified farming is general, this on the one hand giving a more economical method of using water than the method necessarily used upon hay land, and on the other hand increasing the use of water in the latter part of the irrigation season when hay meadows do not require much. Despite the existence of the reservoir, an advantage which the Laramie Plains appropriators do not possess, the Wheatland farmers have felt a shortage of water. W. L. Ayers testified (p. 1225): "There have been years when we were a little short of water. That has also occurred since the completion of the large reservoir on the Laramie Plains known as Reservoir No. 2. There have only been one or two years that the farmers had all the water they wanted. We were short this year (the year 1913). Last year we got along fairly well, though there were a good many complaints about the water last year. The lands of my neighbors take more water

than mine. Some of mine is sub-irrigated. With that exception I use about the same amount of water as they do. They are using it to the best advantage they know how. We usually feel the shortage in the last irrigation of alfalfa, the last of August and first of September."

W. A. Baker, another Wheatland farmer, said (p. 1259): "There has not at all times been sufficient water. I do not remember the details except in the last two or three years. In these years in the first part of the irrigation season we had a pretty fair run until the latter part of July. Then we began to fall short and cut down, and sometimes we would be stopped for a few days."

As stated, the record shows without any contradiction that these early appropriators have actually used all of the water of the river. The physical facts with respect to the stream make such proof easy. By reference to the map attached to either the bill of complaint or the answer, it will be observed that the Wheatland No. 2 Reservoir is at the extreme northerly or lower end of the Laramie Plains, and below all of the ditches and canals upon the Laramie Plains. This is a channel reservoir, created by a dam thrown across the river so that it is in a position to store every drop of water that comes down the Laramie River, the Little Laramie River or any of their tributaries. It was located in 1894, and completed in July, 1901 (p. 48). The former manager of the project, M. R. Johnston, testified (p. 35) that it was the practice of the company to keep the reservoir gates closed except when water was drawn for irrigation purposes, and water was never released down the river in the early spring or late winter; that there was not enough water

below the reservoir when the gates were shut down, to protect the fish; and at page 112-113 he testified that since the construction of the reservoir, water had been permitted to flow down the river on only two occasions excepting when there was some accident. In 1907 water was released from the reservoir as a precautionary measure, high winds and uneven settling of the dam creating doubt as to its safety. In 1909, which was a year of high water the like of which the witness who had been in charge of this project since 1888 had never seen, a very large quantity was discharged from the reservoir; in fact, it is stated by the witness at another place (p. 30-32) that in 1909 the water continued to rise at such a rate that all discharge gates were opened; that he constructed an emergency spillway with plows, through which the water ran at a terrific rate for several weeks.

It is thus shown that there was really but a single year between 1901 and 1913, a period in which occurred both years above and years below the average in stream flow, in which all of the water of this river system was not actually used by these Wyoming appropriators.

Prior to 1909 the James Lake and Lake Hattie systems upon the Laramie Plains, and the Sybille and Bordeaux units of the Wheatland project, had not been completed and had diverted no water, and thus it appears that from 1901 to 1909, except for the small amount let down the river in 1907, the Wyoming appropriators who have a conceded priority over the Colorado appropriation used the entire flow of the stream, and in using it felt a pressure for water which any new diversion in Colorado must necessarily increase.

The history of the construction of the Wheatland No. 2 Reservoir presents in striking fashion the in-

sufficiency of the supply of water after the first of July in each year. Mr. Johnston briefly stated the facts as follows (p. 114): "I was present when Reservoir No. 2 was located at its present site in 1894. The settlers under our canals had held meetings and offered to increase the price to be paid us per acre under their contracts, if we would build the reservoir. At that time there were 2,000 acres under cultivation. There had been difficulty in securing water enough for the 2,000 acres. We were in position to divert and had been diverting all the natural flow of the river. Prior to constructing Reservoir No. 2 we ran short of water the first of July in some seasons, and from the middle of July on in some years." And at page 28 Mr. Johnston testifies that the owners of this small area then under irrigation, finding themselves short of water for even that amount of land, called a meeting and demanded of the company the construction of reservoirs, and submitted voluntarily to an increase of $2.50 per acre in their contract price for land and water. This resulted in the construction in the '90s of Reservoir No. 1, a small reservoir within the irrigated area itself, and the construction of Reservoir No. 2, of great capacity, completed in 1901. Certainly no more convincing proof that the undepleted flow of the river in July, August and September is wholly inadequate for the irrigation of the greatly increased acreage reclaimed prior to 1902, could be found.

IV. CERTAINTY OF INJURY FROM COLORADO DIVERSION, IRRESPECTIVE OF METHODS OF USE IN WYOMING, IS MADE CLEAR BY CONSIDERATION OF SEASONAL DISTRIBUTION OF FLOW OF RIVER.

The conclusion just reached is confused by the evidence offered by Colorado consisting almost wholly of generalizations, to the effect that there is a great waste of water in Wyoming through the methods of use. Without discussing the question of waste at this juncture, we believe it is clearly shown that the Colorado diversion will be a serious injury to the prior Wyoming appropriators irrespective of their method of using water, this being the conclusion from the evidence as to the seasonal distribution of the flow of the river.

The value of a water appropriation is determined wholly by the physical possibility and legal right to secure water under it when water is scarce; irrigation litigation arises when there is scarcity, not when there is plenty, and the right of a prior appropriator which courts are called upon to protect, is the right to take the water when the stream is low, and not the right to take the water when the stream is high. If all years were high, the country would be humid and not arid, and no irrigation whatever would be necessary. And so the effect of the Colorado diversion which is important to the Wyoming appropriators is its effect in years of low flow and in months of low flow, and the stream flow records introduced by Colorado itself show conclusively that whatever may be the adequacy of the

water supply during the high-water season of May and June for direct irrigation at these seasons, the present supply is wholly inadequate in July and August, and although the proposed diversion in May and June will in high years be of much less importance, that diversion in July, August and September is not only relatively much higher as compared to the amount of water in the stream at the point of diversion, but the portion of the drainage area from which such diversion is made is furnishing a very much higher part of the total stream flow than in the earlier part of the irrigation season. Accordingly, even should it be contended that the Wyoming appropriators make a lavish and wasteful use of water in May and June, during the period of greatest discharge, it still appears that when this high flow has passed and cannot be called back, the total flow of the stream is inadequate, even with the most economical method of use, to furnish water for these prior appropriators, and the Colorado diversion will further diminish this supply, already insufficient for the warm months of July and August, in which there is so little precipitation and the need is greatest. Much has been said by Colorado about the relative value of the grain crops in the valley of the Poudre as compared to the hay crop of the Laramie Plains, but never will Wyoming have an opportunity to carry on the gradual change from hay to grain now going on upon the Laramie Plains, if Colorado is permitted to take the best part of the water supply during the period of greatest need.

To present in the clearest form the practical situation with respect to the stream flow in the later irrigation season, and the greater relative importance of the higher drainage area in July, August and September,

we have prepared a table to show the comparative discharge of the Laramie River at Glendevey, Colorado, which is immediately below the Greeley-Poudre tunnel, and at Woods Landing, Wyoming, which is about ten miles north of the state line, and at the extreme upper end of the Laramie Plains, and below all of the mountain tributaries of the Laramie River, excepting one small one. The portion of the table relating to the discharge at Glendevey is derived from defendants' Exhibit 125 (p. 3418), which shows an average annual discharge of the river at this point for the six years included in the table, of 65,717 acre feet. This does not include the water diverted above the station by the Skyline and Wilson Supply (or Divide) ditches, which if added to the discharge at Glendevey would make the total 86,160 acre feet (p. 3420). It is also stated (p. 3422) that the six years covered by the table represent a flow of only 85 per cent. of the average for a long period, and upon that basis the Colorado engineer, Mr. Field, estimates the average annual flow at Glendevey to be 77,000 acre feet, this excluding, of course, the Skyline and Divide ditch diversions, (p. 3422), which if added would make the average annual discharge of the drainage area tributary to the Glendevey station approximately 100,000 acre feet. In the following tabulation, however, we have taken the discharge records as actually presented on Exhibit 125.

The discharge records of the Woods Landing station are taken from defendants' Exhibit 128 (p. 3440). This exhibit shows an average annual discharge of 254,111 acre feet, which for our present purposes would make an even more conclusive showing than a smaller amount furnishes. The winter records are, however, very greatly distorted, the discharge in January,

February and March, nearly all the way through exceeding the discharge in April, which is conclusive proof that the records for the winter months are entirely erroneous. The engineer presenting this table states (p. 3443) that while the table shows an aggregate discharge during the winter months of 68,349 acre feet, he has allowed but 32,000 acre feet, and accordingly we have deducted 36,349 acre feet from the total of 254,111 acre feet given in Exhibit 128 as the average annual discharge, leaving a balance of 217,762 acre feet. Aside from this change we have taken the figures for monthly discharge as given upon the exhibit; as stated hereafter in our general discussion of the stream flow records, we believe that these records as a whole are of but very little value, the methods of measurement being wholly unsatisfactory, but the records upon which Exhibit 125, covering the Glendevey station, and Exhibit 128, covering the Woods Landing station, are based, were obtained in the same way, and the objections that may be made to the one are applicable to the other, so that for our present purpose of showing the relation the discharge of each area bears to the entire drainage area of the river, the two tables may safely be used.

Comparative Table of Discharge of Laramie River at Glendevey (near Colorado tunnel) and Woods Landing, Wyoming. Abstract from Defendants' Exhibits 125 and 128.

	Glendevey	Woods Landing
Average annual discharge	65,717	217,762
May discharge.....	13,657	58,920
Percentage of annual	20.7	27.0
June discharge.....	27,644	76,107
Percentage of annual	42.0	35.0

	Glendevey	Woods Landing
July discharge	9,706	22,293
Percentage of annual	14.7	10.0
August discharge	3,043	7,460
Percentage of annual	4.6	3.4
September discharge	1,818	4,314
Percentage of annual	3.0	2.0
May-September discharge	55,867	169,094
Percentage of annual	85.0	77.7

The foregoing table shows that in July the discharge at Glendevey is 14.7 per cent. of the annual discharge, while at Woods Landing it is only 10 per cent. In August the Glendevey discharge was 4.6 per cent. of the annual, and the Woods Landing discharge was 3.4 per cent. In September the Glendevey discharge is 3 per cent. of the annual, and at Woods Landing, 2 per cent. In other words, the proportion of the annual discharge of the river occurring in July, August and September, is about 50 per cent. greater at Glendevey than at Woods Landing.

Another important fact proved by the foregoing table is that as we have before stated, the portion of the entire supply of the river coming from the higher mountain areas is greater in the last months of the irrigation season than in the earlier months. In June the discharge at Woods Landing was 76,107 acre feet, of which amount 27,644 acre feet, or 36.3 per cent., came from the area above Glendevey; in July there was 22,293 acre feet flowing by Woods Landing, of which 9,706 acre feet, or 43.5 per cent., passed Glendevey. In August the Woods Landing discharge was 7,460 acre feet, and the discharge at Glendevey 3,043 feet, feet, or 40.8 per cent., and in September 1,818 acre feet, or 42.1 per cent. of the discharge at Woods Landing flowed by the Glendevey station.

If to the discharge records as given in this table is added about 21,000 acre feet diverted into the Poudre Valley by the Skyline and Divide ditches, the proportionate value of the water secured from the high drainage area will be greatly increased. This amount should, of course, be added to both records, that at Woods Landing as well as that at Glendevey, but would increase the smaller flow at Glendevey proportionately more than it would increase the much larger flow at Woods Landing.

Colorado's engineer, Mr. Field, in his report upon the Riverside Ranch, immediately above Laramie City, stated, "The greatest demand will probably come in July, during which month probably three-fourths of an acre foot per acre will be required." (p. 3626). In our statement of the evidence relative to the amount of land irrigated in Wyoming, it has been shown that 52,186 acres is now under irrigation under ditches of conceded priority above the point where the Little Laramie enters the Laramie River, this being exclusive of the area irrigated from Sand Creek, the only stream excepting Fox Creek which is even nominally a tributary of the Laramie River between Woods Landing and the mouth of the Little Laramie. Accordingly, the water in the stream at Woods Landing constitutes substantially the entire source of supply for the land irrigated above the mouth of the Little Laramie River, 52,186 acres according to our evidence, and 38,241 acres according to the evidence for Colorado, (p. 2781). Accepting the statement of the state engineer of Colorado that this land would require three-fourths of an acre foot per acre during July, and assuming that the average annual discharge at Woods Landing in July is 22,293 acre feet (although we shall show that

this estimate is very much too high), then the amount of land which can be properly and economically served by this stream flow in July is 29,724 acres, or but little more than one-half of the area shown by the Wyoming evidence to be dependent upon this source. From this insufficient quantity Colorado intends to divert approximately the amount of water passing the Glendevey gauging station, which in the years covered by the foregoing table averaged 9,706 acre feet, or 43.5 per cent. of the available supply for the Wyoming lands. This amount, however, is based upon records for years said to be only 85 per cent. of the average stream flow, and if we accept this Colorado contention, then the amount that will be diverted through the Greeley-Poudre tunnel in July in years of average run-off, will be 11,419 acre feet, or more than one-half of the amount of water available for the irrigation of Wyoming lands above the mouth of the Little Laramie River.

It is conclusively shown, therefore, that in years of so-called "normal flow" the entire water supply of this interstate stream is inadequate for the proper and economical use of prior appropriators in Wyoming, and that it is the purpose of Colorado to divert one-half of this insufficient supply into the valley of the Poudre River. But the proof of certain damage to the Wyoming appropriators goes much further than this, for we have been dealing with the abstract case of a year of average flow. Such years do not occur with any frequency, and there are just as many or more years with less than average runoff than there are years above the average, and in such years the necessities of the Wyoming appropriators will be just as great (and ordinarily, because precipitation is less, even greater), and the entire undepleted supply will be

even less adequate for filling that demand. In such years any diversion by Colorado will lead to even greater loss.

V. COLORADO'S WHOLE DEFENSE DEPENDS UPON HER RIGHT TO COMPEL PRIOR WYOMING APPROPRIATORS TO CONSTRUCT RESERVOIRS.

Since there is an unquestioned shortage in water supply during the last months of the irrigation season in almost every year, and during the entire season in years of low flow, Colorado's contention that the water supply is adequate for all Wyoming appropriations and for the proposed Colorado diversion, is necessarily based entirely upon a consideration of the flow of the river over a long period of years, and the defendants insist that the records covering such a period show that the average annual flow of the stream is wholly adequate; but as we have shown that from the time of the completion of the Wheatland No. 2 Reservoir in 1901 until 1909, a period of eight years, the entire flow of the stream had been conserved and used, it has been necessary for Colorado to attack the methods of use in Wyoming as wasteful and extravagant, to establish a theoretical stream supply of a vast quantity, and to scale down as much as possible the area of land upon which this theoretical water is used.

But no wheat is raised by the use of water that flowed by two years ago, and the high flow of 1912 could be of no possible value to the farmer in 1913 unless by the construction of reservoirs that flow was conserved for use in the subsequent year. Accordingly,

Colorado's whole case depends upon its right to demand of the prior appropriators in Wyoming that they construct reservoirs to conserve water from the high years for use in years of scarcity, and from the high months for use in the later season, in order that Colorado may take the water which they have heretofore been using by direct diversion. The great mass of evidence with respect to average annual flow, methods of use, and waste, is material only in this connection.

It must be noted that Colorado is not proposing to construct a reservoir in the Laramie valley and store therein in years of high water that part of the flow which it claims is not needed for the prior direct appropriators in Wyoming, and the evidence with respect to stream flow, average annual flow, and waste, has not been offered to justify such a storage or diversion in years of surplus; what Colorado is here seeking is to show that in years of high water there is a surplus which if stored by Wyoming will satisfy the Wyoming appropriators, and upon that basis Colorado contends that she shall have the right to divert the water the lower appropriators have heretofore used, and thrust upon those appropriators the expense of reservoir construction and the chance of having enough water even then.

VI. RESERVOIRS WILL NOT SOLVE WYOMING PROBLEM.

If Colorado has a right which no subsequent appropriator has ever been held to possess, and may require the prior appropriators in Wyoming to construct reservoirs in which to store water in high years to take the place of that which Colorado will divert in low

years, the Wyoming problem will not even then be solved by such reservoir construction, for the following reasons:

1. The construction of reservoirs is impracticable on account of the high cost as compared to the benefit from the use of the water, and because the fluctuation in annual runoff is too irregular to permit fully successful storage.

2. The total supply if conserved is not sufficient to fill Wyoming priorities if depleted by Colorado diversion.

The construction of reservoirs for irrigation purposes has always been entered upon for financial benefit, which is true of all irrigation practices. The value of the product from fruit trees in California justifies expenditures for the conservation and distribution of water which would clearly not be justified by the value of the hay raised upon the ranches on the Laramie Plains, and whether the State of Wyoming, which has had no control over nature, and if it progresses must utilize such resources as have been given it, poor as they may be, is to have the benefit of the natural development of the vast area lying within the valley of the Laramie and by nature tributary to that stream, will depend, if Colorado should take the water it desires, upon the extent of the financial return that may be obtained from the irrigation of this land as compared to the expense of constructing reservoirs. Colorado has burdened this record with tributes to the Poudre valley, and not content with proving the productivity of that area, has sought to make the picture more striking by setting forth the dismal character of the Laramie Plains, and now seeks to force the expense of

reservoir construction more extensive than that which has been undertaken in the Poudre Valley itself, upon an area which is described by the state engineer of Colorado in his testimony as follows: (p. 1413) "When he (any investigator) observes the new irrigation projects, he wonders whether the projectors have been competently advised, and whether it is not spoiling a good ranch country to make a poor farming country, which is destined ultimately to failure. This impression I received when I first went in there, and it has been borne in upon me ever since, every time I go up there."

Naturally we do not concur with Mr. Field's opinion (so different from his conclusion four years earlier, set forth in his report, (pp. 3624-3637) as a paid engineer upon the Riverside Ranch near Laramie) that the product from the irrigated land upon the Laramie Plains is so meagre as to make the expenditure of money in irrigation ditches waste, for through such expenditure there has in the course of time been built up a prosperous community, contributing largely to the prosperity of its State and nation; but it is true that the principal product to this time has been hay, of a value which will not justify expenditures for reservoirs.

But the construction of reservoirs is impracticable as a complete substitute for direct flow, for another reason—the fluctuation in annual discharge of the river. The defendants in the course of the presentation of the evidence developed a theory of obligation to conserve water which finally threatened the Poudre itself, inasmuch as the construction of reservoirs in that district has fallen very far short of such high duty, and it was then possible to secure from the Colorado expert,

Prof. Carpenter, a fair statement of the practical considerations influencing reservoir construction, as follows: (p. 3946)

> "With regard to financial practicability of construction of reservoirs on Poudre River capable of conserving extraordinary floods, will state that they call for an expenditure that could be utilized only occasionally. It would be similar to financial proposition of people in Florida preparing to heat their houses in the same manner as those in the northern part of the United States. For years of unusually high flow in the Poudre River, conservation works, to utilize the excess waters in that stream, would have to count on carrying water over more than one year. The utilization of this water means the presence of population on the land; that population must have a living from year to year and they are not justified in going out on to the land and settling to raise a crop only once in three or four years. They must have sufficient to make a living from one year to another, and consequently the investment must be such that there can be sufficient water every year to keep these people on the land, and when water can only be conserved once in every three to five years, there must be provision for carrying over water or the people cannot live. It is a question of population as well as investment. The population has to exist and stay on the ground. From the standpoint of investment, conservation of flow such as extreme flow of 1884 would be impractical to the extent that it exceeded the ordinary high year. Of such character would be the floods of 1885, 1900 and 1909, three years in thirty."

As a matter of fact reservoirs cannot be constructed upon the theory that by so doing it is possible to make yearly use of the theoretical average flow of a river.

This would be impossible even if the flow of a stream fluctuated with complete regularity, being 125 per cent. of the average in odd numbered years, and 75 per cent. of the average in even numbered years, for the 25 per cent. that is carried over in each alternate year would in the course of a year's storage suffer a very large loss from seepage and evaporation, the evaporation alone, according to a Colorado witness (p. 3754), being as much as six feet per year from the surface of standing water. But stream flow varies in no such manner. For a few years, high and low seasons may alternate; sometimes there are several years of high water grouped together, and sometimes several years of low flow succeed each other. The only rule that seems to be derived from long time records is that there will be one or two years of exceedingly high runoff which will tend to raise unduly the average for the period so that the number of years in which the flow falls considerably short of the average will be greater than the number of years in which the flow is greatly in excess of the average. These irregularities of stream flow are well shown by the defendants' Exhibit 124 (marginal page 3398), which gives the discharge of the Poudre at the mouth of its canyon from April to October, inclusive, from 1884 to 1913, showing an average net annual discharge during the period, of 297,322 acre feet. To facilitate the discussion of practical irrigation problems arising from irregularity in stream flow, we here set forth a tabulation derived from Exhibit 124, setting forth the runoff in each year, the percentage this bears to the average for the thirty-year period, and the amount in acre feet by which the runoff exceeds or falls short of the average:

Variation in Discharge of Cache la Poudre River Derived from Defendants' Exhibit 124

Year	Runoff in Acre Feet	Per cent. of Average	Variance from Average
1884	666,466	227	+369,144
1885	465,475	157	+168,153
1886	290,392	98	– 6,930
1887	286,840	96	– 10,482
1888	155,970	52	–141,352
1889	185,060	62	–112,262
1890	221,023	74	– 76,299
1891	257,236	87	– 40,086
1892	193,790	65	–103,532
1893	216,730	73	– 80,592
1894	309,444	104	+ 12,122
1895	344,500	116	+ 47,178
1896	162,340	55	– 34,982
1897	332,070	112	+ 34,748
1898	172,290	58	–125,032
1899	388,591	131	+ 91,269
1900	474,573	160	+177,251
1901	339,155	114	+ 41,833
1902	151,636	51	–145,686
1903	345,150	116	+ 47,828
1904	315,437	106	+ 18,115
1905	361,652	122	+ 64,330
1906	279,974	94	– 17,348
1907	386,244	130	+ 88,902
1908	252,843	85	– 44,479
1909	486,002	163	+188,680
1910	157,514	53	–139,808
1911	205,611	69	– 91,711
1912	297,722	100	+ 400
1913	217,959	73	– 79,363

Average runoff 297,322.

The foregoing table shows that in the thirty years, one lone year had an average runoff, which of itself sufficiently demonstrates the misuse of the word "nor-

mal", as applied to the average or mean flow over a period of years. In thirteen years the runoff exceeded the average, and in sixteen years the runoff was below the average. In four years the discharge exceeded the average by more than 100,000 acre feet, and in seven years it fell short of the average by more than 100,000 acre feet. In seven years the runoff exceeded the average by more than 50,000 acre feet, while in eleven years it fell short by more than that amount. In 1884 the discharge exceeded the average by more than 369,000 acre feet, being 180,000 acre feet in excess of the next highest year on record. Even with the present reservoir development of the Poudre valley, none of this water could have been stored for the benefit of subsequent years, because in 1885 the runoff exceeded the thirty year average by 168,000 acre feet, which would have exceeded the total reservoir capacity of the Poudre valley as now existing. For all practical purposes, therefore, the surplus discharge of 1884 has been and could be of no possible value to the water users, and yet the presence of this year in the table raises the average for the thirty years by more than 12,000 acre feet, once more demonstrating the purely theoretical quality of the so-called "normal flow" of the river. But the important feature of this table lies in the fact that it shows how much the most complete reservoir construction will fall short of making available in each year the average discharge of a river. It is repeatedly claimed, and we believe with justice, that irrigation practice has reached its highest point in the mountain region in the Poudre valley, and we may therefore look to the present reservoir facilities in that valley as representing the farthest point that may profitably be attained, even in a wonderfully pro-

ductive country. Colorado's state engineer, Mr. Field, testified (p. 3721) that in 1912 the total capacity of reservoirs in the Poudre valley was 146,665 acre feet, and that there was stored in these reservoirs on November 1, 1912, 83,794 acre feet, leaving 62,871 acre feet of available capacity. In that year the stream flow was almost exactly the same as the average for the thirty year period, being 297,722 acre feet from April to October inclusive, and so it is seen that since only 62,871 acre feet of water could have been stored in addition to that actually stored at the close of the irrigation season in that year, the total flow of the stream of which use could be made would be 360,593 acre feet, and any flow in excess of that amount would be lost for lack of reservoir capacity. It appears from the foregoing table that in seven of the thirty years the flow was in excess of 360,593 acre feet, and that the total excess above that figure in those seven years was 704,832 acre feet. Accordingly, even though there had been, throughout the thirty years, the same high stage of reservoir development which had been attained in 1912, there would have been a direct loss of 704,832 acre feet, and a corresponding deduction of 23,500 acre feet should be made from the average flow of the stream, if we are to determine the average amount which in actual practice can be used in the Poudre valley. And even from this must a deduction be made where two or more high years come together, because the reservoirs once being filled cannot conserve any part of the surplus of a second high year; and finally, the great loss from seepage and evaporation must be deducted. This, we believe, sufficiently shows the error that must exist in any conclusion as to the amount of water available through the construction of reservoirs,

based merely upon the average annual runoff as derived from stream flow records.

The inadequacy of reservoir conservation as a substitute for a direct supply is finally demonstrated by observation of the manner in which low years frequently follow each other. A very marked example is furnished by the record of the Poudre as above set forth, for the years prior to 1894. 1884 was the largest year on record. It was followed by another exceedingly large year, and then followed two years of almost average flow, and then six years of very low discharge. No conceivable reservoir system could have conserved the whole surplus flow of 1884. No present reservoir system could have conserved the surplus discharge of 1885. Whatever the amount stored from those two high years might have been under any conceivable circumstances, that amount would have had to be carried over the years 1886 and 1887, which were of average discharge, with the resulting losses, and would have been exhausted by the demand in the very low year of 1888; certainly by the demand in that year and by the demand in the almost equally low year of 1889. No possible amount of storage could have saved any water at all for the use of appropriators in the low years 1890 to 1893 inclusive. This same situation is repeated in the last few years. 1909 had a very large surplus flow, being about 188,680 acre feet in excess of the thirty year average. As a matter of fact none of this surplus was conserved in the Poudre valley; on the contrary it appears that in this favored country of perfect irrigation practices and complete conservation of water not even the so-called "normal flow" was used in that year, for defendants' Exhibit 113 (p. 2487), shows that in 1909, 288,588 acre feet of

water flowed from the Poudre into the Platte River, indicating the use and storage in the year of less than 200,000 acre feet, or only two-thirds of the "normal flow" of the stream. But assuming that it had been financially practicable to construct irrigation systems designed to make use annually of a flow approximating the average flow of the stream, and to construct reservoirs to conserve the surplus of high years for use in low years, even then the amount carried over from 1909, when the inevitable losses from evaporation and seepage are considered, would not have done more than supply the deficiency of 1910, which fell short of the average by 140,000 acre feet; and then followed the year 1911 with a discharge more than 90,000 feet below the average, which would have no supply from former years; the year 1912, with an average flow from which, on the hypothesis assumed, no water could be stored for future use; and the year 1913, with a shortage of 80,000 acre feet, with no stored water to fall back upon. Now if we assume that from this discharge there had been diverted into another watershed the comparatively constant runoff from the head of the stream, amounting to 75,000 acre feet, the disaster to the farmers in the years 1911, 1912 and 1913, would be certain.

Our contention is not that the construction of reservoirs as a general rule is not profitable, and we concede that many irrigation enterprises are successfully carried through where there exists a shortage in some years, but in this case the Wyoming appropriators have a supply which is certain and comparatively constant in every year, namely, the runoff of the high mountain territory at the head of the Laramie River. Colorado threatens to take this certain supply, and contends that its place may be taken by water stored

in years of high flow, in reservoirs which it insists Wyoming should construct, and we now say that even if Colorado may impose this burden upon the prior appropriator, Wyoming, even then the supply so secured will not be constant and certain in each year, and will not therefore be compensatory for the amount taken by Colorado. This is the conclusion if we treat Wyoming appropriators as a single body; it is much strengthened when it is considered that they are numerous, own individual ditches, and must each for himself construct his own reservoir or else pay a large price to some company for reservoir water to take the place of the water which he appropriated without charge from the direct flow of the stream.

Finally, Wyoming contends that the entire flow of the Laramie River, even though fully conserved and economically used, is not adequate to supply prior Wyoming appropriators if the proposed Colorado diversion is made.

We have deferred discussion of the difficult question of water supply as a whole to this point in order to avoid confusion, for we have shown that the Wyoming appropriations are based upon the direct flow of the stream, that this direct flow, if undepleted by Colorado, is a wholly inadequate supply during the most important part of the irrigation season, and that the question of total river discharge in periods when not required for direct diversion is material only if Colorado has the right to take the direct flow and compel us to build reservoirs.

If Colorado has this right, then it becomes important to determine the adequacy of the entire flow of the river, and on that point we contend that the supply is not sufficient to permit the Colorado diversion,

even though it be possible to store all excess flow and hold the water so stored without loss until a low year comes, an irrigation development which, as we have just shown, cannot be attained and which is far beyond the development in the productive Poudre valley.

There are two methods by which the question of the adequacy of the water supply may be determined: First, by ascertaining the volume of water, the area of land irrigated, and the theoretical requirements of that body of land; second, by showing that in actual practice the available supply has been used upon a given area of land without waste.

Colorado has depended principally upon the first method, Wyoming upon the second.

Let us consider the first, requiring as it does the determination of three items:

a. The average annual flow of the stream.

b. The area of land irrigated.

c. The theoretical duty of water.

a. Average Annual Flow of River.

This topic is discussed at considerable length in our original brief, pp. 31-47, to which we would respectfully refer the court; to avoid too much repetition we shall here enter upon no general discussion as appears there, but shall confine ourselves to a more specific reference to the particularly important evidence.

One witness for Colorado, Prof. Carpenter, testified concerning a few individual discharge measurements made by him in 1912, but did not testify generally concerning river flow. Such evidence was given by only two witnesses, one the state engineer of Colorado,

Mr. Field, and the other our hydrographer, Ralph I. Meeker. Mr. Field, so far as the record shows, not only never made a discharge measurement himself (p. 4272), but he did not even have personal direction of any of the hydrographic work the results of which he used in his computations; commencing with April, 1913, he was the state engineer of Colorado, and in that capacity had control of such hydrographic work as was carried on by his assistants, but even in that year he did not personally supervise any of the work upon the Laramie River. On the other hand, the testimony of Mr. Meeker is based upon discharge measurements taken by him personally and by observers acting under his continuous personal supervision, for the period of two years commencing in May, 1912. He supplemented his testimony with respect to the exact discharge between May, 1912, and May, 1914, by conclusions as to the average discharge over a longer period, and in reaching such conclusions made an analysis of all available data (p. 4327), but the important portion of his testimony is that relating to the discharge in the two years covered by his actual measurements, and this is the only evidence of such character appearing in the record. Mr. Meeker's qualifications and diligence as a hydrographer are not challenged. His hydrographic experience covered a period of thirteen years with the Geological Survey, the federal reclamation service, and private corporations, and commencing in May, 1912, until his final testimony in May, 1914, he devoted his entire time to hydrographic work upon the Laramie River and its tributaries (p. 217).

The relative value of the suppositions, surmises, inferences and deductions of Mr. Field and the definite testimony of Mr. Meeker, is best shown by a considera-

tion of Mr. Field's testimony and the continuous difficulty he experienced by reason of the character of the hydrographic data with which he was compelled to work. The instances are so many that but a few may be given.

One set of discharge records which Mr. Field could not accept was the Geological Survey report of the discharge of the Laramie River at Decker's ranch, a gauging station in Colorado immediately above the state line. He says (p. 3435) that there are two sets of records for this station, one kept by the water commissioner and one published by the Geological Survey, and that the latter is very much lower than the former; that the Geological Survey hydrographer had prepared on the ground a rating table which he gave to the water commissioner, and by using this rating table and applying it to the gauging heights as determined by the water commissioner, the witness ascertained that the discharge was much greater than that given in the published record (p. 3435). He also explains (p. 3436) that the published record is based upon a rating table worked out several years later by some hydrographer in Washington with no personal knowledge of the conditions, and that the note attached to the published record that the gaugings were probably too high because of a defective meter, indicates to him that the gaugings were actually too low, because a defective meter would have that tendency. He reaches the same conclusion, that the published records are very much too low, by comparing them with the records of discharge at Glendevey, several miles farther up the stream, and says that the indicated inflow between the two stations is too small, thereby proving that the Decker record is too low, not that the Glendevey

record is too high, (p. 3435), and finally he rejects the conclusion, drawn from the records at Decker and at Boswell, which is immediately below Decker's ranch and just north of the state line, that the amount contributed by Colorado to the Laramie River is 197,000 acre feet (p. 3436).

In dealing with the data with respect to discharge at Woods Landing, a station in Wyoming a few miles north of the state line and below practically all tributaries, Mr. Field excludes the records relating to discharge in January, February and March, because they are questionable (p. 3441); discards the records for the years 1889 and 1893, inclusive (p. 3440), and uses the records between April and October subsequent to 1894 as the foundation upon which he ultimately bases his conclusion with respect to the average discharge of this stream, and says of these records that they are "more reliable and less open to question" (p. 3441).

Generally of the Woods Landing records, Mr. Field says:

> "At Woods Landing Station we have records more or less complete and more or less authentic and reliable for years 1889 to 1900 inclusive, with exception of year 1894. We also have records for 1911, 1912 and 1913, the only records. Most of them at least are not entirely above suspicion, probably on account of ice conditions and fragmentary conditions of records and lack of sufficient number of actual gauge readings during winter. 1912 record as shown on Exhibit 128, was amount given by R. I. Meeker in his tables showing discharge at Pioneer Dam. These records are from April to December inclusive for 1912. This amount for 1912 given by Mr. Meeker is open to serious question, especially for months of June

and July, for reason that amounts given for those months for Pioneer Dam station are less than discharge for same months of that year at Boswell Station, notwithstanding that there is very considerable runoff during those two months from territory lying in between the two stations." (p. 3447.)"

The record taken by Mr. Meeker which Mr. Field here criticises, was made at the Pioneer Dam, four miles below Woods Landing at a point where the river has entered the Laramie Plains, and the measurements were made of water passing over a concrete weir in a dam across the river, so that cross section measurements and gauge heights were absolutely accurate, something that is impossible in measurements made in open rock-strewn channels (p. 218). The record taken under these conditions, and presented under oath by a qualified hydrographer who made the measurements, is not acceptable to Mr. Field, who criticises it on the bases of records kept by persons who did not testify, some of them with no hydrographic experience whatever, at Boswell, a station in the mountains where the channel to be measured is irregular.

Again (p. 3465) Mr. Field points out a serious error in the published record for the discharge at Woods Landing in 1895, a mistake which he discovered by getting hold of the original gauge records and replotting a discharge curve, thereby increasing the annual discharge more than 44,000 acre feet.

An even more striking illustration of the uncertainties of discharge records based upon data furnished by ranchmen who undertook to take gauge readings and change automatic register charts, and who attend to this to them unimportant business just as they happen

to think of it, is supplied by Colorado's long tale about the hydrographic tragedy occurring at Boswell station in 1912. The Colorado expert, Prof. Carpenter, testified (pp. 3792-97) that on May 29, 1912, he discovered that the automatic register was not recording the height as indicated on the staff gauge, and that frequently throughout the summer the register was checked with the gauge and found to vary from time to time from three-tenths of a foot to one foot. This, of course, required a recomputation of the gauge readings furnished by the automatic register, it being necessary for the person revising the record to estimate just what the variation from the actual depth was from day to day. But this was not all. Prof. Carpenter likewise discovered at the same time that the river overflowed its channel when its depth reached 3.4 feet, and a considerable volume of water flowed around the bridge at which the measurements were made and through several culverts, and from time to time during the high water season he measured the flow through these culverts (p. 3798-3804). Here again it was found necessary to increase the discharge record above that as published by the state engineer of Colorado. And because the record maintained continuously by Mr. Meeker at the well equipped station at Pioneer Dam does not agree with the record at Boswell station, taken under these conditions and revised time and again, the Pioneer Dam record is not accepted by the Colorado expert. These instances pointed out by Colorado witnesses, of gross errors in discharge measurements, well illustrate the truth of the following general statement of Mr. Meeker (pp. 4273-4275):

"I am familiar with the general practice and

methods used in measuring streams and recording flow, and have had about fourteen years' experience in measuring streams and in computing data and in analyzing data secured by others, and I am familiar with the methods of measurement and sources of records in the State Engineer office of Wyoming and Colorado and the U. S. Geological Survey, having spent several years with the survey in Colorado and adjoining states, measuring streams and canals and in that work and related work, since which time I have had occasion to go into the records both in Wyoming and Colorado. The accuracy of stream records depends first on the natural conditions at the gauging station, and secondly, the methods and care used in securing those data. The greatest and most common errors that occur in stream measurement are usually caused by incorrect soundings, which invariably give too great a cross section, especially in high water measurements. The reasons are that in making soundings the weight in streams which have rock beds sinks into holes between the rocks or the weight and lines are carried down stream to a point not perpendicular to the cross section, giving soundings which are too great. Errors also occur from lack of keeping the meter point clean and sharp to avoid increased friction. If not well oiled and in good condition the velocities secured are below their true values and the measurement is less than the actual volume of water. At times on mountain streams the velocities of swift currents can only be secured on the surface when a co-efficient is required for the reduction to a mean velocity. Such co-efficients are based on experience and judgment is needed in their application. The tendency of all high water measurements both from sounding and velocity factor is to secure too high results, as disclosed by an examination of the older and earlier records, which being from high water measure-

ments, are usually in error and give results far too great. Errors also occur from the settlement of the gauge, and unless frequent checkings of bench marks are resorted to these errors may cover a considerable length of time, giving a gauge reading which is too high and therefore showing more water than actually passes. Errors frequently occur from careless readings of the gauge or from neglect and faking of the records. The time of day at which gauge height observations are taken may not give a true mean for that day, especially on mountain streams, where the daily tide is pronounced. In case automatic stage registers are used, it is very important that the pen be checked with the staff gauge each time the chart is changed, and proper notations be noted on the sheet, in order that corrections may be made. Errors also occur in measurements at time of high water from rising and falling stages. Back water from dams, drift or other things frequently vitiate the results for short periods. Ice conditions are an important factor and the direct application of discharge measurements based on open channel conditions and applied to gauge heights secured when ice conditions obtain, give result too large. This is also true of obstructions of channels by driftwood or otherwise. Numerous instances have come to my notice of stream measurements in the west where the winter records are practically of no value, being grossly in excess of the actual runoff. This has been confirmed by the more efficient methods of today and greater care used that a sufficient notation as to conditions during the time observations were secured. The errors in the field in making stream measurements are not the only ones. Errors frequently occur in computation, and especially so in the extension of the discharge curve beyond known points of measurement to cover high water. In such case the error is usually positive. In summation then,

the accurate measurement of stream flow with current meters is not a mechanical operation which can be performed by indiscriminate and inexperienced persons but requires experience and judgment, not only in the field, but for the proper application and computation of the data secured. Errors in stream measurement preponderate in the positive direction."

But Mr. Field's testimony and conclusions were not based wholly upon this great mass of nondescript records, the correctness of which he himself so frequently challenged. He adds to the results obtained by the use of these records in two ways: first, by assuming that the records even if correct do not represent the flow in years of average discharge, and second, by finding additional supplies of which he has no measurements.

Mr. Field presented a table which has heretofore been discussed, of the discharge of the Poudre River for thirty years, and throughout his discussion of the Laramie River he assumes that because the very highest portions of the drainage area of the two streams join, that the high and low years upon the Poudre will coincide with the high and low years upon the Laramie. For example, in his discussion of Exhibit 127, a table showing the discharge of the Laramie River at Woods Landing from April to October in each year, being the table upon which he ultimately bases his conclusions with respect to water supply, Mr. Field says (p. 3442) that the average discharge for the nine years which includes all of the data with which Mr. Field is satisfied, is 198,545 acre feet for the months of April to October inclusive. In this period there occurs, he testifies, ninety per cent. of the annual flow, and he accordingly

concludes that the annual average discharge would be 220,490 acre feet; we have no objection to this method of estimating what portion of annual flow occurs in particular months, but in these same nine years the flow of the Poudre River was only ninety-six per cent. of the thirty year average, and Mr. Field unhesitatingly assumes that this is likewise true of the Laramie River, and thereby boosts the average annual flow of the stream to 230,000 acre feet, this being exclusive of the amount diverted into the Poudre River by the old Skyline and Divide ditches, and (p. 3470) Mr. Field even uses this same method upon the Little Laramie River, whose headwaters do not approach within fifty miles of the Poudre and are in a different range of mountains, and applies the Poudre average for as small a number as two years.

We do not believe that this method of determining stream flow has any value, and in order to show that this is true, we offered in evidence a table, complainant's Exhibit T-9, showing the discharge of the North Platte River near Saratoga, Wyoming. (p. 4298). Mr. Meeker, who prepared the table, testified (p. 4297) that the North Platte and Laramie rivers flow about parallel to each other eighty miles apart, the upper portions being only twenty miles apart, however; that the drainage basins are similar, and that in his opinion there is a closer resemblance between them than between the drainage basins of the Laramie and the Poudre, and that the annual fluctuations in the flow of the Laramie and North Platte would be more nearly the same than in the case of the Laramie and Poudre rivers. By this table it appears that the discharge of the North Platte River in 1912 was 115.5 per cent. of the average flow for eight years including the very

high year of 1909, and in 1913 was 73.7 per cent. of the average, whereas it is contended by Colorado that the discharge of the Laramie River in 1912 was 101 per cent. of the average, and in 1913 was about 51 per cent. of the average, because the flow of the Poudre in those years bore the same relation to the average of that stream. Different experts may, it is thus shown, draw such widely different conclusions as to the average flow of the Laramie River, dependent upon whether the flow is considered as more closely related to that in the Poudre or that in the North Platte, that any conclusion based upon any other records than those of the stream itself, must be wholly unsatisfactory. It may be reasonable to say that a very high year upon one stream will coincide with high years upon other adjacent streams and that all streams on the same side of the continental divide will have low flows in the same year, but it is absurd to contend that in these river systems lying many miles apart the annual fluctuations will be within two, ten, or even twenty per cent. of each other.

And finally, Mr. Field has very largely based his conclusions upon an entire lack of data in many instances. He includes in his summary (pp. 3476-3477) 17,000 acre feet as the flow of Sand Creek, and this is the basis upon which he determines that flow: "Sand Creek drainage in Colorado is about 50,000 acres, from which runoff should be one-third of an acre foot per acre, or in round numbers 17,000 acre feet." (p. 3445). As a matter of fact Sand Creek is only nominally a tributary of the Laramie River. We have shown heretofore that nearly 6,000 acres are irrigated from this stream in Wyoming, and it is shown without contradiction (p. 890) that in only five years since 1877 has

any water flowed from Sand Creek into the Laramie River. But it does lie within the Laramie River basin, and upon the theory adopted by Colorado its flow may properly be considered in determining the entire water supply of the whole vast drainage area, but certainly this kind of evidence as to what the annual flow of the stream is, is of no value.

Mr. Field finds an average discharge of 9,000 acre feet from Stuck Creek, one of the small Colorado tributaries (p. 3428-29), his conclusion being based on two measurements in May, five in June and two in July in 1912, and a larger number of measurements in May, June and July in 1913, and the rest of the year is wholly guess work. Mr. Field also properly uses the term "estimated discharge" in considering the value of Johnson and Beaver Creeks, upon similarly inadequate data (p. 3432).

Fox Creek, entering the stream between Woods Landing and Pioneer Dam, is said by Mr. Field (p. 3473) to have an annual discharge of 14,400 acre feet, based upon no data whatever excepting the area of the drainage basin. He then finds 12,800 acre feet in the mountain territory north of the Little Laramie and west of the Laramie River (p. 3474), once more based on nothing but territorial dimensions. Another 12,800 acre feet appears from the territory on the east of the Laramie River on the basis of one-ninth acre foot per acre runoff for the whole area (p. 3474), and he is equally confident that there must be considerable runoff from the plains area itself, but conservatively omits it from his computations (p. 3474). Sybille Creek is given 20,000 acre feet, based upon the record for the single month of April, 1912, (p. 3475), and his conclusion is that the total water supply of the entire

Laramie River drainage area is 447,692 acre feet (p. 3476), of which 250,500 acre feet is the average annual discharge of the Big Laramie River at Woods Landing, including the amount diverted by the Skyline and Divide ditches, 20,700 acre feet is the average annual discharge of the Little Laramie River, and the balance the contributions from the miscellaneous sources just discussed (p. 3473).

We have shown that this evidence is not the testimony of any hydrographer who has made measurements in person but of an engineer whose only data have been unidentified records which he has continuously criticised as inaccurate, who after discarding inconvenient records and shaping the remainder to suit his purpose, has added materially to their face value by assuming that no combination of years in which records were taken did other than represent less than the average flow of the river, and who finally added a few miscellaneous items of water supply without any record at all, making the river larger and larger on its way through the plains and overlooking his statement on the first day he testified that streams in the arid regions differ from those in humid countries in that they decrease materially in flow as they cross the plains (p. 1386). Opposed to this evidence, Wyoming offers the testimony of the only hydrographer who made or personally supervised the continuous records upon which his conclusions are based. Since Mr. Meeker was testifying only with respect to his own records and was not compelled to resort to fanciful methods, his testimony is comparatively brief and the substance thereof is contained in two tables, complainant's Exhibits T-7 and T-8 (p. 4294). On the Laramie River at the Pioneer Dam, which is below all tributaries

excepting Sand Creek and the Little Laramie River, he found that the average annual flow over the period from April, 1912, to May, 1914, was 161,054 acre feet, and the average annual flow of the Little Laramie River as determined from the actual records covering the period from June, 1912, to May, 1914, was 68,820 acre feet. From an analysis of all available data including all used or furnished by the state engineer of Colorado, Mr. Meeker was of the opinion (p. 4296) that the average annual flow of the Laramie River at the Pioneer Dam was approximately 200,000 acre feet. He did not state his conclusion with respect to the average annual flow of the Little Laramie River, but his Exhibit T-8 shows that the total discharge in 1913, adding the amount diverted above the gauging station, was 59,637 acre feet, or a little more than one-half of the flow of the upper stream in that year.

Mr. Meeker, who certainly in two years had become thoroughly familiar with the streams upon the Laramie Plains, was able to testify from personal observation that the miscellaneous items contributed to the total water supply by Mr. Field do not exist. As has been stated, Fox Creek enters the Laramie River between Woods Landing and the Pioneer Dam, and accordingly whatever its flow may be it is included in the discharge records of the Pioneer Dam station. Mr. Meeker testifies that there is practically no inflow from the area north of the Little Laramie and west of the Laramie River, from which Mr. Field thought 12,800 acre feet would be derived (p. 4304-5), and that the same is true with respect to the mythical supply of 12,800 acre feet from the east side of the river (p. 4306). The discharge of Sybille Creek, whatever it may be, is a source of danger rather than of

supply to the Wheatland district, the only one that could be served from it, the discharge being due largely to cloudbursts, which when added to the water being drawn from the Wheatland No. 2 Reservoir frequently washes out the headgates of the distributing canals (p. 164-167).

As a matter of fact all of these small creeks are utilized for the irrigation of small meadows along them, the area of which is not included in the tabulation of lands irrigated from the Laramie River but the extent of which is indicated by the adjudication decrees hereinbefore abstracted.

Our conclusion is that the average annual flow of the Laramie River is not to exceed 200,000 acre feet, and the average annual flow of the Little Laramie River is about 110,000 acre feet, and that these two sources constitute the entire supply of water available for the irrigation of the lands served by the two streams.

b. The Area of Land Irrigated

We have heretofore discussed the evidence as to the amount of land irrigated in Wyoming, and have shown that the area irrigated from the Laramie River under ditches of conceded priority is 97,855 acres, and the amount irrigated from the Little Laramie River, all under very old priorities, is 48,344 acres, a total of 146,199 acres. This does not include the land irrigated from Sand Creek or the other little creeks upon the Laramie Plains, nor the lands irrigated from Sybille Creek, the North Laramie River and Chugwater Creek, on the east side of the Black Hills. For the irrigation of this 146,199 acres we have a water supply averaging

310,000 acre feet, and we are here assuming what is not the true condition, that it is practicable to construct reservoirs to store water for the use of all appropriators so as to make the average flow of the stream available as the actual water supply. Whether this amount of water is sufficient to irrigate this area of land, leaving a balance of 70,000 acre feet or more for diversion by Colorado in addition to the amount already diverted through the Skyline and Divide ditches, depends, using the method of argument adopted by Colorado, upon the theoretical duty of water.

c. The Theoretical Duty of Water

A discussion of the theoretical duty of water leads into a maze of opinions, assumptions and surmises, to which that arising from a discussion of stream flow records is not comparable. The all-important factor in determining how much water is necessary to irrigate a given area of land is the physical situation. If the subsurface water table is close to the surface as it is in the Poudre valley, since three million acre feet of water has been poured into the ground, a much smaller amount will be needed than if the water table is far below the surface as is true of the Laramie Plains; if the soil is thick as it is in the Poudre Valley, less water will be needed than in the Laramie Plains, where the soil, if we believe all the Colorado witnesses say about it, is nothing but gravel. If the climate is so favorable that intensive cultivation of high priced crops is profitable, the methods of use which can be adopted will lead to a higher duty of water than in a region where hay is the principal crop.

Mr. Field states that under one of the very large canals in the Poudre Valley, the average consumption of water was about 1.2 acre feet per annum; that through the re-use of seepage water the net duty of water is less than one acre foot per acre per annum, and that in his opinion the net duty of water in the Poudre Valley as a whole will ultimately rise to three-fourths of an acre foot per acre (p. 3415). Mr. Meeker testified that in his opinion the duty of water in one district of the Laramie Plains where the ditches are close to the river, is about one acre foot per acre (p. 4317). The manager of the Wyoming Development Company system, serving the Wheatland district, testified that the net distribution of water to the Wheatland lands in 1912 was between 2.6 and 2.7 acre feet per acre, (p. 212), and that in 1912 the distribution to the lands under the United States Reclamation Service project on the North Platte River just below the mouth of the Laramie River was 2.55 acre feet per acre, and in 1911, 4 acre feet per acre. (p. 213) Perhaps the fairest opinion is that of Mr. Field himself in his 1910 report upon the Riverside ranches near Laramie City. The report was intended for use in a colonization project, and the adequacy of the water supply was of course the most important feature upon which the opinion of the engineer would be valuable, and there would accordingly be no inclination on the part of the engineer to state that an excessive amount of water was necessary for the proper irrigation of land, because it would be harder to demonstrate the existence of such a large supply. He there stated as his opinion (p. 3626) that two and one-half acre feet per acre per annum was doubtless an ample supply. This is less than the amount of water distributed upon

the Wheatland lands, and upon the lands under the interstate canal of the Reclamation Service, districts where intensive cultivation is being practiced, and we may safely conclude is not unreasonably high. Upon this basis 146,199 acres of land having prior appropriations from the Laramie River in Wyoming would require 365,498 acre feet of water, or 55,000 acre feet in excess of the average flow of the Laramie and Little Laramie Rivers.

But we believe there is a more satisfactory method of determining the adequacy of the water supply of this stream, viz.: by showing that in fact the entire flow has been used without waste. This method requires no consideration of stream flow records leading necessarily to an unsatisfactory conclusion, nor any determination of the exact acreage of land irrigated, nor any conclusion as to the theoretical duty of water.

Wyoming has shown that all of the water of the river has actually been used excepting in the year 1909, since the completion of the Wheatland No. 2 Reservoir in 1901. Colorado has been able to meet this proof and its effect only by insisting that a large amount of water has been wasted, and in support of this claim has introduced much evidence that the appropriators on the Laramie Plains have taken all of the water they have wanted without any control being exercised by water officials, and that many of the ditches have no dams at their headgates to raise the water when the stream is very low, drawing the inference from these facts that there is no pressure for water and that the supply is superabundant.

It must be conceded that such conclusions might properly be drawn from such facts under ordinary circumstances, but the condition upon the Laramie

River is peculiar. By far the largest appropriation from the river is that of the Wyoming Development Company for the Wheatland system, and as shown by the tabulation of priorities which we have presented, this appropriation is also one of the earliest in priority. Accordingly it has been necessary for the upper appropriators to permit a large volume of water to pass their headgates, and since in low stages of the river the total stream flow is not equal to the appropriation of the Wyoming Development Company, the upper appropriators have no right to divert any water from the river at such periods and there would be no advantage to them in constructing diversion dams to enable them to take water at such times. That the absence of diversion dams is not indicative of a superabundant water supply if the large and early priorities are at the lower end of the stream, is fully recognized by the Colorado expert, Prof. Carpenter (pp. 2386-87).

The evidence with respect to the alleged waste of water upon the Laramie Plains is discussed at considerable length and with many quotations from the testimony, in our original brief, pp 60-63, and we feel we can add nothing to that discussion.

Finally, in considering the adequacy of the water supply of the river, assuming that the average flow of the stream over a long period of years and not the flow in any single year must be considered, it must be noted that as a matter of fact Wyoming has done just what Colorado insists it should do, and that even under these circumstances a shortage of water supply is experienced. Colorado contends that we should construct reservoirs; we have constructed a reservoir, the Wheatland No. 2 Reservoir, which being connected with the largest and one of the earliest priorities and

situated at the lower end of the Laramie Plains below substantially all of the ditches of later priority, acts in the words of Mr. Field (p. 3671) "as an equalizer of the whole stream during the season and from year to year, as it is never necessary to permit water to waste, and by the conserving of water when not needed upon the Wheatland tract relieves the demand on the river and makes it possible for higher ditches to get water when otherwise they might not be able to do so, if there was a shortage in the water supply", a situation which of course Mr. Field insists does not now exist. He further says (p. 3671), "Since its completion the Wheatland Reservoir has very largely increased the effectiveness of the whole river, and its capacity is so large that it can practically conserve the flow of the river."

While the Wheatland appropriation from the direct flow of the stream would exhaust the stream during a large part of the irrigation season, it has not been necessary for the Wyoming Development Company to enforce against the upper appropriators its right to the direct flow, for only a part of the entire acreage in the Wheatland district has as yet been cultivated, and the capacity of the reservoir is sufficient when added to the water that the upper appropriators permit to flow down the river to supply this land, the upper appropriators not trespassing too far upon the tolerance of the lower and prior appropriator by constructing water-tight dams and diverting all of the water in the river during the lower stages. Under this arrangement the upper appropriators secure the benefit of the direct flow of the stream and the lower and prior appropriator relies upon the flood waters, and the situation as a whole is exactly the same as though the upper appro-

priators had constructed reservoirs to conserve the flood waters and the lower appropriator was taking the direct flow of the stream. In substance, therefore, Wyoming has actually developed a storage system which enables it to make full use of the average flow of the stream to an even greater degree than is the case in the Poudre Valley, and having done so experiences a shortage of water which will necessarily be increased by any further diversion in Colorado.

VII. CONCLUSIONS TO BE DRAWN FROM WYOMING PERMITS RECENTLY ISSUED

But it is claimed by the State of Colorado that other conclusive evidence in the record supports the testimony of Colorado as to the adequacy of the water supply. In Volume 2 of their brief filed in this case, on pages 214 to 220 inclusive, also pages 228 and 229, the defendant has collected together the evidence supposed to be conclusive on these matters. This evidence consists of divers permits issued by the State of Wyoming on and after April 21, 1908, for the use of water from the Big and Little Laramie. These permits are in the transcript of the evidence as actually taken in the cause and filed herein, though they are not in the abstract of the evidence.

The conclusions reached by counsel are that the "total acreage for which permits have been granted by State Engineers of Wyoming since August 25, 1902, is 278,153.61 acres." And the conclusion goes on to say that "In addition to the above acreage thus granted permits, we have the Bath, Robertson McConnell and Bell No. 2 Reservoirs of The Laramie River Company's

system showing an additional grant from the River of 451,019 acre feet." From this counsel makes this conclusion:

> "Here we find the plaintiff state solemnly decreeing that *after all* lands then under irrigation, or for the irrigation of which permits and appropriations had theretofore been granted or vested, had been and would forever be supplied with sufficient water for their annual reclamation, there still remained in the Laramie River sufficient water to annually irrigate 278,153.61 acres additional, and furthermore, that there existed sufficient water in the stream to warrant the construction of reservoirs for the storage of over 450,000 acre feet of water for irrigation of these or still other lands, after having already supplied the enormous reservoirs included within the acreage permits above mentioned."

One trouble with the argument for the defendant as above outlined is that it proves far too much. Putting it all together and remembering that the evidence here shows that it requires much more than an acre foot of water to irrigate each acre, but assuming that only one acre foot is necessary, the conclusion of the defendant is that there would be at least 278,000 acre feet for the 278,000 acres in favor of which permits were granted, and 450,000 acre feet for the reservoirs outside of the 20,000 acre feet diverted to Colorado by the Skyline Ditch and outside of the water required to irrigate more than 150,000 acres which had prior rights in Wyoming. In other words, this argument would prove that the average available supply from the stream is more than 898,000 acre feet. But the evidence from all years shows that there is not such an

amount of water even in the years of greatest floods, and even Colorado does not claim that the average annual supply of the entire drainage basin is more than one-half this much. There must, therefore, be some other explanation of the fact that these later permits are granted, and this explanation is not far to seek.

(a) These permits are *ex parte* by ministerial administrative officers. It is, therefore, impossible for these administrative officers when issuing permits for the use of water from a stream to adjudicate as to the amount of water already used by the hundreds of appropriators not made parties, or to adjudicate how much water remains in the stream after supplying such prior appropriators. The defendants are wholly in error in their frequent reference to the issuance of permits by a Wyoming State Engineer as a "solemn decree" that there is an ample supply of water for the purpose for which the permit is issued. The very word "permit" gives a wrong impression of the Wyoming method. None of these "permits" originate in the office of the State Engineer; their character is fully shown by Sections 727, 729 and 730, Wyoming Compiled Statutes of 1910, which provide that any person desiring to divert water from a natural stream shall prepare an application setting forth all important data which shall be filed in the office of the State Engineer, who after requiring such further information as he may find necessary, shall either indorse upon the application his approval or his disapproval. The application so approved is the so-called "permit". The difficulty in determining *ex parte* just how much water is available, the certainty that a very large proportion

of all permits, particularly for large projects, will never be followed up by actual construction, the appearance before the engineer of only one party, the applicant, all have led to a practice well exemplified in this very instance, of approving all applications which comply with the regulations of the office and letting the applicant take his chance upon the water supply.

(b) The method followed by Wyoming is not different in this particular from that followed in Colorado. Mr. Armstrong, a witness for the State of Colorado, testifies that he has been water commissioner or acting water commissioner of that water district in Colorado which includes the Cache la Poudre River and its tributaries for twenty-four years (p. 2454). He further testifies as follows:

> "Decree of water right on Cache la Poudre River or any other stream, does not amount to guarantee that the owner will receive amount of water specified in decree, unless it is among the very earliest priorities. It is a pretty good guarantee if the priority is early enough, but it would have to be pretty early. The decree merely represents that if there is enough water to supply all appropriators, then you can have the next turn at the water to the amount of your decree." (p. 2493).

Again, the Colorado engineer, Field, states that the decrees of the Colorado Court give to the Colorado ditches in the Laramie Valley 563 cubic feet per second, and he remarks:

> "Fact that these decrees are for excessive amounts does not change flow of river. A decree

> does not necessarily mean that there is that much water in river; neither does a decree put water in stream. (p. 3878)."

We have shown that the Wyoming "permit" is in no sense a "solemn decree", as stated by counsel for defendants. But here in Colorado we do have the "solemn decrees", for these decrees are judgments of the district courts of Colorado in contested proceedings. If Colorado assures us that such decrees prove absolutely nothing about the amount of available water supply, surely the Wyoming permits cannot be said to have any value in determining such question.

(c) In this case the permits, at least all of them which we have read, and we have read many of them, have this statement endorsed thereon:

> "The records of the State Engineer's office show the waters of the stream to be largely appropriated. The appropriator under the permit is hereby notified of this fact, and the issuance of this permit grants only the right to divert and use the surplus or waste water of the stream and confers no rights which will interfere with or impair the use of water by prior appropriators."

(d) So well understood in Wyoming is the practice of allowing permits whenever application is made, and the necessity for allowing them in that form without adjudicating as to the amount of water already appropriated or the amount of surplus in the stream, or indeed the question whether there be a surplus, that the people of Wyoming when they came to frame their constitution put into it on that subject this language:

"No appropriation shall be denied except when such denial is demanded by public interests." Wyoming Constitution, Article 8, Section 3.

We submit, therefore, that proof of permits issued after 1908 and the amount of water covered by them has no practical bearing upon the question of the actual amount of water in the stream; certainly no bearing whatever on the amount of water in the stream in average years, or upon the amount of water in the stream during the irrigation season in dry years.

SECOND

The Principles of Law Involved in the Case Applied to the Facts

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SYNOPSIS

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A. The Claim that Colorado Will take Only Surplus Water. p. 129.

1. General Doctrines of Prior Appropriation. p. 130.

(a) Right of Prior Appropriator existed in Both States even before Constitutions. p. 132.

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(c) Rights of Prior Appropriator especially Clear in Time of Water Deficiency, yet Colorado Will Take more Water at such Times. p. 140.

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COLORADO'S CLAIMS OF JUSTIFICATION FOR TAKING THE WATER.

We believe that the evidence which we have sought to briefly analyze makes it clear that Colorado is endeavoring to divert from the Laramie River a very large amount of water, and that to say the very least such diversion is detrimental to Wyoming and her people.

As indicated above, Colorado admits both in the pleadings and in the evidence that she is intending to divert a large amount of the water. This she attempts to justify, as we have seen, on three grounds, which we will here repeat.

A

She contends that there is an abundance of unappropriated water in the Laramie River, and that her intention is to take only from the surplus and unappropriated waters.

B

She contends second that in case the doctrines and practices of prior appropriation would not justify her taking the water, she would still be permitted to take it on the ground that the waters should be equitably divided between the two adjoining States, and that her diversion as here intended will not transgress the principles of equitable division as applied to the situation existing between Colorado and Wyoming in relation to the Laramie River.

C

She contends that in case neither of her contentions as above shall be allowed, then that Colorado as a sovereign state may take all the waters found within her boundaries and use them as she will regardless of any supposed rights of others.

We shall attempt to discuss these three grounds in the order above given.

A

Colorado's claim that there is an abundance of unappropriated water and that she will take only from the surplus.

The very statement of her contention indicates that the claim here under consideration must rest on some principle of the doctrine of appropriation. The very language used in this part of Colorado's claim is language pertinent only to discussions of questions of prior appropriation, and it is evident that the defendants used this language with the full intention of claiming under the principles of prior appropriation.

In attempting to show that there is a surplus of water in the Laramie River out of which she is entitled to appropriate, Colorado uses the expression "normal flow" as probably indicating the average flow per year when a number of years in succession are considered.

As we have already seen, in the discussion of the evidence Colorado proceeds to deduct from this so-called "normal flow" such amount as she contends would be sufficient for Wyoming needs, and calls the

balance a "surplus". This method, as we have seen, leads only into error.

Again, Colorado adds together all the supposed flow of the Laramie River and all its tributaries, and calls that the flow of the Laramie River, and this no matter where the waters of the Laramie River are used in Wyoming for irrigation. The stream is not a mere level body of water, and appropriators near the head of the stream would not be particularly aided even by large floods of water at some point in the stream below them or at some point in some tributary stream which furnishes its water below. In other words, this method, on its face, leads only to error and confusion.

The General Doctrines of Prior Appropriation.

In this case the rules of prior appropriation are alleged in the bill of complaint and admitted in the answer to be as follows:

> "In accordance with the customs and usages of the people, recognized by the laws and decisions of the Courts of both Colorado and Wyoming, in all cases where prior rights to the contrary have not intervened it has been the custom to divert and apply the waters of the natural streams to supply the deficiency in the annual precipitation to cultivate the lands within the drainage basin of said streams and make the same productive. Under the said customs, usages, laws and decisions it has been established, enacted, held and decided in both States as to the waters of all streams and other sources of water supply where prior rights to the contrary have not intervened that such

waters are open for a reasonable appropriation and use for irrigation purposes; that except as aforesaid priority of appropriation gives priority of right."

The Constitution of Colorado, Article 16, Sections 5 and 6, contains this language:

"Sec. 5. The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the State, subject to appropriation as hereinafter provided."

"Sec. 6. The right to divert unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."

Many Colorado cases state and illustrate the same doctrine.

Coffin v. Left Hand Ditch Co., 6 Colo. 443.
Hammond v. Rose, 11 Colo. 524.
Schilling v. Rominger, 4 Colo. 100.
Wyatt v. Larimer etc. Irrigation Co., 1 Colo. App. 480.
Beaver Brook Reservoir Co. v. St. Vrain Reservoir Co., 6 Colo. App. 130.

The Constitution of Wyoming, Article VIII., Sections 1 and 3, are as follows:

> "Section 1. The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the State, are hereby declared to be the property of the State."
>
> * * * * * * *
>
> "Sec. 3. Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests."

The decisions in Wyoming further illustrate the same matter.

Farm Investment Co. v. Carpenter, 9 Wyo. 110.
Willey v. Decker, 11 Wyo. 496.

Throughout the arid region the rule is more or less similar, though in some the doctrine of prior appropriation is made more or less subordinate to the general doctrines of riparian rights.

Atchison v. Peterson, 1 Mont. 561.
Crane v. Winsor, 2 Utah, 248.
Jones v. Adams, 19 Nev. 78.
Barnes v. Sabron, 10 Nev. 217.
Irwin v. Phillips, 5 Cal. 140.
Kidd v. Laird, 15 Cal. 161.
Sharp v. Hoffman, 79 Cal. 404.
Lux v. Haggin, 69 Cal. 255.

Right to Appropriation existed in both States Prior to Constitutions.

Indeed it is held in both States that this principle

existed as the law of the region prior to the enactment of their constitutions.

"The history of water rights in this State will show that the rights and principles declared in the constitution were recognized and acted upon by the people years before they were formulated and declared in that instrument; that such rights had their inception in the earliest attempt at agriculture, when it was found that climatic conditions demanded the artificial use of water to produce crops. The title of the public and the people to the water in the streams, and the right to divert and appropriate, were recognized and acted upon, the only requirement being an application to a beneficial use; and such rights to the use of water as between different consumers or users were established upon the broad equitable basis that preferences were to be controlled by the respective dates when the conflicting appropriations were made."

Wyatt et al., v. Larimer-Weld Irrigation Co., 1 Colo. App. 480, 497, (29 Pac. 906).

"The common law doctrine relating to the rights of a riparian proprietor in the water of a natural stream, and the use thereof, is unsuited to our requirements and necessities, and never obtained in Wyoming. So much only of the common law as may be applicable has been adopted in this jurisdiction. The doctrine invoked is inapplicable. A different principle better adapted to the material conditions of this region has been recognized. That principle, briefly stated, is that the right to the use of water for beneficial purposes depends upon a prior appropriation. Our statutes have repeatedly recognized this right, and the constitution of the State declares it. We incline strongly to the view expressed by the Supreme Court of

Colorado, to the effect that such right and the obligation to protect it existed anterior to any legislation upon the subject."

Moyer v. Preston, 6 Wyo. 308, 318.

The Right of the Prior Appropriator is Exclusive.

In both Colorado and Wyoming and in every other State where irrigation is practiced, it is held to be the only equitable rule that the rights of a prior appropriator shall be considered exclusive, and that he shall at all times take from the stream such amount of water as he needs up to the full amount of his appropriation without any requirement that he shall divide with other appropriators in times of scarcity. As a necessary result of this doctrine, it is everywhere held that the prior appropriator has a right to the stream as he originally found it; that he is not obliged to build reservoirs nor store the water, but has the right to take it from the stream as it was running when he first appropriated, and without any requirement that he shall make any expenditures whatever in order that others may have water. Indeed to require that he shall incur the expense necessary in storing the water would often be to destroy his priority, since the expense of such storage would be more than the value of his prior right.

"As opposed to the correlative rights of the common law, whereby all riparian owners on the stream have equal rights, under the law of appropriation the rights of the claimants are unequal. Each has an exclusive right to the extent of his prior appropriation, and appropriations vary great-

ly in the extent of right appropriated. 'A party appropriating water has the *sole and exclusive* right to use the same for the purposes for which it was appropriated.' So long as the water is put to beneficial use, priority alone governs. Full protection is given to the prior appropriator against all later comers. This exclusiveness includes the right to tributaries and sources, even tributary percolating water so far as proof traces it as tributary, and also storm waters that are of annual occurrence. It is held: 'The prior appropriator of a particular quantity of water from a stream is entitled to the use of that water, or so much thereof as naturally flows in the stream, unimpaired and unaffected by any subsequent changes which, in the course of nature, may have been wrought. To the extent of his appropriation his supply will be measured by the waters naturally flowing in the stream and its tributaries above the head of his ditch, whether those waters be furnished by the usual rains or snows, by extraordinary rain or snow fall, or by springs or seepage which directly contribute.' It is said, 'The appropriator took the water with the right to have the stream flow as it was wont to flow', which is as strict a statement as the '*aqua currit et debet currere ut currere solebat*' of riparian rights."

1 Wiel on Water Rights (3d Ed.) Section 279.

"But the prior appropriator of the waters of a certain stream has the right to insist that the water continue to flow as it did when he first made the appropriation, as far as the interference by other subsequent appropriators is concerned. 'The appropriator took the water with the right to have the stream flow as it was wont to flow' is the language of the law under the Arid Region Doctrine of appropriation, which is as strict a rule as that of the common law of riparian rights,

aqua currit et debet currere ut currere solebat. He has also the right to insist on this flow and that no change be made in it by later comers to his material injury."

2 Kinney on Irrigation (2d Ed.) Sec. 801, p. 1398.

"It is a recognized rule of law that a person who has appropriated water at a certain point in a stream is entitled to have so much of the waters of said stream as he has appropriated flow down to him to the point of his diversion."

Conant, et al., vs. Deep Creek etc. Irr. Co., et al., (23 Utah 627), 66 Pac. 188, 190.

"The reasons which constitute the groundwork of the common law upon this subject remain undisturbed. The conditions to which we are called upon to apply them are changed, and not the rules themselves. The maxim, *sic utere tuo ut alienum non laedas*, upon which they are grounded, has lost none of its governing force; on the contrary, it remains now, and in the mining regions of this State, as operative a test of the lawful use of water as at any time in the past, or in any other country. When the law declares that a riparian proprietor is entitled to have the water of a stream flow in its natural channel *ubi currere solebat* without diminution or alteration, it does so because its flow imparts fertility to his land, and because water in its pure state is indispensable for domestic uses. But this rule is not applicable to miners and ditch-owners, simply because the conditions upon which it is founded do not exist in their case. They seek the water for a particular purpose, which is not only compatible with its diversion from its natural channel, but more frequently necessitates such

diversion, and moreover does not require the water in a pure state in order to insure its reasonable and beneficial use. Yet the maxim above mentioned upon which the rule founded is equally as applicable to the ditch-owner and to the miner as to the riparian proprietor, and neither can so use the water as to injure or prejudice the prior rights to a like use by the other. This maxim is one which every riparian proprietor is bound to respect, and it is no less obligatory upon those who use and divert water for mining purposes. So that in all controversies like the present the question to be determined after all is the same as that presented by a like controversy between riparian proprietors, to-wit: has the plaintiff's use and enjoyment of the water *for the purposes for which he claims its use been impaired* by the acts of the defendant? This is purely a question of fact for the jury, and all the law applicable to it is found, as stated by the learned counsel for appellants, in the case of the Phoenix W. Co. v. Fletcher (23 Cal. 483), embraced in the three following maxims: *Qui prior est in tempore, potior est in jure*; *Ubi jus, ibi remedium*; *Sic utere tuo ut alienum non laedas*; and beyond these principles they do not require to be instructed. What diminution in quantity or what deterioration in quality will injuriously affect the use of the water by the plaintiff may be safely left to the determination of the jury, guided only by the foregoing maxims."

Hill vs. Smith, 27 Cal. 476, 482.

"The right to the use of the running water (that is, the right to appropriate water on one's own land) is a corporeal hereditament; but the water when once appropriated includes and comprehends an incorporeal hereditament, to-wit, the right to have the water flow in the stream, without diminution or deterioration, to the head of the ditch or

place of diversion—an easement in the stream, and a servitude upon upper riparian lands."

Smith vs. Deniff, (24 Mont. 20), 60 Pac. 398, 400.

"The prior appropriator is clearly entitled to protection against acts which materially diminish the quantity of water to which he is entitled, or deteriorate its quality, for the uses to which he wishes to apply it."

Phoenix Water Co. vs. Fletcher, 23 Cal. 482, 487.

"The right acquired to water by an appropriator under our system is of the same character as that defined by the foregoing authorities as an incorporeal hereditament and easement. The consumer under a ditch possesses a like property. He is an appropriator from the natural stream, through the intermediate agency of the ditch, and has a right to have the quantity of water so appropriated flow in the natural stream, and through the ditch, for his use."

Wyatt vs. Larimer & Weld Irrigation Co., 18 Colo. 298, (33 Pac. 144, 150).

"To the proposition that appropriators of water out of a natural stream for irrigation purposes, with priorities decreed, are entitled to have the conditions substantially maintained upon the stream as they were when the appropriations were made, and have existed during the continuance and perfection of such appropriations, we cite the following authorities: Handy Ditch Co. vs. Louden Irrigating Canal Co., 27 Colo. 515, 62 Pac. 847; Ft. Lyon Canal Co. vs. Chew, 33 Colo. 392, 81 Pac. 37; New Cache La Poudre Irrigation Co. vs. Water Supply & Storage Co., 29 Colo. 469, 68

Pac. 781; Baer Bros. Land & Cattle Co. v. Wilson, 38 Colo. 101, 88 Pac. 265; Cache La Poudre Reservoir Co. vs. Water Supply & Storage Co. et al., 25 Colo. 161, 53 Pac. 331, 46 L. R. A. 175, 71 Am. St. Rep. 131; and Vogel et al. vs. Minnesota Canal and Reservoir Co. et al., 47 Colo. 534, 107 Pac. 1108."

Comstock vs. Ramsay, 55 Colo. 244, 257, (133 Pac. 1107, 1111.)

"The doctrine that the first appropriator has the superior right, 'where the right to the use of running water is based upon appropriation, and not upon an ownership in the soil' has been recognized and acknowledged by the decisions of this Court in Lobdell vs. Simpson (2 Nev. 274), and the Ophir S. M. Co. vs. Carpenter et al. (4 Nev. 534).

"The facts of this case do not call in question the correctness of the decision in Van Sickle vs. Haines (7 Nev. 249), where the title to the land had been obtained from the government prior to the acts of Congress herein referred to.

"It logically follows from the legal principles we have announced that the plaintiff, as the first appropriator of the waters of Currant Creek, has the right to insist that the water flowing therein shall, during the irrigating season, be subject to his reasonable use and enjoyment to the full extent of his original appropriation and beneficial use."

Barnes vs. Sabron, 10 Nev. 217, 233.

" 'That a valid appropriation of water from a natural stream constitutes an easement in the stream, and that such easement is an incorporeal hereditament, the appropriation being in perpetuity, cannot well be disputed.' He refers to the discussion of property in water by Washburn in his work on Easements and Servitudes (p. 276),

and Angell on Water Courses (Sec. 141), and adds: 'The right acquired to water by an appropriator under our system is of the same character as that defined by the foregoing authorities as an incorporeal hereditament and easement. The consumer under a ditch possesses a like property. He is an appropriator from the natural stream, through the intermediate agency of the ditch, and has the right to have the quantity of water so appropriated flow in the natural stream, and through the ditch for his use.'"

Willey vs. Decker, 11 Wyo. 496, 544.

The Act of Congress of July 26, 1866, contains this language:

"Whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed."

Revised Statutes, Sec. 2339.
United States vs. Rio Grande Dam etc. Co., 174 U. S. 704.

The Rights of the Prior Appropriator are Especially Active in Time of Water Deficiency, yet Colorado will Take More Water at such Times.

As we have indicated, the plan proposed by Colorado in the argument here leads only into error. Colo-

rado proposes that the so-called normal flow of the stream shall be ascertained, and that from this so-called normal flow shall be deducted for use in Wyoming such an amount of water in gross as shall equal the Wyoming appropriations that are prior to the inception of the Colorado enterprise, and that the remainder thus ascertained shall be held to be the amount of water which Colorado may divert from the stream. This is called by Colorado the "surplus" or unappropriated water.

Any study of the evidence discloses that this so-called normal flow is ascertained by adding together the supposed annual stream flow of the various years and dividing the result by the number of years taken.

As we have seen in this case, it has the additional error of being estimated not so much by study of the actual measurements of the Laramie River as by theoretical amounts of water obtained from a supposition (denied by the evidence) that a certain number of square miles of arid land in Wyoming might yield a certain number of acre feet of water, and also by a supposition that the amount of water flowing in the Laramie River can be ascertained by measuring the Poudre, an entirely different stream, flowing in a different direction, having its own water and its own peculiar features.

And besides there is error in that no allowance is made for the losses in the stream from evaporation and seepage. As stated even by the witnesses for the defendants:

> "Our plains streams are of a very different type from streams in eastern states. With stream running through humid country, at least in eastern United States and most humid countries, streams steadily increase. Country through which it runs

is contributing to stream. That is not case of our plains streams—after they leave mountains. We cannot say that these plains streams are actually draining the country in sense of deriving supply of water from the country most of time. These streams are naturally decreasing instead of increasing as they go away from the mountains. They have always done so from earliest period of discovery and, inasmuch as these conditions have existed for a long period, undoubtedly it has always been the case."

(Testimony of Mr. Carpenter, Record Vol. 2, pp. 3006, 3007.)

But the error we desire to point out here is still a different one. If the actual flow in the Laramie River by actual measurements were ascertained to be in accordance with the testimony of Mr. Field, the Colorado expert on that question, still the plan of settling the rights between the parties here by taking the average flow of the stream as suggested, calling that the "normal flow" and giving Colorado the right to take *first* what they choose to term the "surplus" of the water—that is to say the difference between this so-called normal flow and the amount required for Wyoming—is to deprive Wyoming irrigators, in practically every season, of the water to which they are entitled. This is easily demonstrated.

This so-called normal flow has in it as a large element the various floods in the stream, and it would be manifest without evidence on the subject that these floods are not available for irrigation. On this question Mr. Carpenter, one of the leading witnesses for the State of Colorado, testifies as follows:

"With regard to financial practicability of construction of reservoirs on Poudre River capable of conserving extraordinary floods, will state that they call for an expenditure that could be utilized only occasionally. It would be similar to financial proposition of people in Florida preparing to heat their houses in the same manner as those in the northern part of the United States."

Record Vol. 2, Star Page 3946.

On the same subject Mr. Wortham, another one of the Colorado experts, testified as follows:

The very great floods on that watershed we cannot consider because we cannot construct works to take care of them.

Record Vol. 1, Star Pages 2120 and 2121.

"No witness testified to the contrary, and indeed this seems self-evident. Moreover, counting the flood waters as a part of the normal flow, and permitting Colorado *first* to take out all of the normal flow, save the amount estimated to be necessary for Wyoming, necessarily puts the whole of such flood waters into that part of the water apportioned to Wyoming. Colorado is at the head of the stream, and whatever she takes must be taken first. It in effect gives her a priority on the stream for the full amount allowed to her. It is, therefore, a mathematical certainty that the burden of the variations from day to day, and year to year, in the stream flow would fall upon Wyoming. Wyoming, then, would be apportioned as a part of her necessary amount the whole of the floods. And this notwithstanding that it would be as unreasonable to construct works to take care of such floods as it would

be to build great furnaces for heating houses in Florida as large and efficient as are required to heat houses in Boston. And this would also be in the teeth of that principle of law in the irrigation states which requires the newcomer to the stream himself to provide ways to catch surplus waters, and compels him to permit the stream to flow as it was wont to flow to the extent necessary to fully supply prior appropriators. It will be remembered that the concededly prior appropriators above the point where the Little Laramie turns its waters into the Laramie River are irrigating many thousand acres of land, and as it stands with no diminution such as is threatened they have insufficient water in many of the years. This is shown by the evidence as to irrigation previously cited in this brief. It will also be remembered that these concededly prior appropriators have no reservoirs, and though beneficially using the water, do not get returns to pay for the construction of reservoirs. On this question Mr. Carpenter, testifying for the State of Colorado, says this:

> "In my opinion hay is the economical crop raised upon the Laramie Plains, this being due to the soil and climatic conditions and not to any lack of enterprise on the part of the inhabitants. I presume that the raising of hay produces some net return, but the large size of ranches would indicate that the return is not very great. While some farmers favorably located and favored with some exceptional season might procure a net return and perhaps a large net return from some special crop, on the whole no other crop would now pay or could be looked to in the future as a paying crop. *I do not believe that the returns from the growth of hay would justify any greater investment than the present investment, and I should say that the present investment is now larger than the*

hay return would warrant. The only practical method of irrigating hay land in that region is through flood irrigation, and taking present conditions as a whole, the methods of irrigation now in use on the Laramie Plains are the natural methods."

Record, Vol. 2, Star Page 2984.
(The italics are ours.)

Along the same line as the question of the flood flow is the fact that the flow of the stream is not regular or constant, but greatly fluctuates not only from year to year, but from month to month, and even from day to day. This is shown by all the evidence. But an inspection of the table prepared and introduced in evidence by Colorado marked Exhibit 128, Star page 3440, sufficiently shows these irregularities. The Colorado plan of figuring up as the normal flow of the stream the average annual flow takes no account whatever of these irregularities and variations, but assumes, contrary to the fact, that the flow is constant, and then fixing a certain figure as this assumed normal, constant flow, asks the Court to permit Colorado to deduct from this assumed constant flow a certain amount of water, which Colorado is pleased to term a "surplus", and this certain amount of water is to be taken by Colorado, day by day, month by month, and year by year, at the times when she can take it, amounting in the aggregate, according to their figures, to 70,000 acre feet per annum, in addition to the 20,000 acre feet every year diverted by the Skyline Ditch. The method that would be used in taking this water on the part of Colorado is disclosed by the record. For example, the first volume of the brief heretofore filed in this cause by Colorado, page 17, lines 31 to 36,

has this solemn statement by those representing Colorado as to her purpose and intention:

> "It will, of course, be recognized that any test of the amount of water flowing in the Laramie River must be based upon what appears to be the normal flow rather than upon the flow for any particular year, *inasmuch as the proposed diversion which is sought to be restrained will, unless enjoined, constitute a continuing diversion.*"
>
> (The italics are ours.)

The matter is further illustrated by the testimony. Mr. Wallace Link, a witness on behalf of the defendant Colorado, testifies that,

> "In the spring the Skyline Ditch is first opened at what they called Three Quarter Creek. They then open up ditch above that point by shoveling for the entire length. They cut a trench through the snow in order to get the water through to cut the snow with water, and they continue that on to the head of the ditch *and it is very often June 15 before we get the water running.*"
>
> Record, Vol. 1, Star Page 2021. (Italics ours.)

Mr. Field, another witness for the State of Colorado, throws further light upon this same purpose. He says:

> "In diversion of water from one watershed to another, there is a greater percentage of water supply furnished by district from which water is taken during low year than during high year, that is, percentage of water diverted from Laramie River over to Poudre River during year of low flow is larger in comparison with flow of that year than water diverted in high year is to water flow during that year. For example, amount of water diverted through Skyline Ditch would be more

clearly constant from year to year than would average flow in Laramie River from year to year. Reason is that during year of low flow on Laramie River there would probably be a year of low flow on Poudre, which would create greater demand on Poudre for water and probably greater effort would be made to bring more water during low year. On other hand in high year, it would probably not be so necessary and the same effort would not be made."

Record, Vol. 2, Star Pages 3401 and 3402.

Another witness for the defendants in testifying as to the intentions of the Colorado enterprise in the matter of taking water from the Laramie River, testified as follows:

"The really dependable water supply of the District will come from the Laramie River, the amount secured from the Poudre River fluctuating greatly and being used to augment the supply from the Laramie. There will be years when the supply from the Poudre River and its tributaries will be practically nothing. Our plans contemplate taking all the water that it is possible for us to take from the Laramie River each year. It is possible to get only a certain amount from that river, and I do not believe that we can absolutely depend on more than half the required amount from the Laramie River. The very great floods on that watershed we cannot consider because we cannot construct works to take care of them. It is our plan and expectation to take all the water we can get from the Laramie River each year irrespective of the amount of water in that river from year to year."

(Testimony of John R. Wortham, the Engineer for the defendant The Greeley-Poudre Irrigation District, Rec. Vol. 1, pp. 2120 and 2121).

In other words, the threat of Colorado is to take a constant amount of 70,000 acre feet per annum in addition to the 20,000 acre feet each year diverted by the Skyline under an older diversion, and to take this largely during the irrigation season, and to take it with even more certainty when the flow in the Laramie River in the irrigation season is least.

Turning again to the table, Exhibit 128, introduced by Colorado, Record Volume 2, Star Page 3440, it will be found that in many of the years the entire flow of the Laramie River for the months of July, August and September would not equal the 70,000 acre feet which Colorado is threatening to divert.

The authorities are very clear as to the rights of the prior appropriator in times of water deficiency.

> "In the case at bar the waters of Antoine Creek were appropriated and being used at the time respondents settled and filed on their land, and were not subject to a riparian right to use the waters for irrigation, as against the first appropriator who has perfected his title and was with reasonable diligence extending the area of cultivation on his lands riparian to the stream. 'It is an elementary principle of the law of appropriation of water for irrigation that the first appropriator is entitled to the quantity of water appropriated by him, to the exclusion of subsequent claimants by appropriation or riparian ownership.' *Longmire vs. Smith, supra.*
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> "It is unfortunate that the flood waters of Antoine Creek cannot be conserved for the use of all, but, so long as our laws measure the rights of the appropriator of water by the necessities of the dry season, the first in time must be held to be the first in right. The just purpose of the trial judge to apportion the waters cannot be sustained in the light of the evidence showing that there is

no excess of water running to, or waste by, the appellants."

Avery vs. Johnson, 59 Wash. 332, (109 Pac. 1028).

"The testimony in the case, the findings of the jury, as well as the findings of the court, clearly determined that Henry Huning had the first right to the amount of water decreed to him; and the court, in its judgment, recognized that fact, and decreed that he 'had, and should have and enjoy, the first right to' that amount of water for the purpose of irrigating that acreage of land, after which it was error to decree that the Scott Bros. were on a parity with him, and that he enjoyed no priority as to them.

"It is assigned as further error that the court found in its decree that the defendants R. and J. Scott and the plaintiff, Henry Huning, have no priority of right to the use of waters in said creek over the other defendants, and in finding, contrary to the evidence and the verdict of the jury, that at all times there had been sufficient water in the creek for plaintiff and defendants Scott.

"The first error complained of in this assignment is incorrectly stated. The decree of the court did not decide that defendants R. and J. Scott and plaintiff, Henry Huning, had no priority of right as against the other defendants, but that they had no priority as against each other, thus putting them on a parity in the rights to use the water.

"The second assignment is incorrectly stated, as no such decree is contained in the judgment, although the court did find among the findings of fact that there had at all times up to that date been sufficient water in the creek for plaintiff and defendants. That fact, however, is immaterial; and the court ignores it in the decree quoted above,

wherein it provides that, in case of scarcity or failure in the flow of the creek, Huning and the Scotts should prorate the amount of water the creek might furnish. When the relative priority in which the rights exist is determined, it is immaterial whether or not the stream furnishes a sufficiency for all. The fact that the stream had before the date of trial furnished a sufficiency for all the parties litigant, or for a certain number of the parties litigant, would be no assurance that it would continue to furnish such sufficiency; and it is in order to provide for the proper distribution of the amount that may be furnished that the relative priority of the several rights enjoyed by the different parties are determined by the court."

Huning vs. Porter, 6 Ariz. 171, (54 Pac. 584).

"In times of natural or other deficiency, also, unless otherwise provided by statute, the prior appropriator may still claim his full amount; the loss must fall on the later appropriators. In a case enforcing an appropriation to the extent of seventy-five per cent. of the whole stream, it is said: 'It further appears from this defense that at certain seasons of the year the flow of the stream will only supply the needs of the defendants. It appears, therefore, from the averments of this defense, that the defendants have a prior right to the use of the water from the natural stream, and, when low, to the entire volume thereof, and the demurrer thereto should have been overruled.' This is true even where (indeed, especially where) unusual scarcity or dry season causes the deficiency."

1 Wiel on Water Rights, Sec. 301.

(The case from which Mr. Wiel makes the quotation indicated last above is the case of Wellington vs. Beck, 30 Colo. 409.)

The principles above enunciated as to the relative rights of appropriators are uniformly and universally adopted by the irrigation states. In accordance with these principles Wyoming, during the irrigation season of each year, is entitled to the flow of the stream as it may at the time naturally flow up to the amount necessary to supply the Wyoming appropriations that are prior in time to the inception of the Colorado attempt at diversion. All of the evidence, without contradiction, shows that in practically every year during the irrigation season the entire stream flow is not only taken by the Wyoming prior appropriators, but is necessary for the purposes of irrigating their lands, and in many of the years—dry years as they are called—the water in the stream is insufficient for the concededly prior Wyoming appropriations. If the water were being diverted by Colorado into reservoirs within the watershed, then the objection to such diversion would be less serious unless in the diversion there was such loss as to work injury to the prior Wyoming appropriators. If it were diverted within the watershed, it would not be difficult under the Wyoming system, or indeed under any system, to require the owners of the reservoir in the watershed into which the water is diverted to turn it back into the stream for the use of the prior appropriators. This was done in the case of Lake Hattie in the year 1913. (Record Vol. 1, page 1288.) But in the case at bar, Colorado's diversion will take the water to a place where it will be impossible to return it to the stream, and therefore in every year when the water in the stream may turn out to be less than the amount of the prior Wyoming appropriations plus the Colorado diversion irreparable wrong will be done to the Wyoming appropriators, and in most of

the years the wrong will go to the extent of entirely depriving many of the Wyoming appropriators of water. But in not more than one year in seven could any substantial fraction of seventy thousand acre feet of water be taken during the irrigating season without depriving the Wyoming prior appropriators of necessary water.

If there is any way to ascertain in advance when, if ever, the water in the stream during the irrigation season will be more than enough for the prior Wyoming appropriators, and therefore will leave a surplus for the Colorado appropriation, we have no knowledge of it. The rain, like the wind, comes when it will. The heat is more or less each day during the summer, and therefore melts and brings from the mountains in the shape of water more or less of the snow just as an overruling Providence may direct. But no man knows what any day will bring, save that we do know that as a rule for all of the years during which records have been taken the amount of water furnished by the rains and the melting snows in the Laramie River has all been required by the Wyoming concededly prior appropriations, and the two or three years in the last twenty in which there has been a surplus have been unusual and it was impossible to anticipate them.

We submit, therefore, that if the State line between Colorado and Wyoming leaves the rights of appropriators as if all were in the same State, it would be clear that the Wyoming appropriators have the right to the water during practically every year; that the years when they will not need it all cannot be ascertained in advance, and that the diversion as intended by Colorado because of the character and place to which it will take the water will in most years cause

such injury and damage as entitle the Wyoming appropriators to injunctive relief.

Effect of State Lines upon Rights of Appropriators.

The question of the effect of State lines upon the rights of appropriators in different States has been before the courts of the arid region in a number of cases, and so far as we have been able to find has always been decided in the same way. The universal holding is that priority of appropriation gives priority of right on inter-state streams the same as on streams wholly within one State.

> "We had occasion recently to consider whether the right of a citizen to use water within the State for irrigation of lands is granted by the State or general government, and we were unable to discover any principle of that kind. Mohl vs. Larmar Canal Co. (C. C.) 128 Fed. 776. The idea of an exclusive right in the people of a State to divert its running waters to the injury of riparian owners in another State must be equally untenable. Indeed, the doctrine of riparian ownership and use of running water is not subject to political boundaries. Between hostile States the doctrine may not be recognized, but any such repudiation would be simple *vis major*. Between States dwelling in peace and concord, as are the States of our Union, the equal right of the inhabitants of each State to the waters of intersecting streams must always be recognized. Water is essential to human life in the same degree as light and air, and no bounds can be set to its use for supplying the natural wants of men other than the mighty barriers which the Creator has made on the face of the earth.
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> * * * * * *
>
> "It is enough that complainants nd their

grantors were in the possession and enjoyment of the water a long time prior to respondents' diversion, and therefore the first appropriators under the law of the land as understood in Wyoming and Colorado."

Hoge vs. Eaton, et al., 135 Fed. 411, 414.

The above case was decided by the District Court of the United States for Colorado. The Judge who sat was on the Supreme Bench of Colorado before the admission of that State into the Union, and became United States District Judge upon the admission. The case was reversed by the Court of Appeals (Eaton vs. Hoge, 141 Fed. 64) but the reversal was upon another point and should not weaken the case as authority upon the point here under discussion.

"It would seem, upon both reason and authority, that the courts of this State, in ascertaining, decreeing, and protecting property rights in water appropriations within the jurisdiction of the State, may at the same time and for that purpose inquire into and determine rights and priorities on the same stream that are located and situated beyond the State line, in order to fairly and finally judicially determine the relative rights of the parties and decree the extent of the title and right of possession of the thing or subject-matter within this jurisdiction. This proposition ought to be accorded a special recognition and application by the courts in water and irrigation litigation. Streams rise in one State and flow into another, irrespective of boundary lines, and still the rules and doctrines of priority of appropriation and use are the same in most of the arid States. This is particularly true with respect to this case. Here the riparian doctrine of the common law has been abrogated in both Idaho and Wyoming, and the

rule of 'first in time is first in right' is recognized and enforced in both States. Drake vs. Earhart, 2 Idaho, 750, 23 Pac. 541; Moyer vs. Preston, 6 Wyo. 308, 44 Pac. 845, 71 Am. St. Rep. 914; Farm Investment Co. vs. Carpenter, 9 Wyo. 110, 61 Pac. 258, 50 L. R. A. 747, 87 Am. St. Rep. 918; Willey vs. Decker, *supra*. The relative rights, therefore, of appropriators of the water of an interstate stream are the same, whether the appropriations are all in the same State, or some in one State and the balance in another State. This proposition is accentuated in a case like this, where the court not only has jurisdiction of the *res* or subject-matter, but also obtains jurisdiction of the person of the defendant. In the case at bar the diversion by the defendants, being the act that causes the injury, takes place in Wyoming; but the injury itself that flows from the wrongful act takes place in this State. It has long been recognized as a general rule that, where an act is committed in one jurisdiction that occasions injury or damage in another jurisdiction, the injured person may elect to bring his action in either jurisdiction."

Taylor vs. Hulett, 15 Ida. 265.

"It is a recognized rule of law that a person who has appropriated water at a certain point in a stream is entitled to have so much of the waters of said stream as he has appropriated flow down to him to the point of his diversion; and if the settlers higher up on the stream, in another State, whose appropriations are subsequent, divert any of the waters of the stream which have been so first appropriated, then the courts of the latter State will protect the first settler in his rights. Howell vs. Johnson (C. C.) 89 Fed. 556. The Idaho courts, therefore, have ample and complete jurisdiction to protect the rights of respondents to

have the waters which they have appropriated, and which they divert in Utah, flow through the channel of the stream, and to limit and determine the rights of the Idaho appropriators with reference thereto; and by the decree entered in the suit in the district court of Oneida County, Idaho, such rights were fully protected, and may be enforced by proper proceedings in that court."

Conant vs. Deep Creek etc. Co., 23 Utah 627.

"This court has stated that the statutory and constitutional declarations seemed rather to declare and confirm a principle already existing than to announce a new one, for the reason that under the rule permitting the acquisition of rights by appropriation the waters became perforce *publici juris*.

* * * * * *

"The obvious meaning and effect of the expression that the water is the property of the public is that it is the property of the people as a whole. Whatever title, therefore, is held in and to such water resides in the sovereign as representative of the people. The public ownership, if any distinction is material, is rather that of sovereign than proprietor. (Farm Inv. Co. vs. Carpenter, *supra.*) That ownership however, is subject to a particular trust or use, specially defined in the statutes and in the constitution. And that trust or use, in the absence of statute, is just as prominently and intrinsically attached to such public ownership. The waters are held subject to appropriation for beneficial uses. And we have endeavored to show that the right of appropriation is not, in the absence of statute at least, restricted locally nor by state lines. The trust is to be considered as coextensive with the right on which it rests. Upon the general principles governing such appropriation, we perceive no reason, if the same be not

prohibited by statute, why the owner of lands in another State may not at a point in this State lawfully divert the water of a stream flowing in both States and conduct such water upon his lands for their irrigation, and thereby secure a valid water right. There is nothing in the essential character of the trust or use for which the waters are held by the public that, in our judgment, prevents the acquirement of a water right on such stream in that manner, provided the appropriator is able to comply with the statutory provisions regulating and controlling the appropriation and diversion of the public waters.

"Moreover, a desirable comity between the States within whose respective dominions the same stream may flow, and a due regard by each for the rights of the residents and land owners in the adjoining State, would seem to require a liberal view of this matter. In an interesting case in Wisconsin, where the question arose whether the State could constitutionally sell the ice formed upon public waters, it was held that where the term 'people of the State' is used to designate the beneficiaries of the trust in navigable waters, all the people who may choose to enjoy the same within the State are referred to, whether citizens of the State or persons who came within its territory, for the purpose of enjoying such public rights. (Rossmiller vs. State, 114 Wis., 169.)"

Willey, et al., vs. Decker, et al., 11 Wyo. 496, 533.

Farm Investment Co., vs. Carpenter, 9 Wyo. 110.

The case of Howell vs. Johnson (C. C. Mont.) 89 Fed. 556, involved a question between Wyoming lands and Montana lands, each party claiming appropriations from a non-navigable interstate stream.

The contention was made that the Wyoming citizens owning the Wyoming lands could not maintain the action in Montana because the State of Montana owned the waters in that State. This contention was overruled by the Court, which held that the rights must be determined without reference to State lines.

In the case of Anderson vs. Bassman, (C. C. Cal.) 140 Fed. 14, the same question arose between landowners in California and landowners in Nevada, each claiming as an appropriator of water from the same non-navigable interstate stream. The Court quotes from the cases of Howell vs. Johnson and Hoge vs. Eaton, *supra*, and endorses the views expressed in those cases, saying:

> "This court is in entire accord with the views of these two Courts upon this question."

In the case of Morris vs. Bean, (C. C. Mont.) 123 Fed. 618, the Court was considering the relative rights of Wyoming and Montana appropriators from the same interstate stream, and held that the prior appropriator is protected in his right "as against subsequent appropriators although the latter withdraw the water within the limits of a different State."

The final hearing of the case was in the same Circuit Court, but before a different Judge.

The contention was again made at the final hearing that an appropriator in Wyoming could not in a court in Montana assert rights as against an appropriator in Montana. The Court overruled this contention, announcing, among other things, the following:

> "In the early stages of this suit Judge Knowles refused to sustain the views thus presented by

the defendants. Whether the ruling made is the law of this case does not become material, because the reasons which actuated him in his decision are not only based upon sound principles, but are sustainable upon authority. No case has been cited where the distinction sought to be drawn has prevailed in the courts, but, on the contrary, apparently, wherever the question has arisen the holding has been the other way."

Morris vs. Bean, 146 Fed. 423.

The case last above cited went to the United States Circuit Court of Appeals for the Ninth Circuit and was there affirmed, the Court saying, among other things:

"The right to divert or appropriate for a useful purpose the waters of a non-navigable stream is recognized by the laws of Montana and Wyoming, and by sections 2339 and 2340 of the Revised Statutes (U. S. Comp. St. 1901, p. 1437); and the broad principle which underlies the relative rights of appropriators from the same stream is, that whoever is first in time is first in right, and the fact that the stream, the waters of which are appropriated, is interstate and non-navigable, does not affect the rule."

Bean vs. Morris, 159 Fed. 651, 655.

A similar question arose in the case of Miller, *et al.*, vs. Rickey, *et al.*, (C. C.) 127 Fed. 573. On appeal, the Circuit Court of Appeals for the Ninth Circuit used the following language:

"The water in the stream, which has a propensity to seek its level, and will continue in its current to the sea, is in strict reality the veritable thing in controversy. It knows not imaginary

State or county lines, and is a thing in which no man has a property until captured to be applied to a beneficial use. The right of appropriation is recognized in law, which means the right of diversion and use. It is the right, not to any specific water, but to some definite quantity of that which may at the time be running in the stream. So the right acquired by an appropriation includes the right to have the water flow in the stream to the point of diversion. The fact of a State line intersecting the stream does not, within itself, impinge upon the right. In other words, the appropriation may still be acquired although the stream is interstate and not local to one State. nor will the mere fact that the stream has its source in one State authorize a diversion of all the water thereof as against an earlier and prior appropriator across the line in another State. On the contrary, one who has acquired a right to the water of a stream by prior appropriation, in accordance with the laws of the State where made, is protected in such right as against subsequent appropriators, though the latter withdrew the water within the limits of a different State."

Rickey Land & Cattle Co., vs. Miller, et al., (C. C. A. 9th Cir.) 152 Fed. 11, 17.

The question has been somewhat involved in several cases before this court, but perhaps not clearly or definitely decided. In one case this Court uses the following language:

"It is conceivable, to be sure, that the decisions of this Court may determine that the States have rights as against each other *in invitum* in streams that flow through the land of both. Kansas vs. Colorado, 206 U. S. 46, 84. Missouri vs. Illinois, 200 U. S. 496, 519, 520. These rights may vary according to the system of law required by

natural conditions. They may be more or less analogous to common law rights between upper and lower proprietors, where irrigation is not necessary, as in most of the older States. See New York vs. Pine, 185 U. S. 93, 96. There may be some, perhaps limited, right of appropriation in the upper State, at least in the watershed of the stream, where irrigation is the condition of using the land. See Kansas vs. Colorado, 206 U. S. 46, 100-104, 117. But whatever this Court may decide, if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his State, and those rights, the petitioner insists, can, or at least should be determined only in a suit brought by the State itself.

"We are of opinion that the petitioner fails to establish the conclusion for which it contends. The alleged rights of Miller and Lux involve a relation between parcels of land that cannot be brought within the same jurisdiction. This relation depends as well upon the permission of the laws of Nevada as upon the compulsion of the laws of California. It is true that the acts necessary to enforce it must be done in California and require the assent of that State so far as this Court does not decide that they may be demanded as a consequence of whatever right, if any, it may attribute to Nevada. But, leaving the latter possibility on one side, if California recognizes private rights that cross the border line, the analogies are in favor of allowing them to be enforced within the jurisdiction of either party to the joint arrangement."

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258.

And in still another case this Court uses this language:

"We know no reason to doubt, and we assume, that, subject to such rights as the lower State might be decided by this Court to have, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that State. Kansas vs. Colorado, 206 U. S. 46, 93-95. Therefore, subject to the same qualifications, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. Missouri vs. Illinois, 200 U. S. 496, 521. Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, 260. But with regard to such rights as came into question in the older States, we believe it always was assumed, in the absence of legislation to the contrary, that the States were willing to ignore boundaries, and allowed the same rights to be acquired from outside the State that could be acquired from within. Manville Co. vs. Worcester, 138 Massachusetts, 89. Thayer vs. Brooks, 17 Ohio, 489. Slack vs. Walcott, 3 Mason, 508, 516. Stillman vs. White Rock Manuf. Co., 3 Woodb. & M. 538. Rundle vs. Delaware & Raritan Canal Co., 1 Wall. Jr. 275, 14 How. 80. Foot vs. Edwards, 2 Blatchf. 310. See Wooster vs. Great Falls Manuf. Co., 39 Maine, 247, 253, Armendiaz vs. Stillman, 54 Texas, 623; State vs. Lord, 16 N. H. 357. Howard vs. Ingersoll, 17 Alabama, 780, 793. There is even stronger reason for the same assumption here. Montana cannot be presumed to be intent on suicide, and there are as many if not more cases in which it would lose as there are in which it would gain, if it invoked a trial of strength with its neighbors. In this very instance, as has been said, the Big Horn, after it has received the waters of Sage Creek, flows back into that State. But this is the least consideration. The doctrine of appro-

priation has prevailed in these regions probably from the first moment they knew of any law, and has continued since they became territory of the United States. It was recognized by the statutes of the United States, while Montana and Wyoming were such territory, Rev. Stat., Secs. 2339, 2340, p. 429, Act of March 3, 1877, c. 107, 19 Stat. 377, and is recognized by both States now. Before the State lines were drawn of course the principle prevailed between the lands that were destined to be thus artificially divided. Indeed, Morris had made his appropriation before either State was admitted to the Union. The only reasonable presumption is that the States upon their incorporation continued the system that had prevailed theretofore, and made no changes other than those necessarily implied or expressed. See Willey vs. Decker, 11 Wyoming, 496; Smith vs. Deniff, 24 Montana, 20."

Bean vs. Morris, 221 U. S. 485.

"The rights of the respective States and of the citizens thereof in and to the use of waters of an interstate stream depend somewhat upon the laws of those States governing waters. If the common law is the only law of waters governing two adjoining States through which an interstate river flows, or if both States have adopted the Arid Region Doctrine of appropriation, the right to the use of the waters of an interstate stream is not affected by the boundary line which divides the States. But where there is conflict of the laws relative to the subject of water, that is to say, the lower State upon the stream having only the common law of riparian rights, and the upper State having adopted the Arid Region Doctrine of appropriation, the rule is different, and will be discussed in a subsequent section of this chapter.

"The rights as between appropriators of the

> waters of an interstate stream are not affected by the boundary line between the two States. As was said by a Wyoming case: 'The separation of lands capable of irrigation from such streams is of no consequence'. As was said in a recent Idaho case, 'The relative rights, therefore, of appropriators of waters of an interstate stream are the same, whether the appropriations are all in the same State or some in one State and the balance in another State.' 'The right to divert running waters for irrigating lands in an arid country is not controlled or affected by political divisions. It is the same in all States through which the streams may pass."
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> 3 Kinney on Irrigation, (2d Ed.) Sec. 1225, page 2216.

Both Colorado and Wyoming are at the crest of the continent. They have both adopted to its broadest extent the doctrine of prior appropriation. It may be that this doctrine is not as entirely antagonistic to the doctrine of riparian rights as some text writers and some of the Courts near the crest of the continent seem to indicate. Of this we shall have more to say later. But whether it can stand alongside the doctrine of riparian rights in the same jurisdiction, (as it actually does in a majority of the irrigation States), or is so antagonistic as to exclude the latter, we believe that for the purposes of the decision of this case the doctrine of prior appropriation must furnish the rule. The people of both States by their constitutions have declared that doctrine to be the just and reasonable doctrine throughout the area involved in this litigation. The people by their representatives assembled in the legislatures have reiterated the same doctrine and provided numerous rules and regulations for carrying it

out in both States. The courts in both States have given their adherence, even to the extent of saying that the rule was in force in each State long prior to any constitutions or statutes on the subject. Therefore, so far as the parties here are concerned, that rule and doctrine must be held reasonable and just, and neither State could complain of its use in settling the controversy here.

Applying that doctrine and rule here, the appropriations in Wyoming that were by all the evidence prior and superior to the commencement and initiation of the threatened diversion here complained of, so use the waters of the stream and so need those waters as to make it certain that the threatened diversion cannot fail to work in most years, indeed in nearly all years, great and irreparable injury and damage to Wyoming and to the Wyoming appropriators. And as the evidence distinctly shows, these Wyoming appropriators and the communities and industries supported through their appropriations not only constitute a large share of the wealth and prosperity of the plaintiff State, but also furnish a large share of its taxation resources.

B

Does any Rule of Equitable Division of the Waters Justify the Threatened Diversion even though Injurious to Wyoming?

We might repeat here that the facts in the case at bar would permit and even justify a decision of this cause on the general principles of prior appropriation without deciding anything as to the rights of different

States whose differing climates have caused the adoption of rules and principles differing in the one State from those in the other.

We realize that the doctrine of prior appropriation is not recognized in all the States, and that if general principles are to be here decided such as shall apply to all interstate streams, and boundaries shall be here fixed to the rights of differing States in interstate streams applicable to all circumstances, in reaching such universal principles and conclusions there are many and serious problems entirely outside of the mere appropriation problems which we have so far discussed.

Wyoming and Colorado are at the crest of the continent. Waters falling within the State of Colorado flow out of that State, some of them to the Gulf of California, and some of them to the Gulf of Mexico; and it would be entirely possible within the State of Colorado to construct diverting systems which would take waters naturally tributary to the flow into the Gulf of Mexico and turn them into the streams emptying into the Gulf of California. Of course the States through which the waters would run in case of such diversion would be entirely different and separate from the States into and through which those waters naturally run. The same situation exists in Wyoming, even to a greater degree. Some of the waters of Wyoming flow naturally into the Missouri and Mississippi River systems, and thence into the Gulf of Mexico. Others of the waters of Wyoming flow into the Green River and the Colorado River and into the Gulf of California. Still others of the waters of Wyoming flow into the Columbia River and thus into the Pacific. No two of these systems naturally carry the waters through the same States after leaving Wyoming. Every State

watered by each system in any degree is an entirely different State from any State watered by any other of the systems. It would be entirely possible in Wyoming to construct diversion works such as would turn large bodies of the water from either one of the systems into the other. Each State receiving water from Wyoming has great need for the water. In the case of at least two of the systems the water from Wyoming flows into States and through States which refuse to recognize rights by prior appropriation as superior to riparian rights. In some cases the needed flow from Wyoming is into States which fully recognize the doctrine of prior appropriation. We recognize that Wyoming, if allowed to divert the waters from one stream and one system to another, could inflict vast injury upon sister States. It may not be amiss, therefore, for this Court to consider at least in the decision of this case, the general question of the effect of its decision on the problems which would naturally grow out of the attempt upon the part of Wyoming or Colorado to use within their own boundaries methods of diverting water such as will become injurious to sister States.

The streams rising in Colorado and Wyoming but illustrate the very general character of the questions involved if rules are sought applicable universally to rights on interstate streams. The stream in the case at bar rises in Colorado and flows into and through Wyoming and thence into Nebraska and on down into other States where the riparian rights doctrine pure and simple is adopted. The rights of Wyoming might easily be ground between the upper and nether millstone if Colorado should be permitted to take a large share of the water on some general principle of prior appropriation, while at the same time Nebraska and

lower States could require Wyoming to permit the waters to flow on down into the lower States practically undiminished in quantity.

The situation for Wyoming will be still worse—far worse—if Colorado shall be permitted to ignore the Wyoming rights acquired by prior appropriation, and also at the same time all riparian rights by taking waters for use not only within the watershed but also without, while leaving Nebraska and lower States the power to compel Wyoming to yield to Nebraska riparian rights.

In a case affecting rights in earth and air tried here, this Court said:

> "*The case has been argued largely as if it were one between two private parties; but it is not.* The very elements that would be relied upon in a suit between fellow-citizens as a ground for equitable relief are wanting here. The State owns very little of the territory alleged to be affected, and the damage to it capable of estimate in money, possibly, at least, is small. This is a suit by a State for an injury to it in its capacity of *quasi*-sovereign. In that capacity the State has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air. It might have to pay individuals before it could utter that word, but with it remains the final power. The alleged damage to the State as a private owner is merely a makeweight, and we may lay on one side the dispute as to whether the destruction of forests has led to the gullying of its roads."
>
> *Georgia vs. Tennessee Copper Co.*, 206 U. S. 230, 237.

The case last above was cited and the principle applied by this Court to rights in water in the case of Kansas vs. Colorado, 206 U. S. 46, 99, where this Court said:

> "It is the State of Kansas which involves the action of this Court, charging that through the action of Colorado a large portion of its territory is threatened with disaster. In this respect it is in no manner evading the provisions of the Eleventh Amendment to the Federal Constitution. It is not acting directly and solely for the benefit of any individual citizen to protect his riparian rights. *Beyond its property rights it has an interest as a State in this large tract of land bordering on the Arkansas River.* Its prosperity affects the general welfare of the State. *The controversy rises, therefore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint.*"

The exact nature and limits of the rights of the State as distinguished from the rights of private parties is not disclosed in either of the cases last above.

Certain indications of those limits are disclosed in the case of Kansas vs. Colorado where this Court said:

> "It is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes."
>
> 206 U. S. 117.

In still another case this Court, referring to such rights of a State, said *arguendo*:

> "These rights may vary according to the system of law required by natural conditions. They may be more or less analogous to common law rights between upper and lower proprietors, where irrigation is not necessary, as in most of the older States. See New York vs. Pine, 185 U. S. 93, 96. There may be some, perhaps limited, right of appropriation in the upper State, at least in the watershed of the stream, where irrigation is the condition of using the land. See Kansas vs. Colorado, 206 U. S. 46, 100-104, 117."
>
> *Rickey Land & Cattle Co. vs. Miller & Lux*, 218 U. S. 258.

Likewise *arguendo* this Court in speaking of water rights in another case used this language:

> "We know of no reason to doubt, and we assume, that, subject to such rights as the lower State might be decided by this Court to have, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that State. Kansas vs. Colorado, 206 U. S. 46, 93-95. Therefore, subject to the same qualifications, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. Missouri vs. Illinois, 200 U. S. 496, 521. Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, 260. But with regard to such rights as came into question in the older States, we believe that it always was assumed, in the absence of legislation to the contrary, that

the States were willing to ignore boundaries, and allowed the same rights to be acquired from outside the State that could be acquired from within. Mannville Co. vs. Worcester, 138 Massachusetts, 89. Thayer vs. Brooks, 17 Ohio, 489. Slack vs. Walcott, 3 Mason, 508, 516. Stillman vs. White Rock Manuf. Co., 3 Woodb. & M. 538. Rundle vs. Delaware & Raritan Canal Co., 1 Wall. Jr. 275, 14 How. 80. Foot vs. Edwards, 2 Blatchf. 310. See Wooster vs. Great Falls Manuf. Co., 39 Maine, 246, 253; Armendiaz vs. Stillman, 54 Texas, 623; State vs. Lord, 16 N. H. 357. Howard vs. Ingersoll, 17 Alabama, 780, 793."

Bean vs. Morris, 221 U. S. 485.

In 3 Kinney on Irrigation (2nd Ed.) Sec. 1225, page 2216, that learned author has this to say:

"The rights of the respective States and of the citizens thereof in and to the use of waters of an interstate stream depend somewhat upon the laws of those States governing waters. If the common law is the only law of waters governing two adjoining States through which an interstate river flows, or if both States have adopted the Arid Region Doctrine of appropriation, the right to the use of the waters of an interstate stream is not affected by the boundary line which divides the States. But where there is conflict of the laws relative to the subject of water, that is to say, the lower State upon the stream having only the common law of riparian rights, and the upper State having adopted the Arid Region Doctrine of appropriation, the rule is different, and will be discussed in a subsequent section of this chapter."

The learned author quoted above refers to Section 1227 of the same Chapter for the promised discussion. In that Section he says:

"The equitable division of the waters of interstate streams between the States through which or adjoining which such streams flow being the rule of law adopted by the Supreme Court of the United States as governing the subject, in what that Court terms the 'practically building up what may not be improperly called interstate common law', as discussed in the preceding sections, it must therefore follow that this rule is not affected by the conflict of the laws of the respective States governing the waters flowing within their respective jurisdictions. Although each State has the power to adopt such laws as it sees fit to govern the waters within its own territory, no State has the power to enact such laws for another State. As said by Mr. Justice Brewer in rendering the opinion of the unanimous Court in the Kansas-Colorado case: 'Neither State can legislate for nor impose its own policy upon the other.' So, as far as this rule of equitable division of the waters of an interstate stream is concerned, it makes no difference as to whether or not one of the States has utterly repudiated the common law of riparian rights and adopted the Arid Region Doctrine of appropriation and another State relies wholly upon the common law of riparian rights. The rule of equitable division between the two States must prevail in any event. This rule of law is illustrated by the Kansas-Colorado case, where the Arkansas River takes its rise in the mountains of Colorado, where the rule of law governing the waters of the State is that of the Arid Region Doctrine of appropriation only, and where the stream flows into the State of Kansas, where it was contended that the prevailing rule of law was the common law doctrine of riparian rights, but which State, in fact, had both systems of laws governing waters.

"Again, the rule is illustrated in the case of Anderson vs. Bassman, where the stream in question takes its rise in the high Sierras in California,

which State has both rules of law governing its waters, the doctrine of appropriation and the common law of riparian rights, and where the stream flows into the State of Nevada, which State has utterly repudiated the common law of riparian rights and has adopted the Arid Region Doctrine of appropriation as its only rule of law governing the waters flowing within its boundaries.

"Neither does the fact that one of the States has dedicated all the waters flowing within its boundaries, either by constitutional provisions or by statutory enactment, to the State and to its citizens affect the right of the division of the waters of interstate streams upon an equitable basis. As was stated by Judge Hallett in the case of Hoge vs. Eaton: 'The idea of an exclusive right in the people of a State to divert its running waters, to the injury of riparian owners in another State, must be equally untenable. Indeed, the doctrine of riparian ownership and the use of running water is not subject to political boundaries. Between hostile States the doctrine may not be recognized, but any such repudiation would be simply *vis major*. Between States dwelling in peace and concord, as are the States of our Union, the equal right of the inhabitants of each State must always be recognized.' "

3 Kinney on Irrigation, Page 2220, Sec. 1227.

Again in Section 1230 that author has this to say:

"The equitable division of the waters of interstate streams between the respective States through or by which they flow involves no question of international law, as is the case of the division of the waters of streams which flow through or bound different independent countries. Under Article I, Section 10 of the Constitution of the United States, it is provided: 'No State shall, without the con-

> sent of Congress, * * * enter into any agreement or compact with another State', etc. Therefore, 'they can not enter upon diplomatic relations, and make treaties.' 'Bound hand and foot by the prohibition of the Constitution, a complaining State can neither treat, agree, nor fight with its adversary, without the consent of Congress.' Therefore, a resort to the judicial power is the only means for adjusting the rights to the waters of interstate streams between the different States entitled thereto. And, again, the idea that there can arise any international question in the case of the use of the waters of an interstate stream by the different States of this country, through which or adjoining which such a stream flows, can not be maintained."
>
> 3 Kinney on Irrigation, Sec. 1230.

The Attorney General of the United States, Judge Harmon, was called upon in 1895 to give an opinion concerning certain complaints made by Mexico against certain diversions of water from tributaries of the Rio Grande which were claimed to reduce the flow of that stream to the injury of Mexican appropriators. The opinion given contains this language:

> "The case presented is a novel one. Whether the circumstances make it possible or proper to take any action from considerations of comity, is a question which does not pertain to this Department; but that question should be decided as one of policy only, because, in my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States."
>
> Opinions of the Attorneys General, Vol. 21, page 274.

If by the word "novel" the Attorney General intended to say that the question was one of first impression, he was apparently, to some extent at least, in error. On June 12, 1880, Mr. Evarts, as Secretary of State, enclosed to the United States Legation in Mexico certain complaints from citizens of Texas living on the Rio Grande. These complaints were to the effect that certain Mexicans in Mexico were in the habit of diverting the waters of the Rio Grande into their ditches, thereby preventing the complainants from obtaining water for the irrigation of their crops.

> "This", said Mr. Evarts, "if true, would be in direct opposition to the recognized rights of riparian owners, and, if persisted in, must result in disaster and ruin to our farming population on the line of the Rio Grande, and might eventually, if not amicably adjusted through the medium of diplomatic intervention, be productive of constant strife and breaches of the peace between the inhabitants of either shore."
>
> 1 Moore's Dig. Int. L. 653.

It is worthy of notice that the complaints made by the Mexican Minister concerning which the opinion of Mr. Attorney General Harmon was written, continued in one form or another for many years after 1895. They resulted in an action brought by the Attorney General of the United States in the District Court of the Third Judicial District of New Mexico against the Rio Grande Dam & Irrigation Company on May 24, 1897. That case reached this Court and is found as United States vs. Rio Grande Dam & Irrigation Company, 174 U. S. 690. The complaint still persisted, and resulted in a special treaty confined to

the distribution of the waters of the Rio Grande. In that treaty between the United States and Mexico, the United States agreed, without expense to Mexico to furnish and deliver to Mexico 60,000 acre feet of water annually. Mexico agreed on its part in consideration of the delivery of the water above stated, to waive any and all claims to the waters of the Rio Grande between the head of the Mexican Canal and Fort Quitman, Texas, and also declared fully settled and disposed of and waived "all claims heretofore asserted or existing, or that may hereafter arise, or be asserted, against the United States on account of any damages alleged to have been sustained by the owners of land in Mexico, by reason of the diversion by citizens of the United States of waters of the Rio Grande." (34 Statutes at Large, Part 3, Page 2953.)

It is true that the United States in that treaty stipulated that it did not concede any basis for the claims asserted by Mexico, nor concede the establishment of any general principle or precedent by the concluding of the treaty.

It is apparent that nothing in any of the quotations or discussions above draws in any clear way the lines bounding the rights of a State as distinguished from those of its citizens in the waters of an interstate stream. Nor is there anything in any clear way marking out the principles upon which equitable division of waters shall be made in such streams. These matters are left to be determined by rules that may be worked out or by analogies from rules governing such matters where the adjoining proprietors instead of being States are individuals. Some of the suggestions of this Court, as above indicated, seem to hint that such rules "may be more or less analogous to common law rights between upper and lower proprietors."

A just criticism has often been made on precedents established in interstate relations to the effect that many such precedents are almost solely the result of "*vis major*". It is to be hoped that the tendencies in dealings between States are in the direction of principles of right and justice; in other words, equitable principles. When such principles are sought and applied in international relations, they are found to approximate more and more closely the equitable principles governing relations between individuals.

In the case at bar at least there can be no such thing as *vis major*. The parties to this controversy are not permitted to make war upon one another, nor even to make treaties with one another. Their controversy is, therefore, brought to this Court to be here determined. So far as we can see, the rules of right, justice, equity, in the controversy here, are identical with the rules of right, justice, equity, that would govern between private persons located on this stream.

So far as we can see, if it is equitable that a prior appropriator should have a right prior to the appropriator who comes later to the stream when private persons only are involved, it is also equitable as between States that the State which first appropriates the water shall have a right in the stream superior to the State which comes later. In the case of private persons, as well as in the case of a State, there may be other rights involved than the rights of the parties to the controversy. In the case of litigation between private persons, a Court of Equity will ordinarily require all who are affected by the decree to be pronounced between the parties to be brought into the litigation in order that the rights of all may be determined.

In this case the waters flow naturally into, by and

through many States. The decision here, if final as to other States not parties, might if made in one direction easily affect injuriously many citizens of Nebraska and that State herself. It is perhaps with something of this in view that the Court has directed an appearance by the Attorney General of the United States so that every consideration may be given to all possible interests of all possible persons.

In irrigation litigation the indirect results to others have thus far not persuaded the Courts to require all directly or remotely affected to be made parties to the proceedings, and in the case at bar such a course would be impracticable. But it is clear that not only the direct results but the tendencies of the decision here as affecting not only the parties to this proceeding but others not here made parties should be taken into account.

The Rights of States in Interstate Streams as Analogous to the Rights of Private Owners

If this case is to be ruled by principles of law already discovered and laid down, so far as we have been able to see they are ruled by principles governing between private persons. The precedents as to international rights on international streams are scarcely sufficient upon which to base any rule, and such as they are they are contradictory, even this Government contending now that riparian rights govern as between States when diversions of water were made within the boundaries of a foreign government, and again contending that the foreign government has no right to complain when

diversions were made within the boundaries of this country from an interstate stream, and still later, while in words protesting that it was not doing so, in deeds recognizing the rights of those injured by diversions within our territories from an interstate stream. The only precedents, therefore, from which the principles that must here govern can be deduced, so far as we can see, are the principles discovered and adopted as to rights between private persons.

Applying the principles as they govern between adjoining private proprietors, there are, as we have seen, two general sets of principles, one denominated the riparian rights doctrine, the other denominated the doctrine of prior appropriation.

The Roman law as appears from the Pandects of Justinian adopted the principles of riparian rights and apparently allowed something in the way of irrigation and of equitable division of waters for that purpose. The same is true of the Code Napoleon, Article 644. This was true likewise of the Mexican law at the time of the acquisition of our Mexican territory, including Colorado and large parts of Wyoming. (1 Wiel on Water Rights, 68, 685, 1026.) But in all these jurisdictions, while water was to an extent used for irrigation, riparian rights were held superior to rights for irrigation.

It is needless to cite authority to show that in Great Britain and in most of the States of the Union, while there has been some limited right to use water more or less for irrigation purposes, still the rights of the riparian proprietor are superior. In all the jurisdictions above mentioned, the riparian proprietor had the right to insist that the use of water should not unreasonably reduce the flow of the stream, should be

confined within the watershed, and that the surplus should always be returned to the stream.

There are eighteen of the States and territories of the United States which may be denominated generally the irrigation States, inasmuch as in each of these eighteen States there is more or less of arid land requiring irrigation, and the laws of these States recognize more or less irrigation rights. These are Alaska, Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington and Wyoming. In ten of these States and territories, namely, Alaska, California, Kansas, Montana, North Dakota, Oklahoma, Oregon, South Dakota, Texas and Washington, while the use of waters of streams for irrigation is permitted, the riparian proprietor is recognized as having the superior right and the waters are not permitted to be diverted by the irrigators beyond the watershed, but the surplus must be returned to the original stream.

1 Wiel on Water Rights (Third Edition) p. 849.

1 Kinney on Irrigation, p. 782.

2 Farnham on Waters 1572, 3 Id. 1903.

Wiggins vs. Water Co., 113 Cal. 182, 45 Pac. p. 160.

Bathgate vs. Irvine, 125 Cal. 135, 58 Pac. p. 442.

Southern Cal. Inv. Co. vs. Wilshire, 144 Cal. 68.

Anaheim Union Water Co. vs. Fuller, 150 Cal. 327, 88 Pac. 978, 980.

Clark vs. Allaman, 71 Kans. 206, 80 Pac. 571, 585.

Watkins Land Co. vs. Clements, 98 Tex. Civ. *App.* 578.

Matagorda Canal Co. vs. Markham Irr. Co.,
. . . . Tex. Civ. App. . . . . , 154 S. W. 1176.

In the other seven irrigating States, viz., Arizona, Colorado, Idaho, New Mexico, Nevada, Utah and Wyoming, fuller rights of appropriation are recognized, and apparently the right is recognized to take water outside the watershed, even over the objections of those within the watershed. *But in neither of these States is any diversion from the watershed permitted on any principle of equitable division even remotely expressed or implied.* On the contrary each of these States insists upon the doctrine which we have discussed elsewhere, that the rights of a prior appropriator are exclusive, even to the full extent of his prior appropriation. No division of the waters which would take anything from the prior appropriator to his injury is recognized as in any sense equitable.

This Court in the case of Kansas vs. Colorado, reached a conclusion that on the facts in that case equitable division of the waters was a reasonable principle as between adjoining States on an interstate stream. As we understand that case, this principle of equitable division was not evolved as a new principle but was a mere application of the doctrine of equitable division as between private riparian owners. No rules for equitable division were laid down in that case, nor were any such rules even discussed excepting by a reference to rules of division between riparian owners. This, we think, is made clear by the language of the opinion in that case. The Court said:

"And here we must notice the local law of Kansas as declared by its Supreme Court, premis-

ing that the views expressed in this opinion are to be confined to a case in which the facts and the local law of the two States are as here disclosed. In Clark vs. Allaman, 71 Kansas, 206, is an exhaustive discussion of the question, Mr. Justice Burch delivering the unanimous opinion of the court. In the syllabus, which by statute (Compiled Laws, Kansas, p. 317, sec. 14) is prepared by the justice writing the opinion, and states the law of the case, are these paragraphs:

" 'The use of the water of a running stream for irrigation, after its primary uses for quenching thirst and other domestic requirements have been subserved, is one of the common law rights of a riparian proprietor.

" 'The use of water by a riparian proprietor for irrigation purposes must be reasonable under all the circumstances, and the right must be exercised with due regard to the equal right of every other riparian owner along the course of the stream.

" 'A diminution of the flow of water over riparian land caused by its use for irrigation purposes by upper riparian proprietors occasions no injury for which damages may be allowed unless it results in subtracting from the value of the land by interfering with the reasonable uses of the water which the landowner is able to enjoy.

" 'In determining the quantity of land tributary to and lying along a stream which a single proprietor may irrigate the principle of equality of right with others should control, irrespective of the accidental matter of governmental subdivisions of the land.'

"And in the opinion, on pages 242, 243, are quoted these observations of Chief Justice Shaw in the case of Elliott vs. Fitchburg Railroad Company, 10 Cush. 191, 193, 196:

" 'The right to flowing water is now well settled to be a right incident to property in the land; it is a right *publici juris*, of such a character that whilst it is common and equal to all, through whose land it runs, and no one can obstruct or divert it, yet, as one of the beneficial gifts of Providence, each proprietor has a right to a just and reasonable use of it, as it passes through his land; and so long as it is not wholly obstructed or diverted, or no larger appropriation of the water running through it is made than a just and reasonable use, it cannot be said to be wrongful or injurious to a proprietor lower down. What is such a just and reasonable use, may often be a difficult question, depending on various circumstances. To take a quantity of water from a large running stream for agriculture or manufacturing purposes, would cause no sensible or practicable diminution of the benefit, to the prejudice of a lower proprietor; whereas, taking the same quantity from a small running brook passing through many farms, would be of great and manifest injury to those below, who need it for domestic supply or watering cattle; and therefore it would be an unreasonable use of the water, and an action would lie in the latter case and not in the former. It is, therefore, to a considerable extent a question of degree; still, the rule is the same, that each proprietor has a right to a reasonable use of it, for his own benefit, for domestic use, and for manufacturing and agricultural purposes. * * *

" 'That a portion of the water of a stream may be used for the purpose of irrigating land, we think is well established as one of the rights of the proprietors of the soil along or through which it passes. Yet a proprietor cannot under color of that right, or for the actual purpose of irrigating his own land, wholly abstract or divert the watercourse, or take such an unreasonable quantity of water, or make such unreasonable use of it, as

to deprive other proprietors of the substantial benefits which they might derive from it, if not diverted or used unreasonably. * * *

" 'This rule, that no riparian proprietor can wholly abstract or divert a watercourse, by which it would cease to be a running stream, or use it unreasonably in its passage, and thereby deprive a lower proprietor of a quality of his property, deemed in law incidental and beneficial, necessarily flows from the principle that the right to the reasonable and beneficial use of a running stream is common to all the riparian proprietors, and so, each is bound so to use his common right, as not essentially to prevent or interfere with an equally beneficial enjoyment of the common right, by all the proprietors. * * *

" 'The right to the use of flowing water is *publici juris*, and common to all the riparian proprietors; it is not an absolute and exclusive right to all the water flowing past their land, so that any obstruction would give a cause of action; but it is a right to the flow and enjoyment of the water, subject to a similar right in all the proprietors, to the reasonable enjoyment of the same gift of Providence. It is, therefore, only for an abstraction and deprivation of this common benefit, or for an unreasonable and unauthorized use of it, that an action will lie.'

"As Kansas thus recognizes the right of appropriating the waters of a stream for the purposes of irrigation, subject to the condition of an equitable division between the riparian proprietors, she cannot complain if the same rule is administered between herself and a sister State."

Kansas vs. Colorado, 206 U. S. 46, 102.

In the case last above cited, the equitable division was all within the watershed. No question arose there

of permitting such division as would carry waters without the watershed. One would search in vain for any doctrine of equitable division of waters which would permit one proprietor to carry the waters without the watershed with no obligation to return them to the stream in any State or country administering the rule of riparian rights. In the seven States, possibly the most arid, as we have seen, no doctrine of equitable division of the waters is allowed. The matter rests solely upon prior appropriation and he who first appropriates may use the water to the extent of his appropriation even though later appropriators obtain nothing from the stream. Nowhere, therefore, do we find any rule of equitable division allowing the waters to be taken from the watershed, with no obligation to return them to the stream.

It is interesting, moreover, to note that there are at least tendencies in some of these States constituting the seven last above mentioned, to recognize rights of owners along the stream and to restrict the diversion beyond the watershed. For instance in the Session Laws of Nevada of 1907, Chapter 18, Section 4, page 31, the following provision was put into statute law of the State of Nevada:

> "No person shall be permitted to divert or use any more of the waters of a natural water course or natural lake than sufficient when properly and economically used to answer the purpose for which the diversion is made; nor shall any person be permitted to waste any such water and all surface water remaining after use, unavoidable wastage excepted, shall be returned to the channel by the persons diverting the same, without unreasonable delay or detention."

In the Session Laws of New Mexico 1907, Chapter 49, Section 72, page 95, (New Mexico Statutes Ann. 1915, Section 5718) occurs the following provision:

> "It shall hereafter be unlawful for any person, company or corporation to divert the waters of any public stream in New Mexico for use for reservoirs or other purposes in a valley other than that of any such stream to the impairment of valid and subsisting prior appropriations of such waters."

In the case of Hutchison vs. Watson Slough Ditch Co., Limited, *et al.*, 16 Ida. 484, (101 Pac. 1059), the Court first recognizes the principle that in that State the rights of a riparian proprietor are inferior to the rights of an appropriator, but nevertheless recognizes substantial rights such as must be appropriately guarded and protected by the courts in riparian proprietors as such.

And in the case of Anderson vs. Bassman, 140 Fed. 14, decided by Circuit Judge Morrow, sitting in the Circuit Court, that learned Judge used these words:

> "The decree will also restrict defendants, whether riparian or nonriparian owners, on and after June 1, 1906, from using water from the river where no provision is made for returning surplus water to the river."
>
> (140 Fed. on page 29.)

This language is significant when it is remembered that the stream was an interstate stream; that the lands irrigated by some of the parties to the suit were lands in Nevada, the water being taken from the stream in that State, and that lands of other parties

were in California, the water being taken from the stream in that State.

The effect of the claim of Colorado in this case is therefore a contention for a new principle of law antagonistic to the judgment of mankind from the beginning of history to this day. We submit that there is no right to any equitable division of the waters such as will permit Colorado to take the waters of the Laramie River in the manner here threatened.

C.

Does Colorado have the Right as a Sovereign State to take all Waters found within her Boundaries and use them as she will, Regardless of the Injuries thereby Inflicted upon Others?

This Court has in many cases considered the rights of States as against one another. Missouri vs. Illinois *et al.*, 180 U. S., 208; Georgia vs. Tennessee Copper Company, 206 U. S., 230; Kansas vs. Colorado, 185 U. S., 125; 206 U. S., 46, and cases cited by these. It is clearly established by this Court that a State does not have a right to do acts within its own borders which shall affirmatively cause injury in another State. In the Georgia case the defendant was enjoined from so polluting the atmosphere in Tennessee as to cause damage in Georgia. In the case of Missouri vs. Illinois, while no decree was rendered the case was considered by this Court on its merits in such way as conceded that the pollution of the waters of the river by the State of Illinois so as to cause damage to Missouri

and its citizens, would give a right of action in this Court to the State of Missouri. In the case of Kansas vs. Colorado as reported in the 185 U. S., the demurrer was over-ruled, necessarily holding as it seems to us that a right of action could exist in favor of Kansas against Colorado for diverting the waters of the Arkansas within the boundaries of Colorado in such way as to prevent those waters from flowing down into Kansas. And in the final decision of the case of Kansas vs. Colorado this Court in terms announced the principle that the depletion of the waters could be carried so far that Kansas might "rightfully call for relief against the action of Colorado, its corporations and citizens, in appropriating the waters of the Arkansas for irrigating purposes."

On the whole we deem the question of the sovereign right of Colorado to take the waters as she will, one so fully settled by this Court even if the principle claimed by Colorado were much better founded in reason, that we feel it unnecessary further to discuss it.

We submit:

First, that the proof is clear in favor of Wyoming showing prior appropriations of all the waters of the stream. The proof is especially clear showing that the stream does not furnish sufficient water for the Wyoming irrigators during the irrigation season in most years, and therefore that Wyoming is entitled to ask injunctive relief against Colorado for the threatened diversion, which, as we believe the evidence shows, would clearly cause irreparable injury and damage in the destruction of prosperous communities and enterprises within the State of Wyoming.

Second, That there is not here any right in Colorado to a so-called equitable division of the waters for the purpose of the diversion threatened because (a), the threatened diversion interfering as it does with the Wyoming prior appropriators and depriving them of necessary water is contrary to every principle of prior appropriation; (b), the diversion threatened taking the water as it does from the watershed so that it cannot return to the stream is contrary to every principle and doctrine of riparian rights; (c), that there is no rule or principle governing the depletion of streams *in invitum* excepting the doctrines and principles of prior appropriation and the doctrines and principles of riparian rights and combinations of these two, and nowhere do such principles permit equitable division of water outside the watershed so as to take it away at the same time from prior appropriators and from riparian owners.

Third, That no rule of sovereign rights exists as claimed by Colorado permitting her to take and use the waters as she will, regardless of others.

Fourth, That Wyoming is entitled to the injunction prayed for.

Respectfully submitted,

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JOHN W. LACEY,

Of Counsel.

No. _____ Original

In the Supreme Court of the United States

OCTOBER TERM, 1912

IN EQUITY

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, DEFENDANTS.

Brief of Complainant on Demurrer

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N. E. CORTHELL,
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In the Supreme Court of the United States

OCTOBER TERM, 1912

NUMBER _____ ORIGINAL

THE STATE OF WYOMING,
Complainant,
vs.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, a municipal corporation, The Laramie Poudre Reservoirs and Irrigation Company, a corporation,
Defendants.

IN EQUITY

BRIEF OF COMPLAINANT ON DEMURRER

I.

STATEMENT OF THE CASE

This is a suit by the State of Wyoming against the State of Colorado and two individual defendants, growing out of questions of the use of water from an interstate stream, the Laramie River.

The Bill alleges that in 1865 the settlement of the valley of the Laramie in Wyoming began, and

from that time on to the time of the commencement of the wrongs complained of the settlers in the valley of the Laramie in Wyoming had improved and by the practice of irrigation had rendered highly productive the lands in that valley in Wyoming, and had built up there a community of twenty thousand people, irrigating three hundred and twenty-five thousand acres of land.

It is alleged that these lands without the artificial irrigation are so arid in character that they are unproductive; that the citizens of the plaintiff had built the City of Laramie within the valley of the stream, and the plaintiff had established there its State University; and the community, the City, the University, the real values of the lands, are all dependent upon the use of the waters in controversy; that by the practice of irrigation the lands within the valley have become worth a large amount, to-wit, more than ten millions of dollars.

The Bill alleges that it has become established by the customs, laws and decisions of both Colorado and Wyoming that the waters of all streams are open for appropriation and use for irrigation purposes; that priority of appropriation gives priority of right; that neither the point of diversion nor the place nor kind of use of any appropriation or any water appropriated

may be changed to the injury of any other appropriator.

The Bill further alleges that the mountains at the head of the Laramie River where very heavy banks of snow fall in winter are within the State of Colorado, and that it is these heavy banks of snow in Colorado which supply the waters of the stream, the valley of the Laramie in Wyoming being arid and furnishing little water.

It is further alleged that notwithstanding the prior appropriation of the water by citizens of Wyoming, the defendants are threatening to pierce the walls of the water shed by a tunnel through the mountains, and to carry away the waters of the stream to the amount of more than one hundred thousand acre feet per annum, (an acre foot being such amount of water as will cover one acre of ground to a depth of one foot), to a point more than one hundred miles away from the Laramie valley and from which no part of the waters can return.

It is further alleged that if this threat is carried out, it will destroy the value of the lands within the watershed of the Laramie River in the State of Wyoming, and will destroy the community which has been built up there. These matters are confessed by a demurrer to the Bill, the demurrer claiming that these facts do not authorize any relief.

II.

BRIEF OF THE ARGUMENT

1. THE CONTROVERSY IS ONE OF JUSTICIABLE NATURE.

The admission by the demurrer is that the State of Colorado, directly and through her agencies the other defendants, is threatening and intending to divert the waters of the Laramie River in such way as to prevent the waters so diverted from reaching the State of Wyoming, and that such diversion will practically render valueless 325,000 acres of lands which through the use of said waters in irrigation have become of the value of more than ten million dollars, and have been made to support a community of more than twenty thousand people.

That the matter so confessed is one of a justiciable nature is made entirely clear by the opinions of this court in Kansas v. Colorado, 185 U. S. 125, and 206 U. S. 46, and the complainant may maintain the action on its own behalf and also "as *parens patriae*, trustee, guardian or representative" of the considerable portion of its citizens whose property is threatened with destruction and whose health and comfort are threatened with serious injury.

2. THE RELATIVE RIGHTS TO THE WATER.

Stated briefly, counsel for the defendants claim that there are three separate doctrines under which the rights of the parties are to be viewed, as follows:

First. It is said that there is one doctrine under which Colorado as a sovereign State might claim ownership and title to all waters within that State, and the full right to use all such waters regardless of the rights of neighboring States and regardless of injuries that might be thereby occasioned to neighboring States.

Second. It is said that there is another doctrine under which Colorado might use the waters within that State, but not in such way as to diminish unreasonably the resources of Wyoming.

Third. The third doctrine, as suggested by counsel, is the doctrine of prior appropriation under which he who first appropriates water from a particular stream is prior in right regardless of State lines.

From our standpoint a discussion of the first and third doctrines stated by counsel must merge into a single discussion.

(a) COLORADO MUST RESPECT PRIOR APPROPRIATIONS.

Counsel argue for the doctrine of State ownership. The claim is that Colorado owns the waters of the

State; that she has the "paramount right to the exclusive use of all waters of her natural streams"; that she "has the right to control the waters of the non-navigable streams of the State without interference by any other State"; that the "entire flow of the water within the State is impressed with the public use for the benefit of the State and the people thereof"; that her statutes contemplate "the appropriation of all the waters flowing in Colorado for use on lands in Colorado."

For this argument and contention, counsel cite Article 16, Section 5 of the Colorado Constitution and the following decisions of the Colorado Courts, viz.: Wheeler v. Northern Colorado Irri. Co., 10 Colo. 587; Wyatt v. Larimer-Weld Irri. Co., 1 Colo. App. 480, and Lampson v. Vailes, 27 Colo. 201; and in the same connection counsel cite Article 1, Section 31, and Article 8, Section 1 of the Wyoming Constitution, and Turley, et al. v. Furman, et al. (N. M.) 114 Pac. 278.

The Colorado Cases Do Not Support Defendants Here.

Let us first consider the Colorado decisions under her constitution.

Sec. 5 of Article XVI of the Colorado Constitution is as follows:

"Water Public Property—The water of every natural stream not heretofore appropriated, within the state of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided."

Sec. 6 of the same Article is as follows:

"The right to divert unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."

In the case of *Wheeler v. Northern Colorado Irrigation Co., supra*, cited by counsel, no question arose as between use of waters within the State and their use without the State, nor did the Court even by way of discussion or *obiter dicta* refer to any such question. To be exact, the language used by the Court is as follows:

"Our Constitution dedicates all unappropriated water in the natural streams of the State 'to the use of the people', the ownership thereof being vested in 'the public' ".

In other words, the Court in that case quoted from the Constitution, and did practically nothing in the way of construing it.

The case of *Wyatt v. Larimer-Weld Irrigation Company, supra*, cited by counsel, is similar. There was nothing in the facts in that case which could raise any question of priorities depending upon use within as against use without the State, nor was there any attempt to raise or pass upon any such question. The opinion of the Court, however, quoted the State Constitution, and by way of quotation gave definitions of the words "public" and "people" as contained in Section 5 of Article 16 of that instrument. In speaking further of the Section and its effect upon rights, the Court used this language:

> "The offices to be performed by a constitution are two: First, it is declaratory of the rights inherent in the people, exercised by them, and existing long before its adoption; second, it is a limitation upon all legislative power, preventing any subsequent interference with the declared rights, and perpetuating them. 'Written constitutions sanctify and confirm great principles, but the latter are prior in existence to the former.'
>
> * * * * * * * * *
>
> The history of water rights in this state will show that the rights and principles declared in the constitution were recognized and acted upon by the people years before they were formulated,

and declared in that instrument; that such rights had their inception in the earliest attempt at agriculture, when it was found that climatic conditions demanded the artificial use of water to produce crops. The title of the public and the people to the water in the streams, and the right to divert and appropriate, were recognized and acted upon, the only requirement being an application to a beneficial use; and such rights to the use of water, as between different consumers or users, were established upon the broad equitable basis that preferences were to be controlled by the respective dates when the conflicting appropriations were made. When thus appropriated, the party appropriating was regarded as having a proprietary interest,—a right of property in, and the title to, the water appropriated and diverted, with the right to use, sell, or loan it, like other property. By such appropriation, and by reason of the diversion and separation of the water from the volume of the stream, the title of the public or people was divested, and the appropriator became the owner. Cleared of all embarrassment, by reason of the supposed double ownership, we find the rights declared in the constitution to be the same that were recognized and acted upon by the people before its adoption."

It is evident that the Supreme Court of Colorado in the language just quoted did not attempt to hold that the Constitution enacted a new principle by way of legislation, or otherwise, or declared a new doctrine. On the contrary the holding is that the Constitution

merely declares the old principles long recognized and exactly as recognized, viz., that water is subject to appropriation, that priority of appropriation gives priority of right, and that the appropriator obtains by his appropriation "a proprietary interest,—a right of property in, and the title to, the water appropriated." The Court does not declare in that case that the owners of the lands within the State are the elect, and that the rest of the world is without rights. It does not discuss the question of the effect of State lines on water rights, *but it does very significantly hold that the Constitution is not an enactment, and declares no new doctrine, establishes no new right.* It is needless to say that this construction is reasonable, and that this Court will not reverse the construction given by the Supreme Court of Colorado. The Constitution, therefore, leaves the question of the rights as between lands in the State and lands without exactly as it was before the Constitution was adopted. In other words, it leaves it to the customs and usages of the region.

Counsel are no more fortunate in the case of *Lampson v. Vailes, supra*, which they cite. In that case the Supreme Court of Colorado state the question before it and its decision, as follows:

> "The legal questions discussed are: First. Can water be appropriated by diversion in Colo-

rado for use in New Mexico? In other words, may one owning land in the territory of New Mexico, whether he be a citizen of the State of Colorado or of some other state or territory of the Union, make a diversion in this state from the waters of a nonnavigable stream, and convey the same into the territory of New Mexico for the irrigation of lands therein? Second. Has the district court of La Plata County, under the so-called 'Irrigation Statutes', jurisdiction in the statutory proceeding to award priorities to a ditch which, though having its headgate in this state, was intended to, and does, carry water outside of this state, and into the territory of New Mexico, for the irrigation of lands there?

The first is a very important question, and one which, so far as we are advised, has not been passed upon by a court of last resort, though it is claimed that, in principle, the decision in Howell v. Johnson (C. C.) 89 Fed. 556, is authority for the contention. Certain it is that it is a case of first impression in this jurisdiction. In the view we take of the second legal proposition, it is not necessary to a decision of this appeal to determine the first."

Having thus refused to rule upon the general question like the one at bar, the court disposes of the other question (viz. the jurisdiction of the district under the statutory proceeding), as follows:

"It is clear that the court below, in deciding that it had not jurisdiction to award a priority

to the ditch of appellants for the irrigation of lands in New Mexico, but only to the extent that the appropriation was made for lands in Colorado, was right under the statutes governing this special proceeding. The appellants contend that sections 2399, 2403, Mills' Ann. St. (Gen. St. 1883, sections 1762, 1766), contemplate an adjudication for settling the priority of rights for irrigation for all ditches whose points of diversion are within the state, even though the lands to be irrigated are, in whole or in part, beyond its territorial limits. These sections provide for an adjudication of priorities for ditches drawing water for irrigation from the same stream or its tributaries within the same water districts. If driven to that extremity, it would not be difficult, from the language used, to demonstrate that the adjudication was limited to ditches, etc., used for irrigating lands in this state only, though the language does not in terms so provide. We do not, however, rest our conclusion solely upon the language of these sections. We cannot presume that the general assembly intended to enact a law to operate beyond the territorial limits of the state. The distinction sought to be made by appellants, that the point of diversion of the ditch is the sole factor determining the jurisdiction of the court, is not good. The statutes under which this proceeding was instituted—those creating the various water districts, and our entire irrigation law—must be taken together, and, if possible, the different provisions so interpreted as to give effect to all, and make them harmonious, the one with the other. It is not to be supposed that the state was legislating

for the reclamation or irrigation of lands beyond its boundaries, or making provisions, by the way of police regulations (which we have held these statutes, in some measure, to be), over a territory beyond its jurisdiction.

The different acts establishing water districts (1 Mills' Ann. St. sec. 2310 et seq.; Gen. St. 1883, Sec. 1741 et seq.) either in terms declare, or by implication assume, that these districts are restricted to lands within the State; and the particular act creating district No. 33, the one in question, is 'that district number thirty-three shall consist of all lands lying in the state of Colorado irrigated from ditches or canals, taking water from the La Plata river, and its tributaries, which lie in Colorado.' 1 Mills' Ann. St. sec. 2344 (Sess. Laws 1885, p. 259, sec. 26). The earliest territorial acts expressly confine legislation relating to irrigation to lands situate in the territory. 1 Mills' Ann. St. sec. 2256 et seq. (Gen. St. 1883, sec. 1711). From these enactments it is altogether conclusive that in these proceedings, at least, the intention of the general assembly was to limit the adjudication to ditches irrigating lands situate in this state, and not elsewhere.

Such being our conclusion, it is unnecessary, as we have said, to pass upon the other legal proposition pressed upon us."

It will thus be seen that the Court in that case had a question similar to the one at bar, but refused to give any opinion upon it, though citing a case which holds a doctrine contrary to the contention of counsel here.

The case does hold that the "special proceedings" for the adjudication of water rights in force in Colorado which limit themselves to ditches "within the same water district" were in the nature of "police regulations" and not applicable or operative beyond the State lines.

This seems to us a very clear and correct construction of the statutes of Colorado relating to waters. They provide the means of appropriation and the machinery for adjudicating water rights within the state. These statutes are "police regulations", operative only within the state, and hence without extra-territorial effect.

But there is certainly no support here for the contention that these statutes are enactments declaring the waters the exclusive property of Colorado appropriators. So far as the decision goes upon the question it is against any contention that these statutes intend to have any operation either for or against outside appropriators. It shows that the matter within the legislative intent was "police regulation" as between appropriators within the state.

These cases by the Supreme Court of Colorado, therefore, do not decide that appropriators whose lands are beyond the boundaries of the State hold their property right in the water appropriated by a title

in any wise less certain or less sacred than if their lands were within the boundaries of Colorado.

We have, then, the only constitutional provisions of Colorado which are cited by counsel construed by the Supreme Court of that State as not enacting anything new whatever on the subject of rights to water. Moreover the decisions themselves make no attempt to claim for Colorado the exclusive right to the waters within that state which is here claimed in the brief of counsel, and no legislation is cited by counsel which attempts affirmatively to restrict the doctrine of prior right as obtained by prior appropriation to lands within the State as against lands without.

Other Courts.

(1) *The Federal Court in Colorado Holds to The Rule of Prior Appropriation from Interstate Streams.*

We insist that the Supreme Court of Colorado adopts the correct principle when it says that constitutions are not meant to be legislative in character; they are not enactments; they are not the creation of new rights, but merely declare rights as they already exist. If this section of the Constitution be considered in the light of the customs of the region in relation to waters and their appropriation, the matter would

not seem to be difficult. The result reached in the case of *Hoge v. Eaton, et al.*, 135 Fed. 411, 414, would seem to be the natural result. In that case the question here was brought for decision to the United States District Judge for the District of Colorado while sitting in Circuit within that State. It is worthy of remark that the particular Judge who sat in that case was on the Supreme Bench of Colorado before the admission of that State into the Union and became United States District Judge upon the admission. He therefore must be presumed to have been familiar with the legal history of that State when in 1905 the question was brought before him in the case last cited. In that case the Court, sitting as we have said in Colorado, used this language:

> "We had occasion recently to consider whether the right of a citizen to use water within the state for irrigation of lands is granted by the state or general government, and we were unable to discover any principle of that kind. Mohl v. Lamar Canal Co. (C. C.) 128 Fed. 776. The idea of an exclusive right in the people of a state to divert its running waters to the injury of riparian owners in another state must be equally untenable. Indeed, the doctrine of riparian ownership and use of running water is not subject to political boundaries. Between hostile states the doctrine may not be recognized, but any such repudiation would be simple *vis major*. Between states dwelling in

peace and concord, as are the states of our Union, the equal right of the inhabitants of each state to the waters of intersecting streams must always be recognized. Water is essential to human life in the same degree as light and air, and no bounds can be set to its use for supplying the natural wants of men other than the mighty barriers which the Creator has made on the face of the earth.

* * * * * * * *

It is enough that complainants and their grantors were in the possession and enjoyment of the water a long time prior to respondents' diversion, and therefore the first appropriators under the law of the land as understood in Wyoming and Colorado."

This case was reversed by the Court of Appeals (*Eaton v. Hoge*, 141 Fed. 64) but the reversal was upon another point and should not weaken the case as authority upon the point here under discussion. The decision of the Court, then, in that case is that the citizens of Colorado have no right to waters of an interstate stream already appropriated beyond her borders; that the fact that the prior appropriation is beyond her borders is immaterial.

(2) *The Courts of New Mexico.*

The case from New Mexico (*Turley, et al. v. Furman, supra*), cited by counsel, decides only that the police regulations of that jurisdiction in relation to

water do not operate beyond the boundaries of the State.

(3) *The Wyoming Courts.*

The Constitution of Wyoming is quite similar to that of Colorado. The provisions are these:

> "Water being essential to industrial prosperity, of limited amount, and easy of diversion from its natural channels, its control must be in the state which, in providing for its use, shall equally guard all the various interests involved."
>
> Constitution of Wyoming, Art. I, Sec. 31.

> "The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state."
>
> Constitution of Wyoming, Art. VIII, Sec. 1.

> "Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests."
>
> Constitution of Wyoming, Art. VIII, Sec. 3.

The Supreme Court of Wyoming has been called upon to decide the force of these constitutional declarations and of a Wyoming statute containing similar provisions. A case before the Court was one in which an appropriator in Montana from a nonnavigable inter-

state stream sought to have his rights declared superior to those of an appropriator from the same stream for use upon lands in Wyoming. The opinion of the Court upon the point contains the following:

> "This court has stated that the statutory and constitutional declarations seemed rather to declare and confirm a principle already existing than to announce a new one, for the reason that under the rule permitting the acquisition of rights by appropriation the waters become perforce *publici juris.*
>
> * * * * * * * *
>
> The obvious meaning and effect of the expression that the water is the property of the public is that it is the property of the people as a whole. Whatever title, therefore, is held in and to such water resides in the sovereign as representative of the people. The public ownership, if any distinction is material, is rather that of sovereign than proprietor. (Farm Inv. Co. v. Carpenter, supra.) That ownership however, is subject to a particular trust or use, specially defined in the statutes and in the constitution. And that trust or use, in the absence of statute, is just as prominently and intrinsically attached to such public ownership. The waters are held subject to appropriation for beneficial uses. And we have endeavored to show that the right of appropriation is not, in the absence of statute at least, restricted locally nor by state lines. The trust is to be considered as co-extensive with the right on which it rests. Upon the general principles governing

such appropriation, we perceive no reason, if the same be not prohibited by statute, why the owner of lands in another state may not at a point in this State lawfully divert the water of a stream flowing in both states and conduct such water upon his lands for their irrigation, and thereby secure a valid water right. There is nothing in the essential character of the trust or use for which the waters are held by the public that, in our judgment, prevents the acquirement of a water right on such stream in that manner, provided the appropriator is able to comply with the statutory provisions regulating and controlling the appropriation and diversion of the public waters.

Moreover, a desirable comity between the states within whose respective dominions the same stream may flow, and a due regard by each for the rights of the residents and land owners in the adjoining state, would seem to require a liberal view of this matter. In an interesting case in Wisconsin, where the question arose whether the state could constitutionally sell the ice formed upon public waters, it was held that where the term 'people of the state' is used to designate the beneficiaries of the trust in navigable waters, all the people who may choose to enjoy the same within the state are referred to, whether citizens of the state or persons who came within its territory, for the purpose of enjoying such public rights. (Rossmiller v. State, 114 Wis., 169.)"

Willey, et al., v. Decker, et al., 11 Wyo. 496, 533.

Farm Investment Co. v. Carpenter, 9 Wyo. 110.

(4) *The Supreme Court of Idaho.*

The constitution and laws of the State of Idaho contain similar provisions.

"The use of all waters now appropriated, or that may hereafter be appropriated for sale, rental or distribution; also of all water originally appropriated for private use, but which after such appropriation has heretofore been, or may hereafter be sold, rented, or distributed, is hereby declared to be a public use, and subject to the regulation and control of the state in the manner prescribed by law."

Constitution of Idaho, Article 15, Section 1.

"The right to divert and appropriate the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water."

Constitution of Idaho, Article 15, Section 3.

"The right to the use of any of the public waters of this state may be acquired by appropriation which must be for some useful or beneficial purpose."

Laws of Idaho 1895, page 174, Section 2.

See also Laws of Idaho 1899, page 380, Section 2.

Laws of Idaho 1903, page 223 and following.

In the case of *Taylor v. Hulett*, 15 Ida. 265, the

Supreme Court of that State had before it questions of the relative rights between appropriators in Wyoming and Idaho drawing waters from an interstate stream, and in passing upon those questions the Court uses the following language:

> "It would seem, upon both reason and authority, that the courts of this state, in ascertaining, decreeing, and protecting property rights in water appropriations within the jurisdiction of the state, may at the same time and for that purpose inquire into and determine rights and priorities on the same stream that are located and situated beyond the state line, in order to fairly and finally judicially determine the relative rights of the parties and decree the extent of the title and right of possession of the thing or subject-matter within this jurisdiction. This proposition ought to be accorded a special recognition and application by the courts in water and irrigation litigation. Streams rise in one state and flow into another, irrespective of boundary lines, and still the rules and doctrines of priority of appropriation and use are the same in most of the arid states. This is particularly true with respect to this case. Here the riparian doctrine of the common law has been abrogated in both Idaho and Wyoming, and the rule of 'first in time is first in right' is recognized and enforced in both states. Drake v. Earhart, 2 Idaho, 750, 23 Pac. 541; Moyer v. Preston, 6 Wyo. 308, 44 Pac. 845, 71 Am. St. Rep. 914; Farm Investment Co. v. Carpenter, 9 Wyo. 110, 61 Pac. 258, 50 L. R. A. 747, 87 Am. St. Rep. 918; Willey v. Decker,

supra. The relative rights, therefore, of appropriators of the water of an interstate stream are the same, whether the appropriations are all in the same state, or some in one state and the balance in another state. This proposition is accentuated in a case like this, where the court not only has jurisdiction of the res or subject-matter, but also obtains jurisdiction of the person of the defendant. In the case at bar the diversion by the defendants, being the act that causes the injury, takes place in Wyoming; but the injury itself that flows from the wrongful act takes place in this state. It has long been recognized as a general rule that, where an act is committed in one jurisdiction that occasions injury or damage in another jurisdiction, the injured person may elect to bring his action in either jurisdiction."

(5) *The Supreme Court of Utah.*

Similar provisions are found in statutes enacted by the legislature of Utah.

Statutes of Utah, 1905, Chapter 108, Section 47.
Statutes of Utah 1907, pages 56 and 248.
Compiled Laws of Utah 1907, Section 1288, Clause 18.

The question came up somewhat collaterally in the case of *Conant v. Deep Creek etc. Co.*, 23 Utah 627. The litigation concerned the rights of appropriators taking water from an interstate stream. This question had been adjudicated by the District Court

for Oneida County, Idaho, the stream arising in Idaho and flowing into Utah. In defining the force of the Idaho decision the Supreme Court of Utah in the case above cited uses the following language:

> "It is a recognized rule of law that a person who has appropriated water at a certain point in a stream is entitled to have so much of the waters of said stream as he has appropriated flow down to him to the point of his diversion; and if the settlers higher up on the stream, in another state, whose appropriations are subsequent, divert any of the waters of the stream which have been so first appropriated, then the courts of the latter state will protect the first settler in his rights. Howell v. Johnson (C. C.) 89 Fed. 556. The Idaho courts, therefore, have ample and complete jurisdiction to protect the rights of respondents to have the waters which they have appropriated, and which they divert in Utah, flow through the channel of the stream, and to limit and determine the rights of the Idaho appropriators with reference thereto; and by the decree entered in the suit in the district court of Oneida county, Idaho, such rights were fully protected, and may be enforced by proper proceedings in that court."

(6) *The Federal Courts in the Arid Region Hold against the Defendants.*

The case of *Howell v. Johnson* (*C. C.*) 89 Fed. 556, involved a question between Wyoming lands and

Montana lands, each party claiming appropriations from a nonnavigable interstate stream. The contention was made that the Wyoming citizens owning the Wyoming lands could not maintain the action in Montana because the State of Montana owned the waters in that State. This contention was overruled by the Court, which held that the rights must be determined without reference to State lines.

In the case of *Anderson v. Bassman*, (*C. C.*) 140 Fed. 14, the same question arose between land-owners in Nevada and land-owners in California, each claiming as an appropriator of water from the same non-navigable interstate stream. The Court quotes from the cases of *Howell v. Johnson* and *Hoge v. Eaton*, *supra*, and endorses the views expressed in those cases, saying:

> "This court is in entire accord with the views of these two Courts upon this question."

In the case of *Morris v. Bean*, (*C. C.*) 123 Fed. 618, the Circuit Court for the District of Montana, upon a demurrer, again had before it the relative rights of Wyoming and Montana appropriators from the same interstate stream, and again held that the prior appropriator is protected in his right "as against subsequent appropriators although the latter withdraw the water within the limits of a different state."

The final hearing of the case was in the same Cir-

cuit Court, but before a different Judge. *Morris v. Bean*, 146 Fed. 423.

The contention was again made at the final hearing that an appropriator in Wyoming could not in a court in Montana assert rights as against an appropriator in Montana. The Court overruled this contention, the opinion containing among other things the following:

> "In the early stages of this suit Judge Knowles refused to sustain the views thus presented by the defendants. Whether the ruling made is the law of this case does not become material, because the reasons which actuated him in his decision are not only based upon sound principles, but are sustainable upon authority. No case has been cited where the distinction sought to be drawn has prevailed in the courts, but, on the contrary, apparently, wherever the question has arisen the holding has been the other way."

The case last above cited went to the United States Circuit Court of Appeals for the Ninth Circuit and was there affirmed, the Court saying, among other things:

> "The right to divert or appropriate for a useful purpose the waters of a nonnavigable stream is recognized by the laws of Montana and Wyoming, and by sections 2339 and 2340 of the Revised Statutes (U. S. Comp. St. 1901, p. 1437); and the broad principle which underlies the relative

rights of appropriators from the same stream is, that whoever is first in time is first in right, and the fact that the stream, the waters of which are appropriated, is interstate and nonnavigable, does not affect the rule."

Bean v. Morris, 159 Fed. 651, 655.

The same question arose between appropriators in different States (California and Nevada) in the case of *Miller, et al. v. Rickey, et al.* (*C.C.*) 127 Fed. 573. The Circuit Court held the rights of the parties unaffected by State lines. The case was taken to the Circuit Court of Appeals and there affirmed. The opinion of the Circuit Court of Appeals contains the following:

"The water in the stream, which has a propensity to seek its level, and will continue in its current to the sea, is in strict reality the veritable thing in controversy. It knows not imaginary state or county lines, and is a thing in which no man has a property until captured to be applied to a beneficial use. The right of appropriation is recognized in law, which means the right of diversion and use. It is the right, not to any specific water, but to some definite quantity of that which may at the time be running in the stream. So the right acquired by an appropriation includes the right to have the water flow in the stream to the point of diversion. The fact of a state line intersecting the stream does not,

within itself, impinge upon the right. In other words, the appropriation may still be acquired although the stream is interstate and not local to one state; nor will the mere fact that the stream has its source in one state authorize a diversion of all the water thereof as against an earlier and prior appropriator across the line in another state. On the contrary, one who has acquired a right to the water of a stream by prior appropriation, in accordance with the laws of the state where made, is protected in such right as against subsequent appropriators, though the latter withdraw the water within the limits of a different state."

Rickey Land & Cattle Co. v. Miller, et al., (C. C. A. 9th Cir.) 152 Fed. 11, 17.

So far as we can discover all of the courts of the arid region without any exception, whether state courts or Federal Circuit Courts or Federal Circuit Courts of Appeals, have thus agreed that prior appropriation gives priority of right without regard to State lines. And this ruling has been unaffected by general language in constitutions or statutes to the effect that the waters of streams are "declared to be the property of the state" or "property of the public". Such expressions are held to mean only that the waters are *publici juris*:— the property of the "negative community", in other words, belong to no one, until seized and beneficially used.

These are familiar ideas to all systems of law. The conception is further that he who first beneficially uses—he who first appropriates becomes the owner in the full sense that he thereby acquires a right of property—the right to use as against all others.

1 Wiel on Water Rights, Section 172.

The Decisions of This Court.

The question of the relative rights of two states and their citizens in the waters of a nonnavigable interstate stream in certain of its phases has come before this Court.

In the case of *Kansas v. Colorado*, 185 U. S. 125, and 206 U. S. 46, the question arose between states one of which maintains the doctrine of riparian rights, the other the doctrine of appropriation. The Bill of Complaint in that case is grounded largely on the claim that Kansas has the right to the uninterrupted flow of the river, while "the extreme contention of Colorado is that it has the right to appropriate all the waters of the stream for the purposes of irrigating its soil and making more valuable its own territory".

While it seems to be contended that this Court did not in that case fully or clearly decide upon this "extreme contention" of Colorado—did not in terms decide whether or not Colorado as claimed in that case

and here has the "paramount right to the exclusive use of the water of her natural streams in so far as her necessities require the use of such waters for beneficial purposes within the state", it must be conceded that at the very least this Court in that case *arguendo* takes strong grounds against the doctrine there and here claimed in favor of Colorado. In that case the whole spirit of the decision is against that extreme contention. Besides this general spirit the Court made use of the following language:

> "Colorado could not be upheld in appropriating the entire flow of the Arkansas River, on the ground that it is willing to give, and does give, to Kansas something else which may be considered of equal value." (Page 100.)

And at another place in that case this Court said:

> "At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes." (Page 117).

This language seems to be entirely inconsistent with any view that Colorado by virtue of her sovereignty or of any declaration in her constitution has the

right to the exclusive use of all waters within the State regardless of the effect upon other states or upon the citizens of other states.

The case of *Rickey Land & Cattle Co. v. Miller & Lux*, *supra*, came before this court on certiorari, 218 U. S. 258. This Court affirmed the decree. The opinion contains the following:

> "It is conceivable, to be sure, that the decisions of this court may determine that the States have rights as against each other *in invitum* in streams that flow through the land of both. Kansas v. Colorado, 206 U. S. 46, 84. Missouri v. Illinois, 200 U. S. 496, 519, 520. These rights may vary according to the system of law required by natural conditions. They may be more or less analogous to common law rights between upper and lower proprietors, where irrigation is not necessary, as in most of the older States. See New York v. Pine, 185 U. S. 93, 96. There may be some, perhaps limited, right of appropriation in the upper State, at least in the watershed of the stream, where irrigation is the condition of using the land. See Kansas v. Colorado, 206 U. S. 46, 100-104, 117. But whatever this court may decide, if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his State, and those rights, the petitioner insists, can, or at least should be, determined only in a suit brought by the State itself.
>
> * * * * * * * * *

> We are of opinion that the petitioner fails to establish the conclusion for which it contends. The alleged rights of Miller and Lux involve a relation between parcels of land that cannot be brought within the same jurisdiction. This relation depends as well upon the permission of the laws of Nevada as upon the compulsion of the laws of California. It is true that the acts necessary to enforce it must be done in California and require the assent of that State so far as this court does not decide that they may be demanded as a consequence of whatever right, if any, it may attribute to Nevada. But, leaving the latter possibility on one side, if California recognizes private rights that cross the border line, the analogies are in favor of allowing them to be enforced within the jurisdiction of either party to the joint arrangement."

Likewise the case of *Bean v. Morris*, *supra*, was brought to this Court upon certiorari, (221 U. S. 485.) The decree as entered by the courts below was likewise affirmed in that case. The Court, among other things, says:

> "We know no reason to doubt, and we assume, that, subject to such rights as the lower State might be decided by this court to have, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that State. Kansas v. Colorado, 206 U. S. 46, 93-95. Therefore, subject to the same qualifi-

cations, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. Missouri v. Illinois, 200 U. S. 496, 521. Rickey Land & Cattle Co. v. Miller & Lux, 218 U. S. 258, 260. But with regard to such rights as came into question in the older States, we believe that it always was assumed, in the absence of legislation to the contrary, that the States were willing to ignore boundaries, and allowed the same rights to be acquired from outside the State that could be acquired from within. Manville Co. v. Worcester, 138 Massachusetts, 89. Thayer v. Brooks, 17 Ohio, 489. Slack v. Walcott, 3 Mason, 508, 516. Stillman v. White Rock Manuf. Co., 3 Woodb. & M. 538. Rundle v. Delaware & Raritan Canal Co., 1 Wall. Jr. 275, 14 How. 80. Foot v. Edwards, 2 Blatchf. 310. See Wooster v. Great Falls Manuf. Co., 39 Maine, 246, 253, Armondiaz v. Stillman, 54 Texas, 623; State v. Lord, 16 N. H. 357. Howard v. Ingersoll, 17 Alabama, 780, 793. There is even stronger reason for the same assumption here. Montana cannot be presumed to be intent on suicide, and there are as many if not more cases in which it would lose as there are in which it would gain, if it invoked a trial of strength with its neighbors. In this very instance, as has been said, the Big Horn, after it has received the waters of Sage Creek, flows back into that State. But this is the least consideration. The doctrine of appropriation has prevailed in these regions probably from the first moment that they knew of any

law, and has continued since they became territory of the United States. It was recognized by the statutes of the United States, while Montana and Wyoming were such territory, Rev. Stat., Secs. 2339, 2340, p. 429, Act of March 3, 1877, c. 107, 19 Stat. 377, and is recognized by both States now. Before the state lines were drawn of course the principle prevailed between the lands that were destined to be thus artificially divided. Indeed, Morris had made his appropriation before either State was admitted to the Union. The only reasonable presumption is that the States upon their incorporation continued the system that had prevailed theretofore, and made no changes other than those necessarily implied or expressed. See Willey v. Decker, 11 Wyoming, 496; Smith v. Deniff, 24 Montana, 20."

It does not seem to us that the case of *Hudson Water Company vs. McCarter*, 209 U. S. 349, cited by counsel, has anything contrary to the contentions of complainant here. That case was based largely upon the principles underlying the doctrine of riparian rights. The opinion itself states, "the problems of irrigation have no place here." The attempt which was enjoined in that case was an attempt of a riparian proprietor to divert and take away to a long distance a very substantial portion of the stream. The holding by the State Court was "that a riparian proprietor has no right to divert waters for more than a reasonable

distance from the body of the stream or for other than the well known ordinary uses and that for any purposes in general he is narrowly limited in amount." This statement of the doctrine seems to be concurred in by this court. The case was not one where the state was seeking to divert the water of the stream so as to injure those below, but, on the contrary, the state, in its own right and in the right of the riparian owners below, sought successfully to prevent the diversion of the stream.

APPLYING THE PRINCIPLES MAINTAINED BY THE COURTS.

Both Colorado and Wyoming have held that the doctrine of prior appropriation of waters through the very necessities caused by the arid conditions prevailing, were in force throughout this region long before any constitutional provision was adopted or statute enacted on that question. Both states hold that he who first applies the waters to a beneficial use thereby acquires a property right prior and superior to the rights of all others who may come afterwards to those waters. The laws and customs of the two States concur. The constitutions of the two States contain similar terms upon the question, and the courts of both States hold

that these constitutional provisions enact nothing new but merely declare that which was the rule before. The rule and custom had in the beginning no regard to state boundaries; indeed it was recognized and prevailed when there were no state boundaries. There is no legislation in either state restricting the rights acquired to lands within its own boundaries.

These States touch one another along a line more than two hundred and fifty miles in length. Both States are at the summit of the continent. Across the boundary line between them some of the streams flow southward and some flow northward. Indeed about two-thirds of that line sees its streams arising in Wyoming and flowing southward into Colorado. Along about one-third of the line the streams originate in Colorado and flow into Wyoming. Throughout practically the entire line bounding Wyoming on the East, North and West Wyoming is the upper state. Her mountains and plains gather the water into streams and pour them into the domains of her neighbors. So the plaintiff is not here asking the enforcement of any right which shall work out advantageously to her alone.

For the moment we may waive for the purposes of the argument the question of the extent to which Colorado might go by appropriate legislation in the way of appropriating all of the streams of the State

as she might choose regardless of the destruction thereby wrought in other states. These facts would still remain.

1st. That Colorado has not so legislated.

2nd. That she concurs with Wyoming in the proposition that the very necessities of the region created the principles underlying appropriation which operated throughout the entire region before the States were in being and without regard to state lines.

3rd. That growing out of this absence of legislation coupled with this necessity and the resulting laws and customs, it must be assumed that Colorado has ignored and been willing to ignore boundaries and allow "the same rights to be acquired from outside the state that could be acquired from within".

Upon this assumption plaintiff and her citizens had a right to rely. They began the use of these waters long before there was any state boundary between the lands now in Colorado and those in Wyoming, and have continued till now. They applied these waters to a beneficial use long before any thought of using them came to the defendants. By such use Wyoming and her citizens have built up and are maintaining within the water shed a large and prosperous community. Such a community and the values they have created and are sustaining are substantial and give

substantial rights such as a court of equity will regard even in a contest between states. The defendants seek to destroy this community and these values, not because of any prior use of the water by them, but for the purpose of beginning in the future a new use of these waters. They seek to make fertile in the future lands which are now arid,—to create in the future a community where there is now a desert, but to make fertile this new region and build this new community in Colorado they restore to the desert a region which has already been reclaimed and destroy the community already built up in Wyoming. And this water is to be used by the defendants in the future, not upon riparian lands where some compensating benefit might accrue to the complainant, but entirely outside of the water shed at points so remote and so situated that no part of the water taken can in any way reach or benefit complainant or its citizens.

COLORADO MAY NOT NOW DIVEST COMPLAINANT AND HER CITIZENS OF THESE PROPERTY RIGHTS.

All of these appropriations of water by complainant and her citizens became vested property rights before the diversion charged in the Bill was threatened.

Upon the facts alleged all the courts agree that this result was accomplished. These property rights became so vested at a time when there was neither constitution nor statute of Colorado expressly or otherwise refusing her assent to a rule and principle which had been in operation from the beginning throughout the region with no limitations by artificial boundaries.

Colorado may not now if she would, by any act of her legislature or people, without process of law, take away these vested property rights. Indeed she has not attempted it. Her administrative officers alone without any legislative declaration, are claiming here their right as representatives of Colorado to create the disaster to Complainant and her people. No action of these can operate to overcome the presumption that Colorado concurs with Wyoming in ignoring boundaries, even if such presumption were necessary.

THE GENERAL SOVEREIGN RIGHTS OF COLORADO WITHIN HER OWN BOUNDARIES.

But Counsel quote from the case of Kansas v. Colorado the following:

> "The powers affecting the internal affairs of the States not granted to the United States by the

> Constitution nor prohibited by it to the States are reserved to the States respectively and all powers of a national character which are not delegated to the National Government by the Constitution are reserved to the people of the United States."

In the language above quoted this Court was not speaking of the rights of a state as against its neighbors. The question there discussed grew out of a contention by counsel for the GENERAL GOVERNMENT that in some way a superior right was vested in the United States as a sovereign "to control the whole system of the reclamation of arid lands" as against the states. The language quoted had to do with the powers conferred by the constitution upon the General Government. It had nothing to do with the question how far a state might invade or ignore private rights or the rights of other states.

SOME THINGS FORBIDDEN TO STATES.

It is manifest that there are many things injurious to her neighbors which no state may do even within her own boundaries.

> Missouri v. Illinois, 180 U. S. 208; 200 U. S. 496.
> Kansas v. Colorado, 185 U. S. 125; 206 U. S. 46.
> Rhode Island v. Massachusetts, 12 Peters 720.
> Georgia v. Tennessee Copper Co., 206 U. S. 230.

It is equally clear that general discussions as to the powers granted and powers reserved as between the states and the General Government are of little, if any, service in drawing the line between permitted and prohibited injuries by one state to its neighbor.

Nor is it true that controversies between states must be determined by the rules of strict legal right as distinguished from equitable principles. This court has jurisdiction of controversies between two states, not only such as arise at law but also such as arise in equity.

The plaintiff contends that the defendants are invading her rights. Of course before it arises to such dignity as to require redress here such an invasion must cause substantial injury, and it may be that substantial injury to a state must be weighed on different scales from those used in weighing injuries to individuals. But here the damage threatened we submit is substantial even in a controversy between states, and we submit that the substantial character of the right and damage being as shown, the equities of these states rest largely upon principles similar to those underlying equities between individuals. And in controversies between individuals all the courts of the arid region, State and Federal, unite, as we have seen, in sustaining the equities and redressing the grievances

such as these brought to the attention of this Court.

(b) THE RULE OF EQUITABLE APPORTIONMENT.

Counsel discuss in their brief the rule applied in the case of Kansas v. Colorado allowing to the upper state the right to use the waters of the stream in such way as not unreasonably to diminish the flow reaching the lower state.

It seems to us that this use of the Kansas-Colorado case ignores the caution given by the opinion in that case. The opinion warns that "the views expressed in this opinion are to be confined to a case in which the facts and the local law of the two states are as here disclosed". This warning is coupled with the discussion of the local law as decided by the courts of last resort of the two states. The rule of riparian rights as decided by the Supreme Court of Kansas was by this Court deduced from the opinion in *Clark v. Allaman*, 71 Kansas 206, considered in connection with a quotation therein from observations by Chief Justice Shaw in *Elliott v. Fitchburg Railroad Co.*, 10 Cush. 191. The riparian doctrine as held by Kansas was thus found to recognize "the right of appropriating the waters of a stream for the purposes of irrigation subject to the condition of an equitable division between the riparian proprietors." And this Court after show-

ing that to be the rule in Kansas declares that that state "cannot complain if the same rule is administered between herself and a sister state". Therefore it was that the rule of "equitable division" was adopted in that case. The divergence between the laws of Kansas and those of Colorado left no room to base the decision upon any principle concurred in by both. There was no principle held by Colorado which could be so used as to mete out justice and equity to Kansas with its different rule as to waters. Therefore the Colorado contentions seem to have been rejected. The riparian doctrine as held by Kansas was found to do equity both to Colorado and to Kansas, and therefore that doctrine was adopted.

In the case at bar both states have always held that it is just and right and equitable that the first appropriator shall be protected in his appropriation, that it is inequitable for anyone who afterwards attempts to use any waters of the stream to so use them as to interfere with the full use of the prior appropriator. Colorado has always freely granted equitable relief to protect the prior appropriators against any interference. How can she here complain "if the same rule is administered between herself and a sister state". Colorado when settling controversies between individuals has always insisted not only that this rule is

equitable but that every other rule is inequitable. Why shall she not herself submit to do that which is right? Wyoming has always held to the same rule and could not ask, and does not ask the application of any other rule here.

It seems to us, therefore, that the only rule of "equitable division" which actually does equity between these parties is the rule of prior appropriation.

(3) CERTAIN ANCILLARY QUESTIONS.

We will next discuss certain questions which counsel discuss in their brief and which though material are in relation to matters other than those of first importance on the merits.

(*a*) *The sufficiency of the Bill to show prior appropriation.*

It is claimed by counsel here that the Bill does not state a cause of action under the doctrine of prior appropriation. For this contention they cite the following cases:

Farmers High Line Canal & Reservoir Company, et al. v. Southworth, 13 Colo. 111.
Church v. Stillwell, 12 Colo. App. 43.
Carroll v. Vance, 39 Colo. 216.
Wutchumna Water Co. v. Pogue, 151 Cal. 105.

In each of the cases cited the averment was merely and only that the plaintiff appropriated. No fact was given as to time, or manner, or application to beneficial use. We have no quarrel with the rule as quoted by counsel from one of the Colorado decisions, as follows:

> "In pleading an appropriation, it is necessary to plead the facts which constitute the appropriation."

Nor with that other statement quoted from another Colorado case, as follows:

> "In a suit to determine the priorities of such right, it is not sufficient for the plaintiff to merely allege in his complaint that he has the priority of right. That is a legal conclusion. He must specifically aver all of the substantive facts which are necessary to constitute such priority."

Counsel quoted from a single averment in the Bill here which alleges the extent of the appropriation, viz., that the plaintiff and its citizens had appropriated the waters of the river for the actual irrigation of 325,000 acres of land. The Bill on page 9 alleges that:

> "For many years prior to the commencement of said wrongful acts the lands in Wyoming lying along the said Laramie River and its tributaries and in its drainage basin had been settled, cul-

tivated, improved and rendered highly productive *by the practice of irrigation and the use of the waters of the said Laramie River and its tributaries for the irrigation of the said lands.*"

Here we have the statement of the actual application of the water to the lands by irrigation, which is in itself an appropriation provided such application results beneficially. There is also the averment here that this application of the waters in the way of irrigation was many years prior to the commencement of the wrongful acts of the defendants, so that without stating it as a conclusion of law, the facts are here alleged making the appropriation prior and superior to the appropriation by the defendants, which, as the averment is, began many years later.

On page 15 of the Bill the allegation is made that the use of the waters in irrigation is beneficial, and that the taking away of the waters would be destructive to the values of the lands. The allegation is in these words:

> "And your Orator further avers that without the use of the said waters as aforesaid the lands of your Orator and its citizens within the said water shed within the State of Wyoming would be to a very large extent valueless and incapable of supporting any considerable population, and

that with the use of the said waters as aforesaid, the said lands are very valuable, to-wit, of a value of more than ten million of dollars, and support a large population, to-wit, a population of more than twenty thousand people, and that the wrongs and threatened wrongs of the said defendants as hereinafter set forth if persisted in would render the lands of your Orator and its citizens in the said water shed and drainage basin to a very large extent valueless."

The things necessary to constitute prior appropriation are these three.

1st. The water must have been applied upon the lands.

2nd. The use must have been beneficial.

3rd. This must have been accomplished prior to the application of the same waters by those who are sought to be made junior.

Wiel on Water Rights 3rd Ed. Sec. 365, and cases there cited.

All of these facts which constitute the prior appropriation are alleged in the Bill outside of the paragraph quoted by counsel. Having alleged these facts, it was not improper for the Bill in the paragraph quoted by counsel to draw the legal conclusion that there was

an appropriation and that it was prior to any right in the defendants.

(*b*) *The question as to the place of use.*

For the general purposes of the discussion here at this time we might well waive all contention with counsel in relation to the materiality of the place of use of the water. We might here for the purposes of the argument concede that the rule defining rights between appropriators disregards the place of use and permits water to be diverted from the water shed of one stream to the water shed of another. Even so, this is but a subsidiary rule to the general doctrine of appropriation and is applicable only where the doctrine of appropriation is adopted. This subsidiary rule, moreover, has the following conditions precedent.

First. The new diversion must not injure any prior appropriator.

Atchison v. Peterson, 20 Wallace 507, 514.
Wellington v. Beck, 30 Colo. 409.
Wellington v. Beck, 43 Colo. 70.
Telluride v. Blair, 33 Colo. 353.
Willey v. Decker, 11 Wyo. 496.

Second. If any appropriator would change the place of use of his waters, he may do so only in case he so changes the place of use as not to injure any other appropriator, either prior or subsequent.

New Cache La Poudre Irrigating Co. v. Water Supply & Storage Co., 49 Colo. 1.
Johnston v. Irrigating Co., 13 Wyo. 208, 237.

In this case under the averments of the Bill the diversion is practically a new diversion, and is destructive of the rights of complainant and her citizens who are prior appropriators.

The plaintiff might well complain against new appropriations within the water shed provided those new appropriations became injurious to her rights. But it was found, as the Bill alleges, that so far as water has heretofore been diverted for use in the water shed seventy-five per cent. of it returns to the stream. It was further found that the area within the water shed in Colorado upon which waters might be used, so far as the plaintiff now knows is not great, nor did the plaintiff find any threatened diversion for use within the water shed concerning which she felt it necessary to complain. The whole complaint, therefore, was that the defendants are threatening now to take water in such way as to greatly injure the plaintiff and her citizens, and to interfere with their prior appropriations, and one element in the matter of working injury is the fact that the threatened diversion will take the waters far beyond the water shed so as to increase greatly the injury that would otherwise be sustained.

We respectfully submit that the Bill states a cause of action; that the invasion of the rights of the plaintiff is of such magnitude as to entitle her to relief, and that the demurrer to the Bill should be overruled.

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In the Supreme Court of the United States.

No....., Original.

IN EQUITY.

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, DEFENDANTS.

BRIEF OF DEFENDANTS ON DEMURRER.

STATEMENT.

The rapid development of irrigation in that part of the United States formerly known as the Great American Desert has given rise to a variety of perplexing problems. Not that the problems themselves are new, for they are not, any more than irrigation itself is new. From the very beginning of the human race we find evidences that the artificial use of water

for growing crops was one of the first steps taken in the development of civilization. All of the great civilizations in the early history of mankind arose in countries where the rainfall was either so slight or so precarious and uncertain that the artificial application of water to land in order to raise crops was a necessity from the very beginning, and a necessity which constantly grew as the nation and its civilization grew.

Thus, there are innumerable quotations in the Old Testament pointing to a knowledge of irrigation; the laws of King Hammurabi of Babylon, unearthed comparatively recently, contained a complete irrigation code, and we know that irrigation was practiced in the valleys of the Tigris and Euphrates from a very early date. The old Chinese, Indian and Egyptian peoples were irrigators; in later days, both Carthage and Rome diverted water for domestic uses and for irrigation. Ruins of old irrigation systems are found all through northern Africa, in Peru and in Mexico. Irrigation has been practiced in Spain at least since the time of the Moors, and probably before; and in Italy, the valley of the Po has been irrigated since about 1100, there being one irrigation ditch at least still in use which is over 800 years old.

In all of these countries we find the development of irrigation closely paralleling in all essential respects our own development in the western part of this country. The same engineering and hydraulic questions have been met and overcome, and the same difficulty has been experienced in molding laws to fit the constantly increasing use and value of water. Indeed, a striking instance of this has come down to

us from Roman times and has found a permanent place in our language. In old Roman days an artificial water channel, and therefore a ditch, was a *rivus,* and the users from such a water-course were *rivals;* and the word still retains its suggestion of the constant struggle for water which apparently characterized the fellow-irrigators of those days, as it does those of our day.

In tracing the history of irrigation, we find that the first use of water is made by small individual ditches which water the land immediately adjacent to the stream. As civilization progresses and a larger amount of land is to be called into requisition to support the needs of the people, these ditches are extended.

By being taken out farther up the river they can be made to cover more land. This means, of course, a longer ditch and greater expense, and then the element of co-operation enters, and associations, and in later history companies, are formed to construct these ditches and divert the water. As the needs continually increase, the question of storage of flood waters, and of water during the season when it is not required upon the land, arises, and reservoirs are constructed. Later the people, in the constant search for more water, turn to other streams, and irrigation reaches the stage where great rivers are turned from their course and made to pass over or through mountain ranges, in order to bring the water into the region where it can be of the greatest amount of service. There are cases of this last-mentioned development in India, China and Italy.

In our own country this same development has been taking place, the only difference being that it has probably gone ahead much more rapidly here than in any other instance in history, due partly to the tremendous advances that have been made in all lines of science, and partly to the character of the Anglo-Saxon race, which has for the first time seriously taken up the science of irrigation. In their home of centuries in middle and northern Europe and in the British Isles, the Anglo-Saxon race and the allied Germanic races have not been called upon to meet this particular problem of applying water to land for the raising of crops, and in the early settlement of this country, in its eastern half, there was no necessity for such a practice. It was only when the Mormons, driven out from their eastern settlements, started to found an empire in the deserts of Utah, where at last they were sure that the unsympathetic civilization of the Gentiles would never reach them, and a little later when the discovery of gold in California brought thousands of settlers from the East, who had to be fed from a soil which, without the artificial application of water, was sterile and barren, that irrigation began in the United States.

The early Californians learned the value of water from their mining, where, both in placer and hydraulic mining, water was diverted and used before it was dreamed of applying it to the land for agricultural purposes. In Utah, however, the use of water for irrigation was instinctive, and our irrigation really had its beginning there. As this court, however, knows from the evidence in the case of Kansas vs. Colorado, there was irrigation in parts of New Mex-

ico and Arizona long before any settlement of the western portion of the country by the Anglo-Saxon race. But it is from the irrigation in Utah and California that the beginning of our present irrigation history should be dated. The development of irrigation here has followed the course which we have mentioned before—starting out first with irrigation of small tracts of land on the banks of the stream from which the water is taken, extending constantly farther and farther back from the stream, accompanied by the building of larger ditches, by the formation of irrigating companies and irrigation districts, and finally, when the enterprises grew too gigantic, to the entry into the field by the government itself.

Never in the history of irrigation have works of such magnitude, or enterprises of such daring or ingenuity, been projected or carried through as within the last sixty years. Reservoirs have been built until the flood waters and the winter flow of our streams are as fully appropriated as the ordinary flow of the streams during the irrigating season; and now the waters of the streams of the West are, when necessary, being carried across ranges of mountains by miles of ditches, or through the mountains by long tunnels, in order that every drop of water, so far as possible, shall be taken where it can be used; and not only where it can be used, but where it can be used with the least waste and largest return. In this stage of the work, some of the tremendous undertakings of the Reclamation Service are good examples.

In what is known as the Strawberry Project in Utah, the headwaters of Strawberry Creek are stored and diverted from the Green River drainage through

a tunnel 19,200 feet long, in the Wasatch Range, into Diamond Creek, a tributary of Spanish Fork River, and there used to irrigate lands draining into Utah Lake, at a cost of over three million dollars.

In what is known as the Milk River Project, the government is taking water from St. Mary's River, which rises in northwestern Montana and flows north into Canada, emptying into the Saskatchewan River. This water is to be taken over the Continental Divide by a canal twenty-six miles in length, into the north fork of the Milk River, which flows into the Missouri River, and carried down the Milk River over 100 miles. In this course it passes from the United States into Canada, and then back into the United States, before being diverted upon the lands to be irrigated. The total cost of this project is estimated at six million, two hundred thousand dollars.

In California the development of great centers of population is forcing a search for water and a tremendous diversion, as in the case of Los Angeles, where the water of the Owens River is being taken from the east side of the Sierra Nevadas to the Pacific slope, and thence to the city of Los Angeles, at a cost of twenty-five million dollars. The city of San Francisco has long been getting its water from the hills south of the city and bringing it to a different watershed; now it is proposed to go very much farther for a similar purpose, at tremendous expense. Some of the great cities of the East have done much the same thing. Thus, New York City has taken water from numerous small watersheds, all tributary to the Hudson; while Chicago takes water from the watershed of the Great Lakes and discharges it by canals into

the watershed of the Gulf of Mexico—a fact which was commented on by this court in the case of Missouri vs. Illinois, 180 U. S., 208; ibid., 200 U. S., 496.

The part which Colorado has played in this tremendous development of irrigation can hardly be overestimated. Situate on the very crest of the Continental Divide, with a climate which makes irrigation necessary for every acre of land which is to be cultivated, and with a soil which, when the water is applied, produces with an abundance undreamed of in less-favored localities, Colorado was quick to see the necessity of irrigation, and as quick to take advantage of her knowledge. The people early saw the futility of attempting to combine irrigation with the doctrine of riparian rights with which California was struggling, and, after declaring the water to be the property of the people of the State of Colorado, set at work at once to utilize that water to the greatest possible extent for the common good. Since then Colorado has to her credit a greater number of tremendous irrigation enterprises and a more widely developed system of irrigation than any other state in the Union. The various stages in the development of irrigation have been met and, after their problems have been grappled with, have been passed. The carrying of water from one watershed to another is not new in Colorado, nor in the history of irrigation elsewhere. It has been practiced here in a great many instances, and the Supreme Court of Colorado was probably the first court to pass upon such a question in the case of Coffin vs. The Lefthand Ditch Company, 6 Colo., 443.

The present project, which the State of Wyoming is now seeking to enjoin, is another project for the transfer of water from one watershed to another, at a cost of about five million dollars, and is similar to many of the instances mentioned above. The waters of some of the tributaries of Laramie River in Colorado are proposed to be brought through a tunnel in the Continental Divide to the plains of eastern Colorado and there used for irrigation. The State of Wyoming, which, as we shall see later in this brief, has been doing exactly the same thing for a number of years, following the lead of Colorado, though on a smaller scale, since the development of Wyoming has not kept pace with the development of Colorado, is now objecting to this diversion upon a theory which seems to be a blend of the doctrine of appropriation with the doctrine of riparian rights, and which results in her taking a position not unlike the position which was taken by Kansas in the case of Kansas vs. Colorado; namely, that under some doctrine of riparian rights as between states, Wyoming is entitled to have the water come down to her from Colorado without diminution, in order that her citizens, under the doctrine of appropriation, may apply the water to irrigation.

It is unnecessary to point out to this court that the use of water for irrigation has always raised legal questions of peculiar perplexity and interest. This seems to have been the case in all nations from what records we have, though the difficulty was perhaps not so striking, since in those cases the doctrine of irrigation generally grew up with the legal history of the nation, and where there were any such diffi-

culties there was always a supreme law-making power which was not embarrassed by any troublesome constitutional questions. In this country, however, the difficulties have been and still are great. The doctrine of irrigation has not grown up with the Anglo-Saxon people nor with their laws. It has arisen *ex necessitate rei*. Our people found themselves face to face with conditions which the English people had never before faced, and for which the common law in its great mass of decisions had no adequate theory. Our system of law, however, has been sufficiently assimilative to incorporate this doctrine of appropriation and to harmonize it with the rest of our body of law, in much the same way that it absorbed the new system of law which grew up out of the customs of miners in California and finally developed into our law of mining rights. Yet, in the law of irrigation the difficulties have been greater, since it has brought into being questions which never existed in the mining law; that is, questions between states.

It is obvious that these questions could not arise in the early history of irrigation in this country, the early irrigation being merely upon lands immediately joining the river, and the irrigated land being comparatively small in quantity. The results of irrigation in one state upon another state were not felt for a number of years, until the area of irrigated land had broadened, and until the scarcity of water and its value had grown tremendously. Nor do we yet know at all fully what the result of irrigation in one state is upon the stream in another state. How far the use of water in the upper state and the conserving of water by reservoirs is a benefit instead of a detriment

to the lower state, is a question which, as this court will remember, was involved in the Kansas-Colorado case, but as to which there is still a great deal of speculation among expert engineers. In other words, we are at that period when the states are beginning to be alarmed about the diversion of water in an upper state; and yet this diversion has not continued long enough, or been sufficiently fully observed, so that the damage or benefit, as the case may be, can be authoritatively stated, or the remedy (if remedy is necessary) prescribed.

Naturally Colorado is the center of these attacks, both because of her geographic location, being the upper state in regard to all streams and the lower in regard to none, and because, on account of the advance which she has made in irrigation, she is making more use of her water than most of the states, and therefore is the first one against which complaints are directed.

This litigation over water between states is therefore of recent growth. The ultimate question involved had been foreshadowed for some time before the case of Kansas vs. Colorado by a number of suits in both the federal and state courts between individual appropriators upon the same stream in different states. All of these cases in the federal courts, and some of the state cases, have been decided by applying the doctrine of priority of appropriation between the contending appropriators, without regard to state lines. The difficulty of this doctrine, however, can be seen at once, and was seen very plainly when the states themselves finally entered the field and the case of Kansas vs. Colorado was instituted

in this court. The doctrines of priority of appropriation are not the same in all of the states. The right does not date from the same acts, and the question of procedure necessary to gain a right is entirely different. Moreover, some states have attempted to combine the doctrine of appropriation with the doctrine of riparian rights, making a still greater difficulty in adjudicating rights in different states; but with the Kansas-Colorado case the chief difficulty was immediately apparent. If, as this court has held, a state has a right to sue to restrain a diversion of water by an upper state, or, at least, if this is a proper matter to be tried out between the states themselves; and if, as must be the case, a private appropriator's right is subordinate to, and dependent upon, the right of his state, how can the rights of private appropriators in different states be determined until the rights of their respective states are fixed? In the case of Kansas vs. Colorado these questions, while they would naturally suggest themselves, could not be determined, since Kansas was basing her claim upon a doctrine of riparian rights as against the doctrine of appropriation in Colorado. In this case for the first time is presented a question of right as between two states, both of which have adopted the appropriation doctrine.

Both states desire this water for the same purpose, and this presents squarely the question: Upon what basis are the rights of the states to the waters of interstate streams to be determined? It seems to us that there are only three positions which can possibly be taken upon this matter, and from which the doctrine which this court shall decide to be the law must be taken. These doctrines are as follows:

First—This matter is to be viewed as between two sovereign nations; sovereign in so far as they have not surrendered their sovereignty by the Constitution. This is not one of the matters in regard to which sovereignty was surrendered, and each state, therefore, has exactly the same right to the development and use of its natural resources as one independent nation has against another, and that is the right to the fullest use and enjoyment of all resources within its own borders, without regard to any effect such use and enjoyment may have upon a neighboring sovereignty.

Second—Although the question is one between two sovereignties, yet the sovereignty of each state is under some limitations. While each state has full authority over its own natural resources, yet it must use those resources in such a way as not to unreasonably diminish the resources of its neighboring state.

Third—The question should be settled upon the law of prior appropriation in regard to the particular appropriations in question, and without regard to state lines.

That this is a question between two sovereignties, and therefore falls within one of the first two theories given above, is, we think, conclusively settled by the case of Kansas vs. Colorado. The third doctrine is the one laid down in the early federal cases in the Circuit Courts and the Circuit Courts of Appeal between private parties, and practically amounts to a federal regulation, or at least to a federal adjudication, of all priorities upon a stream, regardless of state lines.

If the first doctrine, which we contend is the law as between states, is adopted, it is obvious that the bill in this case presents no ground for relief on behalf of the state of Wyoming. We think it is equally plain, however, that under either of the other two doctrines the bill is also defective in failing to present any case for relief, and we shall therefore discuss these doctrines in the order above given, and also discuss the allegations of the bill in reference thereto.

BRIEF AND ARGUMENT.

I.

The State of Colorado, as one of the sovereign states of the Union, has the right to control the waters of the non-navigable streams of the state without interference by any other state.

Colorado is situate upon the crest of the Continental Divide. Six interstate streams of considerable size take their rise in its mountains: the Grand River, running westerly into the State of Utah, and there forming a junction with the Colorado; the Laramie, flowing in a northerly direction into the State of Wyoming; the South Platte, flowing northeasterly into Nebraska; the Arkansas, easterly into Kansas; the Animas, southerly into New Mexico; also the Rio Grande, having its source in the Rocky Mountains, flowing southerly into New Mexico and forming the boundary between the United States and the Republic of Mexico. None of these streams are navigable.

Colorado is essentially an arid state, incapable of growing crops except by irrigation. The precipitation

is light, varying in the farming districts from an annual minimum of eight to fourteen inches, according to the locality, to an annual average in the higher mountains of about twenty-five inches, making a general average for the entire state estimated at 14+ inches.

According to the last census, Colorado contained a population of 799,024. While much of this population was originally attracted to the state by its mining resources, these interests have become less and less important in the passing years, and it may be conservatively stated at the present time that the entire population is either directly or indirectly dependent for its very existence upon irrigation.

In another part of this brief we shall urge that if the rule of equitable apportionment shall control, the topography of the state is such that, in so far as the Laramie River is concerned, it is a physical impossibility for Colorado to secure an equitable proportion of the waters of that stream; and if it were within the issues, we think it could likewise be demonstrated that as to other streams the same is true, and that an equitable apportionment would allow Colorado the use within her borders of all the waters of the streams having their sources within the state, leaving to the lower states, with their greater precipitation, all the waters falling within their borders, together with such surplus water as may be discharged in times of flood, and at other periods when the water is not required for beneficial purposes by the upper state.

Considering the several states of the Union as independent sovereignties, we shall endeavor to show that, under the rules, principles and precedents of international law, the State of Colorado as a sovereign

state has a right to the use of the waters of all its natural streams, so far as the same may be necessary to economically and yet fully develop the resources of the state. We shall then contend that this principle of international law has not been modified, set aside or annulled by the Federal Constitution, in so far as the issues in this case are concerned.

The nature and scope of such sovereignty, with respect to judicial jurisdiction, which is one of its elements, is well set forth by Chief Justice Marshall in the early case of the Schooner "Exchange" vs. McFaddon. The case involved the inquiry as to whether an American citizen could assert in an American court a title to an armed national vessel, found within the waters of the United States, and upon this question the great chief justice said, at page 135:

> "The jurisdiction of courts is a branch of that which is possessed by the nation as an independent sovereign power. The jurisdiction of the nation, within its own territory, is necessarily exclusive and absolute; it is susceptible of no limitation, not imposed by itself. Any restriction upon it, deriving validity from an external source, would imply a diminution of its sovereignty, to the extent of the restriction, and an investment of that sovereignty, to the same extent, in that power which could impose such restriction. All exceptions, therefore, to the full and complete power of a nation, within its own territories, must be traced up to the con-

sent of the nation itself. They can flow from no other legitimate source."

Schooner "Exchange" vs. McFaddon et al., 7 Cranch, 116, p. 136.

The question under consideration is very ably discussed in an opinion rendered by Judson Harmon while attorney general in 1895. The Mexican minister had complained upon the ground that the city of El Paso del Norte had for about three hundred years enjoyed the use of the waters of the Rio Grande for irrigation, while quite recently ditches for similar purposes had been constructed in Colorado and New Mexico and used with the effect of diminishing the water supply at El Paso del Norte, thus reducing the price of land and causing other damage. The claims of the injured parties were asserted for them by the Republic of Mexico, and upon a resolution of Congress the matter was submitted by the secretary of state to the attorney general of the United States for his opinion. In the opinion the authorities upon international law are reviewed and are shown to impose no duty or obligation upon the United States requiring it to prohibit its inhabitants from the use of the water of that part of the Rio Grande lying entirely within the United States, although such use results in reducing the amount of water below in the Republic of Mexico. It was also concluded that the fact that there is not enough water in the Rio Grande for the use of both countries for irrigation purposes does not give Mexico the right to subject the United States to the burden of arresting its development and denying to its inhabitants the use of a provision which nature has supplied entirely within its own territory; that the

recognition of such a right would not be consistent with the sovereignty of the United States, as "the fundamental principle of international law is the absolute sovereignty of every nation, as against all others within its own territory."

Opinions of the Attorneys General, Vol. 21, p. 274.
Hilton vs. Guyot, 159 U. S., 113.

International servitudes are upheld by some authorities, such as Heffter and Phillemore, while others, like Grotius and Woolsey, deny their existence apart from an agreement; but, as between the states, the right is only recognized on the assumption of a concurrence between the two states, the one, so to speak, offering the right, the other permitting it to be accepted.

Manville Co. vs. Worcester, 138 Mass., 89.

In the case at bar Colorado has by its Constitution, statutes and decisions expressly repudiated the right, as we shall hereafter show; hence an entirely different question is presented.

1 Phillemore, Int. Law, p. 303.
Heffter, Droit Int., sec. 43.
Letters of Grotius, 2 Hert, p. 106.
Woolsey's Int. Law, sec. 58.
Missouri vs. Illinois, 200 U. S., 521.

This brings us to the consideration of the question as to whether the same rule should be applied to interstate streams between the sovereign states of the

Union as between two independent nations with reference to international streams.

The first settlers in Colorado found that the land, outside of a few small valleys in the mountains, was a desert in its natural condition, incapable of sustaining any considerable population. They soon learned, however, that by taking the water from the streams and applying it to the soil the land became very fertile and wonderfully productive, and the custom of appropriation became established, together with certain well-recognized rules and customs governing its use. These rules and customs were so just and appropriate to the situation that they soon became the basis of decision by the courts.

It has been held by this court, as well as by the Supreme Court of Colorado, that the right to use the water for the purpose of irrigation, mining and manufacturing was a right that grew out of the necessities of the people, and existed before it was written into the Constitution and laws.

Broder vs. Water Co., 101 U. S., 274.

Yunker vs. Nichols, 1 Colo., 551.

Coffin vs. Left Hand Ditch Co., 6 Colo., 443.

In this manner water was given a new status; to-wit, the status of property devoted to the public use. Later, the Constitution of the State of Colorado and other states declared the water an asset and resource of the state, subject to appropriation by its citizens for beneficial uses.

"Water Public Property—The water of every natural stream not heretofore appropriated, within the state of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided."

Constitution of Colorado, Art. XVI, sec. 5.

"Water being essential to industrial prosperity, of limited amount, and easy of diversion from its natural channels, its control must be in the state which, in providing for its use, shall equally guard all the various interests involved."

Constitution of Wyoming, Art. I, sec. 31.

"The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state."

Constitution of Wyoming, Art. VIII, sec. 1.

In reference to the Colorado Constitution the Supreme Court has said:

"All unappropriated water in the natural streams of the state is dedicated to the

use of the people and the ownership is vested in the public."

Wheeler vs. Northern Colo. Irr. Co., 10 Colo., 587.

"The provisions of the Constitution are so plain that no construction whatever is needed. All unappropriated waters in these streams belong to the state, the public, the people."

Wyatt vs. Laramer-Weld Irr. Co. et al., 1 Colo. App., 480-494.

Every legislative and judicial declaration in Colorado having reference to the streams of the state and the use of the waters thereof, since the Constitution was adopted, has been in recognition and affirmance of the doctrine that the entire flow of the water within the state is impressed with a public use for the benefit of the state and the people thereof. The statutes concerning the adjudication of priorities, of rights to water, contemplated the appropriation of all the waters flowing in Colorado for use on lands in Colorado. The statutes creating the offices of state engineer, division engineer and water commissioner, and authorizing them to control the distribution of the water of the several streams, are all based upon the assumption that the water belonged to the state. These statutes either in terms declare or by implication assume that the districts are restricted to lands within the state and not elsewhere.

Lampson vs. Vailes, 27 Colo., 201.

Turley et al. vs. Furman et al. (N. M.), 114 Pac., 278.

Colorado by her very necessities has been driven to declare her paramount right to the exclusive use of the water of her natural streams, in so far as her necessities require the use of such water for beneficial purposes within the state, and her Constitution and statutes negative any assumption of any concurrence between herself, on the one hand, and Wyoming or any other state, on the other hand, whereby the waters of these streams are to be apportioned with other states. The question presented here is one that was expressly left undecided in the case of Bean vs. Morris, 221 U. S., 485; to-wit: To what limits may the upper state go when it seeks to do all that it can? In that case, at page 488, the court said:

> "It follows from what we have said that it is unnecessary to consider what limits there may be to the powers of an upper state if it should seek to do all that it could."

The Constitution extends judicial power of the Supreme Court to controversies between states and gives the court original jurisdiction in cases in which a state shall be a party.

> "Therefore, if one state raises a controversy with another, this court must determine whether there is any principle of law and if so, what, upon which the plaintiff can recover."
>
> Missouri vs. Illinois, 200 U. S., 496-519.

In reference to such controversies the court is in the nature of an international tribunal to which the

several states have agreed to submit certain controversies. The fact that it must decide does not mean that it takes the place of a legislature, or that it is vested with arbitrary or with treaty-making power. It must, we think, be governed by principles explicitly or implicitly recognized, but it does not follow that every matter which would entitle a mere private party to redress would warrant interference by this court with the action of a state.

Missouri vs. Illinois, *supra*, p. 521.

In the case of Georgia vs. Tennessee Copper Co., 206 U. S., 230, some peculiarities are said to mark a suit between a state and a private party, and that, if a state has a case at all, it is somewhat more certainly entitled to specific relief (by injunction) than a private party might be; but this has reference to the nature of relief to be granted, and not to the cause of action itself. The reasoning in that case is only applicable where suit is against an individual, and not against a state as here. In this case we have a state defendant as well as one complainant.

There not being enough water at times for irrigation in both states, the question is the same here as in the Rio Grande case passed upon by Attorney General Harmon; viz.: Which state shall yield to the other?

This case is unlike the case of Missouri vs. Illinois, where the bill sought relief against the pouring of sewage and filth through an artificial drainage canal into the Mississippi River, to the detriment of the State of Missouri and its inhabitants.

Missouri vs. Illinois, 180 U. S., 208.

Missouri vs. Illinois, 200 U. S., 496-517.

So, also, the State of Georgia vs. Tennessee Copper Company, *supra*, is readily distinguishable, for the reason that in the Georgia case the action was to prevent the discharging of sulphurous fumes from the works of the defendant company in Tennessee so as to pollute the air over large tracts of territory in the State of Georgia, thereby causing wholesale damage to forest and vegetable life therein, if not to health in the latter state.

In each of the cases mentioned a *direct invasion* and injury by one of the sovereigns of the territory of the other was contemplated; but here an entirely different question is presented. In this case we have a duplicate of the Rio Grande case hereinbefore quoted from, and we feel that we cannot improve upon the language of the attorney general:

> "The injury now complained of is a remote and indirect consequence of acts which operate as a deprivation of prior enjoyments. So it is evident that what is really contended for is a servitude which makes the lower country dominant and subjects the upper country to the burden of arresting its development and denying to its inhabitants the use of a provision which nature has supplied entirely within its own territory.
>
> Such a consequence of the doctrine of international servitude is not within the language used by any writer with whose works I am familiar and could not have been within the range of his thought without finding expression."
>
> **Opinion of Attorney General Harmon,** *supra*, pp. 280-281.

The several states of the Union are sovereign as to all powers except those delegated to the federal government, having all the functions essential to separate and independent existence. Their preservation and the maintenance of their governments are as much within the care of the Constitution as is the national government.

Kansas vs. Colorado, 185 U. S., 125.
Kansas vs. Colorado, 206 U. S., 46.
1st Wharton Digest International Law, sec. 1.
Rhode Island vs. Mass., 12 Peters, 720.
People vs. Tyler, 7 Mich., 255.

"The states of the Union are a single state in all matters concerning the Federal body as a whole, and yet a group of states, perfectly independent in all matters which concern each member of the group, as a local, self-governing community."

Taylor on International Law, sec. 124.
Texas vs. White, 7 Wallace, 720, 721.
Wheeler vs. Smith, 9 Howard, 78.

"The powers affecting the internal affairs of the state not granted to the United States by the Constitution nor prohibited by it to the states are reserved to the states respectively and all powers of a national character which are not delegated to the National

Government by the Constitution are reserved to the people of the United States."

Kansas vs. Colorado, 206 U. S., 90.

The powers not delegated may be exercised by each state over all persons and properties within its boundaries.

Pennoyer vs. Neff, 95 U. S., 722.

This power may be exercised to the extent of restricting free navigation under certain circumstances.

Escanaba Transportation Co. vs. Chicago, 107 U. S., 678.

In the case of the Hudson Water Company vs. McCarter, 209 U. S., 349, this court sustained a law of the State of New Jersey prohibiting the transportation of water of the state into another state. In that case the problems of irrigation had no place, but, in speaking of the right of a state to keep and control its natural advantages, the court says:

"We are of the opinion further that the constitutional power of the state to insist that its natural advantages shall remain unimpaired by a citizen is not dependent upon any nice estimate of the extent of present use or speculation as to future needs. The legal conception of the necessary is apt to be confined to somewhat rudimentary wants, and there are benefits from a great river that might escape a lawyer's view. But the State is not required to submit even to an æsthetic

analysis. Any analysis may be inadequate. It finds itself in possession of what all will admit to be a great public good and what it has it may keep and give no one a reason for its will."

Hudson Water Co. vs. McCarter, 209 U. S., 349, pp. 356-357.

Of course, a citizen of another state has no greater rights than a citizen of the state within which the resources are situate, and, aside from the question of irrigation, we think the language quoted is applicable to the case at bar. It may be contended, however, that a different rule has been established by this court with reference to irrigation from interstate streams.

Kansas vs. Colorado, 185 U. S., 125.

Ibid., 206 U. S., 46.

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S., 258-261.

Bean vs. Morris, 221 U. S., 485.

In a Kansas vs. Colorado, *supra*, it is said:

"It cannot be denied in view of all the testimony * * * that the diminution of the flow of water in the river by the irrigation of Colorado has worked some detriment to the Southwestern part of Kansas, and yet when we compare the amount of this detriment with the great benefit which has obviously resulted to the counties in Colorado, it would seem that equality of right and equity

between the two states forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation."

Kansas vs. Colorado, 206 U. S., 113-114.

In the case of Rickey vs. Miller, *supra*, the court sustained the jurisdiction of a federal court in Nevada which was proceeding to determine a question of priority of appropriation as between two individual appropriators claiming priorities for irrigation in different states from an interstate stream.

In Bean vs. Morris, 221 U. S., 485, the jurisdiction of the lower court was again sustained in a proceeding to determine the priority of appropriation as between individual appropriators in different states. In this case the court, laying aside the question of the rights of the states, indulges in the presumption that the policy of both states is the same.

From the very nature of the *res*, there must be an inevitable conflict between the doctrine of apportionment between states and the doctrine of prior appropriation between the citizens of different states.

If the rule of apportionment between states is the correct one, after the apportionment has been made, the water of each state belongs to that state, the public, subject to state laws of appropriation for beneficial uses. The two doctrines can only be worked out by first making an equitable division between the states, leaving the distribution of the water allotted to each state for determination by the state under its law, without interference by appropriators in the other state.

In other words, under any rule of equitable apportionment between the states, it would seem to be inconsistent to hold that any question in any instance can be decided as between appropriators in different states. For example, if in the controversy between Wyoming and Colorado there is to be an apportionment of the waters equitably between the two states, how can any single appropriator in either state have any right which can be quieted as against any individual appropriator in the other state?

It appears from the bill of complaint in this case that there are a large number of individuals and corporations claiming water rights from the Laramie River in the State of Wyoming, and a number claiming water rights from the same river in the State of Colorado. If this controversy should be first tried out in a suit between the individual claimants, as in Rickey vs. Miller, and thereafter one of the states brings a separate action to determine the equitable apportionment of the water between Wyoming and Colorado, would not this necessarily result in overthrowing such rights as might be determined to exist between the individual claimants?

In the Kansas-Colorado case the court disposed of the private parties defendant to the bill in this language:

> "While several of the defendant corporations have answered, it is unnecessary to consider their defenses for if the case against Colorado fails, it fails also as against them."
>
> 206 U. S., at p. 85.

II.

It does not appear from the bill that the substantial interests of the State of Wyoming are being or will be injured by Colorado, its corporations or citizens, to the extent of destroying the equitable apportionment of benefits between the two states resulting from the flow of the Laramie River.

In case the doctrine of an equitable division between states shall be finally adopted as the better one, all things considered, then we say that complainant by her bill has not stated a cause for equitable relief. The bill alleges, upon page 2, that the stream rises in the mountainous district of northern Colorado, and flows in a general northwesterly course for about 27 miles in Colorado; thence northerly and northeasterly for a distance of about 150 miles in Wyoming. Upon page 4 the watershed or drainage basin of the Laramie River and its tributaries in Colorado is given as 395 square miles, while the watershed and drainage basis of the river and its tributaries in Wyoming is stated as 3,632 square miles. In other words, the drainage area tributary to the stream in Wyoming is more than nine times as great as the drainage area tributary to the stream in the State of Colorado.

Although Wyoming is north of Colorado, the elevation of the Laramie River is less in Wyoming than in Colorado, rendering it impossible for Colorado to ever receive any advantage of any portion of the water that falls within the State of Wyoming. But this is not all. An examination of the exhibits filed with the bill and made a part thereof will affirma-

tively show that the greater part of the small drainage area of the stream in Colorado is below all the ditches constructed or contemplated for taking water out of the stream for use in the State of Colorado. In other words, it affirmatively appears from the bill and exhibits that the threatened diversion of the defendants will tap about 67.9 square miles of the entire watershed of the Laramie within Colorado, which watershed is about 395 square miles, and that the diversion does not take the entire run-off of even 67.9 square miles within the State of Colorado, because that portion of the watershed lying between what is shown on Exhibit "B" as the two collection ditches is not tapped by the diversion works of the defendants. The section of the stream from which Colorado may divert water carries the run-off of only about one-sixth of the watershed within Colorado, and only about one-fifth of the run-off within that state.

We are therefore justified in urging that it affirmatively appears that Colorado has not taken and cannot take an equitable proportion of the water of the stream.

In another part of the bill, pages 2 and 3, it is alleged that the drainage basin of the river in Colorado is mountainous and heavily timbered, where snows fall in winter to a great depth, which, melting in the spring and summer, have, from time immemorial, supplied the water flowing in the channel of the Laramie River and its tributaries, etc. The pleader has not advised the court as to the amount of the precipitation in Colorado, or given any enlightenment whatever in reference to this very material and important subject. These are matters that could be

easily ascertained from the various reports of the proper officers of the federal and state governments, and failure to state these facts should not be looked upon with favor by the court.

Aside from this, as we have stated, the greater part of the drainage area of this river in Colorado is, owing to the topography of the country, not available in the upper state, but is available each season in the lower state, Wyoming.

The complainant alleges, on page 16 of the bill, that the defendants have already begun the construction of a tunnel or tunnels through the walls of said watershed, in order to convey the water for use upon another watershed. It must be assumed that the use the defendants have made and will make of the water so to be conveyed will be a most reasonable and beneficial use, and necessary to the reasonable development of lands within the State of Colorado.

The bill is more noticeable for what it fails to state in regard to certain matters than for the facts pleaded. That the tunnel spoken of had been run through the mountain for a distance of two and one-half miles, and was practically completed at the time the bill was filed, at a cost of more than a half million of dollars; that two millions of dollars had been expended in the construction of an irrigation system for the use of this water; that bonds had been sold, lands prepared for agriculture, and homes built in reliance upon the water so to be diverted from the Laramie River, were matters of general and public knowledge in the States of Colorado and Wyoming, and we submit that the pleader is not justified in the bare statement of the bill that Colorado and its citizens "have

already begun the construction of a tunnel or tunnels through the walls of said watershed."

At the time the bill was filed in the case of Kansas vs. Colorado (1902), the question of interstate water rights had received very little attention, and the pleader in that case was perhaps not required to strictly conform to the usual rules of pleading. Owing to the uncertainties then involved in such controversies, exactitude in pleading was not required; but in that case, and since, the matter has been so thoroughly considered and so exhaustively treated by this and other courts that we think greater strictness should be required in the present case.

In the Kansas-Colorado case the court said, at pages 117-118:

> "Summing up our conclusions, we are of the opinion that the contention of Colorado of two streams cannot be sustained; that the appropriation of the waters of the Arkansas by Colorado, for purposes of irrigation, has diminished the flow of water into the State of Kansas; that the result of that appropriation has been the reclamation of large areas in Colorado, transforming thousands of acres into fertile fields and rendering possible their occupation and cultivation when otherwise they would have continued barren and unoccupied; that while the influence of such diminution has been of perceptible injury to portions of the Arkansas Valley in Kansas, particularly those portions closest to the Colorado line, yet to the great body of the

valley it has worked little, if any, detriment, and *regarding the interests of both States and the right of each to receive benefit through irrigation and in any other manner from the waters of this stream, we are not satisfied that Kansas has made out a case entitling it to a decree.* At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes.

"The decree which, therefore, will be entered will be one dismissing the petition of the intervenor, without prejudice to the rights of the United States to take such action as it shall deem necessary to preserve or improve the navigability of the Arkansas River. The decree will also dismiss the bill of the State of Kansas as against all the defendants, without prejudice to the right of the plaintiff to institute new proceedings whenever it shall appear that through a material increase in the depletion of the waters of the Arkansas by Colorado, its corporations or citizens, the substantial interests of Kansas are being injured to the extent of destroying the equitable apportionment of benefits between the two States resulting

from the flow of the river." (The italics are ours.)

This case has been cited with approval.

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S., 261.

Bean vs. Morris, 221 U. S., 485-486.

Mr. Wiel, in the third edition of his very excellent work upon Water Rights in the Western States, reaches the following, among other conclusions, regarding interstate streams:

> "The matter is now in a stage of development, and any conclusions must be tentative only. We suggest the following drawn from the foregoing authorities:
>
> (a) Between States, each is entitled to have for its prosperity an equitable apportionment of benefits from an interstate stream. Consequently, control of interstate streams is likely to gravitate toward the formation of joint commissions between the States to supervise their use and make regulations."

1 Wiel Water Rights in the Western States, sec. 345, p. 372.

In discussing the rule between riparian owners in one state and appropriators in another, Mr. Wiel, in section 342, page 364, says:

> "In the late case of Rickey etc. Co. v. Miller, in the supreme court of the United

States, the decision upon a question of procedure below referred to was based upon the principle of Kansas v. Colorado, that riparian owners in California or appropriators in Nevada, upon the Walker River crossing the boundary, must deduce any right they may have from the law of their respective States; and the enforcement of either right beyond the boundary of its State must depend upon the concurrence of the other State. Unless the upper State (California) will voluntarily impose conditions upon its citizens in favor of users in the lower State (Nevada), the latter have no right in the matter other than to complain that the lower State as such (and not merely the plaintiff) is not receiving an equitable share of the benefit of the stream. This seems to make rights upon interstate streams a matter of interstate relation, reachable by creation of joint commissions between the States interested, to establish rules for such streams."

The same author, in his discussion of the rule that should be applied between appropriators in different states, says, at paragraph 343, pages 364 and 365:

"As in the preceding sections, the supreme court of the United States rules that rights upon interstate streams are a matter of interstate concern (similar to international concerns, regarding the States as each a sovereign). Consequently it is for the States

> concerned to see that each receives by joint arrangement, an equitable apportionment of benefit from the stream, opening the way for joint commissions between the States to govern interstate streams."

As to the nature of the proof required to make out a case in a controversy between states, this court has said:

> "Before this court ought to intervene, the case should be of a serious magnitude, clearly and fully proved, and the principle to be applied should be one which the court is at perfect liberty to maintain against all considerations on the other side."
>
> Missouri vs. Illinois, 200 U. S., 521.

By a fundamental rule of universal application, the *probata* cannot go beyond the *allegata*, but must conform thereto. As was said by Sanborn, circuit judge, speaking for the Court of Appeals of the Eighth Circuit:

> "A court can consider only what is in issue under the pleadings. Averments without proofs and proofs without averments are unavailing. The judgment may not go beyond a determination of the issues presented by the pleadings nor beyond the scope and object of the prayers which they contain. These are axioms of the law of pleading and practice. They rest upon the basic principles of our jurisprudence that no man shall be deprived of his life, liberty or property

without due process of law; due process of law must give to the parties to be affected an opportunity to be heard respecting the justice of the judgment sought. It must be one which gives notice of the issue to be determined, which hears before it condemns, proceeds upon inquiry, and renders judgment only after trial."

Gentry vs. U. S., 101 Fed., 51.

If the holding of this court in Kansas vs. Colorado, *supra*, is that the doctrine of equitable apportionment should govern as between states, it does not appear from the bill that the threatened diversion will deprive Wyoming of her equitable part of the waters of the Laramie River.

III.

The Bill of Complaint Does Not State a Cause of Action Under the Doctrine of Prior Appropriation.

The allegation of the bill in this respect is:

"And your orator further avers that prior to the commencement of the wrongs or threatened wrongs hereinafter set forth, your orator and its citizens within the area of the drainage basin of said Laramie River and its tributaries in the state of Wyoming, had appropriated all the available waters of the said Laramie River and its tributaries above the required flow thereof for riparian

> proprietors as herein set forth, for the actual irrigation of the lands of your orator and its citizens within the drainage basin and water shed of the said Laramie River, to-wit, for the irrigation of more than 325,000 acres of land within the said water shed and drainage basin."
>
> Bill of Complaint, p. 14.

This is a mere allegation of a conclusion of law, and the pleading contains no statement of facts upon which the conclusion is based. This is not sufficient.

In the case of Farmers High Line Canal & Reservoir Company et al. vs. Southworth, 13 Colo., 111, the plaintiff alleged that he had a priority, without stating any facts with reference thereto, and that the defendant's right was subsequent in point of time to such priority. A demurrer upon this ground was filed and overruled by the trial court. Upon appeal, the Supreme Court held that the demurrer should have been sustained, and said:

> "In pleading an appropriation, it is necessary to plead the facts which constitute the appropriation."

The case of Church vs. Stillwell et al., 12 Colo. App., 43, was an action in reference to water rights for reservoir purposes, and the court said, at page 48:

> "In a suit to determine the priorities of such right, it is not sufficient for the plaintiff to merely allege in his complaint that he has the priority of right. That is a legal conclusion. He must specifically aver all of

the subsequent facts which are necessary to constitute such priority."

Carroll vs. Vance, 39 Colo., 216; 88 Pac., 1069.

Wutchumna Water Co. vs. Pogue, 151 Cal., 105; 90 Pac., 362.

The rule which requires the facts to be pleaded is not technical, but substantial; not a useless requirement, but necessary to advise the opposite parties and the court of the true nature and objects of the suit. If the pleader had stated the facts upon which the allegation in this case is made—this conclusion of law asserted—such facts would perhaps reveal that the valid appropriations on the Laramie River can be satisfied with the run-off of the drainage basin of that river, and yet leave a sufficiency of water to supply the alleged diversion of the defendants. The defendants ought not to be haled into court to meet litigation as grave in its character as that initiated by this proceeding, unless a clear case is stated in the bill of complaint. How were the appropriations which the complainant seeks to protect initiated? When and in what manner have they been perfected, if at all? are questions upon which the bill is entirely silent. Although the opinion upon demurrer in the Kansas-Colorado case intimates that less exactness will be required where a state is complainant than as between mere private litigants, this was, we think, said with reference more particularly to an equitable division of water between the states, and hence does not apply to the phase of the controversy now under consideration; to-wit, that the bill

does not state a cause of action as between contesting appropriators under the doctrine of prior appropriations.

PLACE OF USE NOT MATERIAL.

It is stated in the complaint, and objection is founded upon it, that this water is being carried to another watershed. If the court upholds the contention of the defendants that the State of Colorado has the absolute right to use for beneficial purposes within the state all the waters falling within its borders, the particular place of use within the state is eliminated from consideration; so, likewise, if the doctrine of equitable apportionment shall be the basis of decision, we assume that the place of use of the water awarded to Colorado will be left entirely to the state. If, however, the doctrine of prior appropriation is to be the rule of decision in this case, we shall still claim that the place of use within the state is unimportant. In Kansas vs. Colorado, 206 U. S., 46, the court, at page 94, in speaking of the state, said:

> "It may determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid regions of the west of the appropriations of water for the purposes of irrigation shall control. Congress cannot enforce either rule upon any state."

See also:

> U. S. vs. Rio Grande Irr. Co., 174 U. S., 690.

We have already shown that the doctrine of prior appropriation has always been the law of the arid regions of the United States, and that all legislation has been based upon the voluntary recognition of pre-existing rights. (U. S. vs. Rio Grande Irr. Co., *supra.*) This doctrine of diversion and appropriation obtaining in the arid regions has arisen from the necessity of the situation, and the same reason that justifies the doctrine justifies taking the water to another watershed. It is the law, and has always been the custom throughout the arid regions, to make application regardless of the watershed. In fact, in order to secure the benefit of the right of appropriation, it is in many cases absolutely necessary to make application of the water upon another watershed. Both Colorado and Wyoming recognize and enforce the doctrine of appropriation, and also the right to apply to another watershed. The following cases in Colorado recognize the right to divert water from one watershed to another:

Coffin vs. Left Hand Ditch Co., 6 Colo., 443, 449.

Thomas vs. Guirand, 6 Colo., 530, 532.

Hammond vs. Rose, 11 Colo., 524, 526.

Oppenlander vs. Left Hand Ditch Co., 18 Colo., 142-144.

Coffin vs. Left Hand Ditch Company, *supra*, has been cited and followed in Wyoming.

Moyer vs. Preston, 6 Wyo., 308, 318, 321.

Willey vs. Decker, 11 Wyo., 496, 516, 528, 530.

Coffin vs. Left Hand Ditch Company, *supra*, is cited with approval in the following federal cases:

Boquillas Cattle Co. vs. Curtis, 213 U. S., 339, 347.

Cascade Town Co. vs. Empire Water & Power Co., 181 Fed., 1014 and 1015 (C. C. Colo.).

Snyder vs Colorado Gold Dredging Co., 181 Fed., 65 (C. C. A.).

The following excerpt from the opinion of the court in Coffin vs. Left Hand Ditch Company, *supra*, is applicable:

> "The doctrine of priority of right by priority of appropriation for agriculture is evoked, as we have seen, by the imperative necessity for artificial irrigation of the soil. And it would be an ungenerous and inequitable rule that would deprive one of its benefit simply because he has, by large expenditure of time and money, carried the water from one stream over an intervening watershed and cultivated land in the valley of another. It might be utterly impossible, owing to the topography of the country, to get water upon his farm from the adjacent stream; or if possible, it might be impracticable on account of the distance from the point where the diversion must take place and the attendant expense; or the quantity of water in such stream might be entirely insufficient to supply his wants. It sometimes happens that the most fertile soil is found

along the margin or in the neighborhood of the small rivulet, and sandy and barren land beside the larger stream. To apply the rule contended for would prevent the useful and profitable cultivation of the productive soil, and sanction the waste of water upon the more sterile lands. It would have enabled a party to locate upon a stream in 1875, and destroy the value of thousands of acres, and the improvements thereon, in adjoining valleys, possessed and cultivated for the preceding decade. Under the principle contended for, a party owning land ten miles from the stream, but in the valley thereof, might deprive a prior appropriator of the water diverted therefrom whose lands are within a thousand yards, but just beyond an intervening divide." (Pp. 449-450.)

In Willey vs. Decker, *supra*, the Supreme Court of Wyoming, at page 531, quotes with approval the following from the Colorado case of Oppenlander vs. Left Hand Ditch Co., *supra:*

> "The appropriator, though he may not own the land on either bank of a running stream, may divert the water therefrom and carry the same whithersoever necessity may require for beneficial use, without returning it or any of it to the natural stream in any manner."

See also:

> Wiel on Water Rights in the Western States, p. 365.

Black's Pomeroy on Water Rights, sec. 47.
Offield vs. Ish, 21 Wash., 277; 57 Pac., 809.
Long on Irrigation, p. 50.

This doctrine of diversion of water from one watershed to another is determined by the local necessities, and obtains throughout the world for domestic and irrigation purposes, without returning the water to the natural stream in any manner. Whether the water shall be taken across a divide and used upon the lands drained into another stream is simply an incident of locality. This rule is not characteristic of any set of laws or of any particular civilization, but is the outgrowth of human conditions.

The court will take judicial notice that the doctrine that water may be diverted to non-riparian land is recognized and followed by the Reclamation Service of the United States government in irrigation enterprises throughout the arid regions; also by the State of Wyoming, the State of Colorado, and by other arid states and countries. All this without limit as to the place of application. Some examples of this have already been referred to.

> "It has been very justly observed at the bar, that the court is bound to take notice of public facts and geographical positions."
>
> U. S. vs. Rio Grande Irr. Co., 174 U. S., 690.

> "The law of any State of the Union, whether depending upon statutes or upon opinions, is a matter of which the courts of

the United States are bound to take judicial notice without plea or proof."

Lamar vs. Micou, 114 U. S., 218-223.

The proposed Bear River diversion works in Utah is an example. This project is mentioned in several reports of the Reclamation Service, from the second to the seventh.

A large number of other federal reclamation projects, diverting water from one watershed for the irrigation of lands upon a different watershed, are described in Public Document No. 1262 of the Sixty-first Congress, Third Session, the same being a message from the President of the United States transmitting a report of the Board of Army Engineers in relation to the Reclamation Fund for the reclamation of arid lands.

In Wyoming, in practice, water is taken from one watershed to another in numerous instances. The greatest number of these cases are in the valley of the Powder and Tongue Rivers near Buffalo and Sheridan, Wyoming. The most notable case, and one which is almost exactly parallel to the diversion from the Laramie River into the Poudre Valley, of which complaint is made in this case, is that of a group of ditches taking water from the Piney, a tributary of Powder River, to Prairie Dog Creek, a tributary of Tongue River. In other words, this water is taken from the Powder River watershed to the Tongue River.

It therefore appears that, by common consent, waters may be taken from one stream for use upon a different watershed, whenever the topography of the country requires this to be done in order to secure the

best results, and that this practice is supported by both reason and authority.

To recapitulate, we conclude that the states should each have the right to control the waters of their non-navigable streams within their borders; but if the court shall conclude that the doctrine of equitable apportionment between states is the proper one, the demurrer should be sustained for the reason that the bill does not state a cause of action for equitable relief. The doctrine of priority of appropriation, which has sometimes been applied between individual appropriators in different states, can have no application in this case; and, even if it had, the bill does not contain facts sufficient to make a case.

For the reasons given, we respectfully submit that the demurrer should be sustained and the bill dismissed.

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Attorney General of the State of Colorado;

CHARLES F. TEW,
DELPH E. CARPENTER,
Solicitors for the Greeley-Poudre Irrigation District.

JULIUS C. GUNTER,
CHARLES D. HAYT,
CLYDE C. DAWSON,
FRED R. WRIGHT,
Solicitors for the Laramie-Poudre Reservoirs and Irrigation Company, Defendant.

In the Supreme Court of the United States.

No. ——— Original.

IN EQUITY

THE STATE OF WYOMING, COMPLAINANT,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, A MUNICIPAL CORPORATION, THE LARAMIE-POUDRE RESERVOIRS AND IRRIGATION COMPANY, A CORPORATION, DEFENDANTS.

ANSWER OF THE STATE OF COLORADO.

This defendant, the State of Colorado, now and at all times hereinafter saving to itself all and all manner of benefit or advantage of exception or otherwise that can or may be had or taken to the many errors, uncertainties and imperfections in the said bill of complaint contained, for its answer thereto, or to so much thereof as it is advised it is material and necessary for them to answer to, saith:

I.

Admits that the greater extent of the drainage basin of the Laramie River in Colorado is in a mountainous and heavily timbered country, where snows fall in winter, but denies that the run-off from said drainage basin supplies all of the waters flowing in the channel of the Laramie River and its tributaries. Defendant avers that less than one-half of the run-off of the Laramie River is supplied by the drainage basin of the Laramie River and its tributaries within the State of Colorado. Defendant avers that among the tributaries of the Laramie River rising in the mountainous regions of Colorado and discharging their waters into the Laramie River, in addition to those enumerated in the bill of complaint, are Johnson Creek and Beaver Creek. Defendant denies that Complainant's Exhibit A shows either the drainage basin of the Laramie River and its tributaries, or the irrigated lands thereunder, within the State of Wyoming, and avers that the map attached to the joint and several answer of the Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs and Irrigation Company, marked Exhibit I and made a part of this answer, shows the drainage basin of the Laramie River and its tributaries, and the irrigation ditches and works taking water therefrom, within the State of Wyoming, but avers that only about 25,000 acres of the lands designated on Exhibit I as irrigated lands were under irrigation at the time of the inception of the defendant's, The Laramie-Poudre Reservoirs and Irrigation Company's rights to divert water through the tunnel mentioned

in the bill of complaint, and which diversion is sought to be enjoined herein. Defendant denies that the map marked Exhibit B, attached to the bill of complaint, is a correct map of the drainage basin of the said river and its tributaries within the State of Colorado, and avers that Exhibit I, heretofore mentioned, and made a part of this answer, is a true map of the last-mentioned drainage basin. Defendant admits that the larger part of the watershed of said river and its tributaries in Colorado is mountainous, rocky, and timbered, and avers that a large portion of the 3,865 square miles of the drainage area of said river and its tributaries in Wyoming is also mountainous, rocky, and timbered, upon which the precipitation of moisture is great, and from which the run-off is about 500,000 acre-feet annually. Defendant avers that a considerable part of the run-off from the drainage area of said river and its tributaries within Colorado enters the Laramie River after it enters the State of Wyoming. Defendant avers that about 4,000 acres of the drainage basin of said Laramie River and its tributaries within Colorado are of irrigable character. Defendant denies that the greater portion of the drainage area of said river and its tributaries in Wyoming is irrigable and productive, and avers that not to exceed 100,000 acres of the drainage area of the said river and its tributaries within the State of Wyoming are productive under irrigation; that of this area about 50,000 acres lie in said drainage area between the Colorado line and the Wheatland Reservoir, as shown on Defendant's Exhibit I, which last-mentioned area is located at a high altitude—to-wit, about 7,500 feet—where the irriga-

tion season is short—to-wit, about six weeks—commencing about the fifteenth of June, and the lands of which are of inferior quality, unproductive, adapted to raising only limited crops. Defendant further avers that the remaining portion of the lands in the drainage basin of said river and its tributaries, lying in the vicinity of Wheatland, aggregate about 50,000 acres. This land has some productivity, but the greater part of the irrigation rights therefor were initiated long after the inception of the rights through which these defendants make claim to divert a part of the waters of said river and its tributaries, through the tunnel mentioned in the bill of complaint. Defendant admits that prior to the act of Congress of July 25, 1868, creating the Territory of Wyoming, that portion of the watershed and drainage basin of the Laramie River and its tributaries which is now within the State of Wyoming was within the boundaries and subject to the laws of the Territory of Dakota; but denies that at any time the riparian proprietors on said stream had the right to have the waters of said stream or its tributaries flow across or along their lands unpolluted and undiminished. Defendant avers at no time did the doctrine of riparian ownership of waters obtain in that part of Dakota Territory, since said act of Congress a part of the State of Wyoming. Defendant avers that at no time has it been the law that diversions of water from said stream or its tributaries in Wyoming, or diversions therefrom made in Colorado for application in Wyoming, could be made to the prejudice of the rights of the State of Colorado in the exercise of her inherent sovereign power to divert from

the section of the Laramie River within Colorado the entire run-off of said section for use within the State of Colorado. Defendant avers that change in the point of diversion, the place of use, and the kind of use, where the same is made from the section of the stream within Colorado, may at any time be made within the State of Colorado, provided the same can be done without prejudice to any existing appropriations within the State of Colorado. Defendant further avers that the waters of said stream and its tributaries within the State of Colorado constitute a part of the natural resources of, and were and are owned by, the State of Colorado, subject to the right of appropriations thereof under her laws. Defendant avers that the right of appropriation and use of the waters of said stream and its tributaries within Colorado is to no extent affected by, or subject to, the laws of any other sovereignty than that of the State of Colorado. As to whether or not the United States of America in 1862, or at any other time, granted to the Union Pacific Railway Company 350,000 acres of land, or any part thereof, within the State of Wyoming, riparian to the Laramie River and its tributaries, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. As to whether or not the last-mentioned lands, or any part thereof, have passed from said railroad company, or are at this time owned or possessed by 1,500 or any other number of people, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. This defendant denies that the right to the continuous flow of the waters of said river, or any part thereof, or any of

the waters of its tributaries, is vested in the citizens of complainant; denies that the doctrine of continuous flow or of riparian rights at any time obtained in the drainage basin of the Laramie River and its tributaries within the State of Wyoming; admits that, prior to the commencement of construction of the system of irrigation having for its purpose the diversion by the defendants of a part of the waters of the Laramie River and its tributaries, some of the lands lying along said river and its tributaries had been settled and improved, and that some part thereof had been rendered more productive by irrigation from said stream and its tributaries, but avers that the run-off of said river and its tributaries was ample to supply the demands and rights so created, and leave an abundance of water to supply the diversions sought to be enjoined herein. Defendant denies that the lands of said area without the use of water, the diversion of which is sought to be enjoined herein, would be rendered valueless, and also denies that 20,000 people, or any number in excess of 2,000, residing upon said lands, are supported, directly or indirectly, by reason of the irrigation and cultivation of said lands; denies that $20,000,000, or any sum in excess of $500,000, had been expended within the State of Wyoming in the development or use of the waters of said stream or its tributaries, prior to the initiation of the rights of the defendant, the Laramie-Poudre Reservoirs and Irrigation Company. As to whether or not 400,000 acres of land lying in the drainage basin of said river and its tributaries within the State of Wyoming had been patented by the United States of America prior to the commencement

of construction of its said system of irrigation by defendant, the Laramie-Poudre Reservoirs and Irrigation Company, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. As to what number of acres of the last-mentioned land are now owned, possessed, or occupied by citizens of complainant, defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant admits that certain of the waters of said river and its tributaries are used by citizens of towns and villages in Wyoming, but avers that there is more than sufficient run-off in said stream and its tributaries to satisfy such needs and to supply the rights of the defendants sought to be enjoined in this suit; admits the existence of certain appropriations from said river and its tributaries prior to the commencement of construction of the defendant's system of irrigation, mentioned in the bill of complaint, but avers that the run-off of said stream and its tributaries was and is more than sufficient to satisfy the same and the diversions sought to be enjoined in this action. As to whether or not complainant is the proprietor of 50,000 acres of land within said watershed, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant admits that prior to the commencement of construction of the irrigation system for the purpose of the diversions, sought to be enjoined herein, certain citizens of the State of Colorado had appropriated, for the purpose of irrigating certain lands within said drainage basin, certain waters of said river and its tributaries, and avers that such appropriations

amounted to about 8,000 acre-feet of water per annum. As to what part of said waters, applied within the drainage basin of Colorado, has heretofore returned to the stream and its tributaries, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant avers that other appropriations of said waters of said Laramie River and its tributaries had been made by the State of Colorado and its citizens within the State of Colorado, prior to the appropriations of said waters by complainant and its citizens, as set forth in the complaint, and avers that on the 25th day of August, 1902, the defendant The Laramie-Poudre Reservoirs and Irrigation Company, and its predecessors in title, by commencement of construction, initiated its rights to the diversion, for the purpose of irrigation and domestic use, through the tunnel mentioned in the bill of complaint, to 1235 *second-feet* of water, and that at the time of the initiation of such rights of the defendant The Laramie-Poudre Reservoirs and Irrigation Company and its predecessors in title, there was abundant water in the said stream to satisfy all prior appropriations then in existence in the State of Colorado and in the State of Wyoming. Defendant denies that, prior to the threatened diversion sought to be enjoined in the complaint, the plaintiff and its citizens had appropriated all of the available waters of the said Laramie River and its tributaries, but avers that at such time there was ample run-off in said stream, and that there is now ample water therein, to supply the threatened diversions of these defendants and all prior rights in the State of Wyoming. Defendant avers that at no time prior to

the institution of this suit had more than 50,000 acre-feet annually been taken from said stream and its tributaries for use in the State of Wyoming. Defendant avers at the time of the initiation of the rights, the exercise of which is sought to be enjoined in this suit, rights for the appropriation of water for irrigation and domestic use in the State of Wyoming had been created or initiated for not exceeding 50,000 acre-feet, and avers that at such time there was available to supply such last-mentioned rights or initiated rights more than 800,000 acre-feet annually in the run-off of said stream. As to whether or not the plaintiff had, and its citizens had, at any time employed the waters of said stream and its said tributaries, for the subirrigation of 25,000 acres of land riparian to said stream and its said tributaries, said land being owned and possessed by said complainant and its citizens, and for live-stock and domestic uses, this defendant has not and cannot obtain sufficient knowledge or information upon which to base a belief. Defendant denies that the waters sought to be diverted through the tunnel mentioned in the bill of complaint would render the lands lying within the basin of said stream and its tributaries, within the State of Wyoming, to a large extent valueless and unable to support any considerable population; denies that the use of the waters so sought to be enjoined would add the value of $10,000,000 to the lands within said watershed within the State of Wyoming, or would enable said land to support a population of 20,000 people, or any other considerable number of people; denies that the diversion sought to be enjoined herein would render the lands in the water-

shed of said stream and its tributaries within Wyoming valueless. Defendant denies that it and its co-defendants are threatening to divert, by the tunnel mentioned in the bill of complaint, or otherwise, more than 100,000 acre-feet per annum of the waters of said stream and its tributaries, and avers that the maximum diversion which can be made through said tunnel, or the irrigation system in aid thereof, does not and cannot exceed 70,000 acre-feet annually from the run-off of said stream, which run-off amounts to about 800,000 acre-feet annually. Defendant denies that there has been diverted in any manner within the State of Colorado, for application to a beneficial use within the drainage basin of said river and its tributaries, a larger amount of water than was necessary to the appropriations made prior to the acquired rights of complainant and its citizens. Defendant avers that at no time has a greater amount of water been diverted from said stream for application to a beneficial use within the State of Colorado than the appropriations within the State of Colorado called for. and that at such time there was ample water in said stream to satisfy such appropriations and all prior appropriations within the State of Wyoming. Defendant avers that the State of Colorado is the owner of all waters within said State of Colorado, with the full right to dispose of them as it may choose, and denies that such rights are subject to the rights acquired by the complainant and its citizens, as alleged in the bill of complaint; avers that it is the right of the defendant commonwealth to dispose of the waters of that portion of said stream lying within the State of Colorado, without let or hindrance by the com-

plainant or its citizens; and defendant avers that the defendant commonwealth can so dispose of the waters of said stream regardless of the prejudice that it may work to the complainant or its citizens within the State of Wyoming, and need give no reason for its will.

II.

Further answering said bill of complaint, this defendant, the State of Colorado, alleges that on the first day of August, 1876, it was admitted into the Union, and then became, and ever since said date has been, and now is, a sovereign state; that within the boundaries of its own territory it possesses the full rights and prerogatives of sovereignty, save as to that portion of power delegated to the federal government by the Constitution of the United States; and that this defendant, the said State of Colorado, is foreign to the State of Wyoming for all but federal purposes; that, being so sovereign within its own territory, it has the plenary and exclusive right and power to control and regulate the use of non-navigable waters within its boundaries, including non-navigable rivers and other streams, and that it has never surrendered this sovereign power over water rights and streams, nor delegated this power, or any portion thereof, to any other sovereign, either national or state.

Defendant further alleges that the territory of the State of Colorado is the apex of the Continental Divide, dividing the waters flowing into the Atlantic and the Pacific, and that streams originating in the mountain heights within the State of Colorado flow

in every direction out of the state; that the origin of these streams is generally near the center of the state, and at no place within the state do any of these streams attain any considerable size in comparison with rivers in the less arid sections of the country; that, owing to the topographical nature of the territory within the State of Colorado, these streams, as a rule, and particularly upon the eastern slope of the Rocky Mountains, after leaving the mountains in which they originate, flow across lands of a nature usually described as plains, and from which, owing to the lack of rainfall, these streams receive no additional supply of water, but, on the contrary, the water in said streams is very rapidly diminished by evaporation and by absorption by the soil through which they pass; that these lands have a soil of unusual fertility, and when irrigated produce crops unexcelled and almost unequalled in quantity and quality.

This defendant alleges that the Laramie River, named in the complainant's bill of complaint, is a stream having its sources within the boundaries of the State of Colorado and flowing within said state for a distance of twenty-seven miles, until it crosses the northern boundary thereof and enters the State of Wyoming; that said river is not navigable within either the State of Colorado or the State of Wyoming, and that the same is not an avenue or instrumentality of interstate commerce as between the States of Colorado and Wyoming. The use of the waters of said stream by diversion thereof, and application of the same upon lands within the territorial limits of the State of Colorado, is essential to the life and well-being of the inhabitants of a large

area within Colorado, and the right of continued use of the said waters is as vital to the inhabitants of the lands upon which said waters are to be applied as is the land itself. This defendant alleges that the jurisdiction and rights of the State of Wyoming, either in its sovereign capacity or as a proprietor of lands, and the rights of the citizens of Wyoming, do not extend into the State of Colorado, and this defendant further alleges that, under the laws and principles of international and interstate law, the sovereign rights of this defendant over the waters of the section of the Laramie River and its tributaries lying within the State of Colorado are not subservient to the sovereignty or rights of the State of Wyoming, and that the State of Wyoming has no dominant estate, rights, or jurisdiction as against this defendant, or its people, in that part of the Laramie River and its tributares flowing in the State of Colorado, and that the State of Colorado cannot be subjected to the burden of arresting its development, or of denying to its inhabitants the use of an element which nature has supplied entirely within its own territory, and without which, and the free use thereof, the lands to which said water is sought to be applied would be uninhabitable.

III.

This defendant, further answering the bill of complaint, says that the Laramie River and certain of its tributaries rise within the State of Colorado; that the drainage area thereof within the State of Colorado is about 428 square miles, and that the

length of the said stream in Colorado is about twenty-seven miles; that the drainage area of said stream and its tributaries within the State of ~~Colorado~~ Wyoming is 3,865 square miles, and that the total drainage area of said stream within the States of Colorado and Wyoming is 4,293 square miles, and that the length of said stream within Wyoming is about 150 miles; that the annual run-off of the sections of said stream lying within the State of Colorado is about 300,000 acre-feet, and that the annual run-off of the sections of said stream lying within the State of Wyoming is about 500,000 acre-feet; that the diversion system, the operation of which is sought to be enjoined herein, taps only the upper sections of said stream and its tributaries lying within the State of Colorado, and only about seventy-five square miles of the said drainage area of 428 square miles lying within Colorado. Further, that said diversion system sought to be enjoined herein cannot divert annually more than 70,000 acre-feet of the annual run-off of 800,000 acre-feet of said stream and its tributaries. Further, that by reason of natural conditions, there cannot be diverted from said stream for said use within the State of Colorado more than 90,000 acre-feet annually. Defendant further alleges that said stream and its tributaries rise in the mountains of Colorado, at an altitude of from about 8,000 to 14,000 feet; that its waters flow through a deep valley and mountain canyons within Colorado, and thence along the same into the section of the stream lying within the State of Wyoming; that the bed of said stream within Colorado is so low that water can only be diverted from the upper sections of said stream and its tributaries

for use in Colorado; and defendant alleges that, under and by the system the operation of which is sought to be enojined herein, and all other practicable means, no more than 90,000 acre-feet annually can be diverted from said stream and its tributaries for use upon lands lying within the State of Colorado.

Defendant avers that long prior to the institution of the present suit, and at a time when all of the diversion from said stream and its tributaries for use within the State of Wyoming did not exceed 50,000 acre-feet, citizens of this defendant and predecessors in title to the co-defendants of this defendant, acting under the authority and by the permission of this defendant, the State of Colorado, diverted from said stream about 8,000 acre-feet annually, and applied the same to irrigation and domestic uses within the watershed of said stream. Defendant further avers that on, to-wit, August 25, 1902, the predecessors in interest of the co-defendants of this defendant conceived an extensive system of irrigation for the conveyance of about 70,000 acre-feet of the run-off of the upper reaches of the said stream to a body of 125,000 acres of rich land, lying in the valley of the Cache la Poudre River in the County of Weld, State of Colorado, and necessary for the reclamation of said body of land; that, in pursuance thereof, and in accordance with the laws of this defendant and by its permission, irrigation rights for said system were initiated by the predecessors in interest of the co-defendants of this defendant, on August 25, 1902, by the commencement of actual construction on said system; and since the last-mentioned date, in further pursuance of said undertaking, a collection system

for gathering the upper water of said river and its tributaries, a reservoir for impounding the same, and a tunnel of about 12,000 feet in length for the carriage of the same through the mountain range constituting the eastern boundary of the watershed of said river and its tributaries, have all been constructed and are now practically completed, at a cost of about $1,200,000. Defendant further avers that, in addition to said expenditure and construction, water rights and other interests, including reservoir sites, have been purchased, and construction work done thereon, at a further cost of about $1,500,000. Defendant avers that said system is practical and will with due diligence be completed. Defendant avers that, in aid of said irrigation system, an irrigation district, the defendant The Greeley-Poudre Irrigation District, a municipal corporation, was formed under the laws of the State of Colorado, embracing about 125,000 acres of land; that bonds for said purpose were voted and issued to the amount of $5,100,000 par value, and made a first lien on the lands of said district, and that a total of about $2,700,000 of said bonds, par value, have been expended in the purchase of water rights and in the construction of said irrigation system. Defendant further avers that about $2,300,000 of said bonds are in the treasury of said district, and are available for the completion of said system.

Defendant avers that, relying upon the diversion of said 70,000 acre-feet annually from said Laramie River and its tributaries, citizens of this defendant have filed upon large bodies of public lands in said district under the homestead and desert land laws of

the United States, and have placed valuable improvements thereon, and are preparing at great expense to make homes thereon; that large bodies of other land in said district have been purchased relying on said diversion from the Laramie River, and valuable improvements have been made on the same; that if the said diversion from the Laramie River is permitted, it will enhance the value of said land about $50,000,000; if denied, it will largely destroy the value of said lands, and will defeat the acquisition of title to all of said lands filed upon under the desert land laws of the United States. Defendant further avers that at the time of the initiation of the irrigation rights, the exercise of which is sought to be enjoined in this proceeding, there was, and after this proposed diversion is made will be, abundant water left in the Laramie River and its tributaries to supply all the irrigation rights in the State of Wyoming which had their origin prior to the inception of the rights, the exercise of which is sought to be enjoined herein. The defendant further avers that the lands within the State of Wyoming, to the irrigation of which the water of the Laramie River and its tributaries has been applied and can be applied, are greatly inferior in productiveness to the lands within the State of Colorado to which the waters herein involved will be applied; and, further, that the lands within the State of Wyoming, in addition to being non-productive, require a greatly increased quantity of water over the necessities of the lands in the State of Colorado for their irrigation; and, further, that the application of water thereto—that is, to the lands

within the State of Wyoming—will produce less returns.

This defendant, having now fully answered all the allegations in plaintiff's bill of complaint, or so much thereof as the defendant is advised ought to be answered, asks to be hence dismissed with costs and charges in this behalf sustained.

Benj. Griffith

Attorney-General of Colorado and
Solicitor for Defendant.

Fra Farrar

of Counsel.

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1910.

No. ———. Original.

THE STATE OF WYOMING,
Complainant,

vs.

THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, a municipal corporation, THE LARAMIE POUDRE RESERVOIRS AND IRRIGATION COMPANY, a corporation,
Defendants.

} In Equity.

APPLICATION FOR LEAVE TO FILE ORIGINAL BILL OF COMPLAINT.

Comes now the complainant in said cause by Douglas A. Preston, Attorney-General for the State of Wyoming and solicitor and of counsel for the complainant, and makes this the application of the said complainant for leave to file in this Court the Bill of Complaint in said cause, and said complainant herewith presents the Bill of Complaint which it proposes to file.

DOUGLAS A. PRESTON,
Attorney-General for the State of Wyoming and Solicitor and Of Counsel for Complainant.

In the Supreme Court of the United States

October Term 1917

In Equity

THE STATE OF WYOMING,
COMPLAINANT,
VS.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company,
DEFENDANTS.

SUPPLEMENTAL BRIEF ON BEHALF OF DEFENDANTS

Volume 1

The Law

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In the

Supreme Court of the United States

OCTOBER TERM, 1917.

NUMBER 5 - ORIGINAL

IN EQUITY

THE STATE OF WYOMING,
COMPLAINANT,

vs.

THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company,
DEFENDANTS.

SUPPLEMENTAL BRIEF ON BEHALF OF DEFENDANTS

PRELIMINARY STATEMENT.

This is an original proceeding between two states of the Union, each asserting sovereign rights.

The defendant Irrigation District is a public corporation organized under the laws of Colorado for the reclamation of a portion of the arid lands of the state by means of a large irrigation system theretofore owned by the defendant Irrigation Company,

a Colorado corporation, engaged in the completion of the system for the defendant Irrigation District.

This suit involves the diversion and use by Colorado and its citizens, for the necessary reclamation of arid lands, of a portion of the waters of that branch of the Laramie River which rises and flows within the State of Colorado.

The Laramie River is an interstate stream, rising and flowing in both Wyoming and Colorado. The diversion complained of is from the southerly or Colorado branch of the stream. The topographical conditions are such that the tunnel project here complained of defines the limit of maximum diversion from the Colorado branch of the river for use in that State. Colorado can never take more than 91/250 of the waters of the branch of the stream rising within the territorial limits of the State, by means of the tunnel project and all other existing diversions, and a greater portion of the waters rising in Colorado must for all time flow into the State of Wyoming, there to increase the supply from the Wyoming branches of the stream, for the use and benefit of Wyoming and its citizens.

The Laramie River in turn is one of many branches or tributaries of the North Platte River, the northerly branch of the Platte River, which unites with the southerly branch, the South Platte River, at North Platte, Nebraska.

(See Map, Exhibit 1, attached to the answer of the corporation defendants.)

The greater portion of the waters of both branches of the Platte River rise within the State of Colorado, and the diversion complained of is from the head-waters of one branch of the stream for use in the reclamation of land situate within the drain-

age of another branch of the same stream. The waters have their origin, and diversion and application occur within the State of Colorado.

Wyoming asserts the right, both as the owner of lands within the drainage area of the Laramie River and also because of alleged prior appropriations of water from the stream within that State by its citizens, to the undiminished flow of the waters which rise and flow in Colorado, as well as those waters which have their source within Wyoming. She denies to Colorado the right to divert and use a portion of the waters rising in that State by means of a system of ditches leading to a tunnel through the mountain range which forms the easterly border of the drainage area of the Colorado branch of the stream, for use upon lands lying within a neighboring drainage. Wyoming also asserts that, as a State, she has the right to an undiminished flow of the waters of the Colorado branch of the Laramie River for the use and benefit of the citizens of Wyoming, and prays that Colorado and appropriators within that State be enjoined from making the diversions of which complaint is made.

Colorado, by answer, denies that this diversion of a portion of the waters of the stream within its borders will injure Wyoming or its citizens, or that the waters of the Colorado stream were appropriated by citizens of Wyoming prior to the initiation of the Colorado enterprise complained of, and alleges that after the Colorado diversions shall have been made there will yet remain ample water in the stream to satisfy all prior appropriations by citizens in Wyoming. Colorado avers that the waters of the Laramie River constitute a natural resource of the State; that it is the owner of all waters within its borders, and that it has full right to utilize the same for its

own necessities and those of its people, and that it may dispose of them as it may choose; denies that the right to divert and use the waters of its stream is to any extent affected by, or subject to, the laws of Wyoming or any other sovereignty or is subject to the rights acquired by complainant and its citizens as in the bill of complaint alleged; and avers that Colorado has the right to use and dispose of the waters of that portion of the stream rising and flowing within its borders, without let or hindrance and regardless of any prejudice it may work to complainant or its citizens, and that it need give no reason for its will.

Colorado further alleges its admission as a State of the Union August 1, 1876; that within the boundaries of its own territory it possesses the full rights and prerogatives of sovereignty, save as delegated by the Constitution to the United States; that Colorado is foreign to Wyoming for all but federal purposes; that being so foreign, within its own territory, it has the plenary and exclusive right and power to control and regulate the use of non-navigable waters; and that it has never surrendered the sovereign power over water rights or streams, or any portion thereof to any other sovereignty, either national or state; that the territory of Colorado is the apex of the continental divide; that its streams originate in its mountain heights, and from thence flow in all directions into lower states; that these streams have an ever-diminishing flow out across arid plains of unusual fertility and productivity when supplied with water for irrigation, but that the waters of these streams are inadequate to supply the needs of its lands; that the portion of the Laramie River in Colorado is non-navigable, has its source within the boundaries of the State and flows therein for a distance

of 27 miles until it enters Wyoming; that the use of the waters of the stream by the diversion and application thereof upon lands within the territorial limits of Colorado is essential to the life and well-being of the State and the inhabitants of a large area thereof, and that the right of continued use of such water is as vital to the inhabitants of the lands upon which such waters are to be applied as is the land itself; that the jurisdiction and rights of Wyoming, either in its sovereign capacity or as a proprietor of lands, and the rights of its citizens, do not extend into Colorado, and that under the laws and principles of international and interstate law the sovereign rights of Colorado over the section of the Laramie River and its tributaries rising and flowing within the State are not subservient to the sovereignty or rights of Wyoming; that Wyoming has no dominant estate or jurisdiction in or against Colorado or its people in that part of the river and its tributaries flowing in Colorado; and that Colorado cannot be subjected to the burden of arresting its development by denying to its inhabitants the use of an element which nature has supplied entirely within its own territory, and without which and the use thereof, the lands to which said water is to be applied would be relatively valueless. Colorado further alleges that the average annual run-off from that portion of the stream within her borders is about 300,000 acre feet, and that the annual run-off of the section of the stream within Wyoming is about 500,000 acre feet; that the irrigation system, the operation of which is sought to be enjoined, diverts water from but a small section of the stream and its tributaries lying within Colorado, and that by means of said system Colorado cannot divert more than 70,000 acre feet out of the 300,000 acre feet of the annual run-off of the Colorado sec-

tion of the stream and its tributaries; and, further, that by reason of natural conditions, no more than 90,000 acre feet per annum of the water of the stream can ever be diverted by Colorado for use upon lands lying within the State.

Further, that long prior to the initiation of the present suit, that is to say, on August 25, 1902, when diversions from the entire stream and its tributaries for use within Wyoming did not exceed 50,000 acre feet per annum, predecessors in interest of the corporate defendants commenced construction of the irrigation system complained of for the necessary reclamation of 125,000 acres of rich but arid land lying in the valley of the Cache la Poudre River in Colorado, and that the tunnel through the mountain range and a large part of the mountain diversion canals of the system have been practically completed at a cost of about $1,200,000. That in aid of said irrigation system defendant Irrigation District was organized under the laws of Colorado and thereafter issued bonds in the amount of $5,100,000 for the purpose of purchasing and completing said irrigation system, and that about $2,700,000 of the bonds of said district have been expended in the purchase of water rights and the completion of said irrigation system; that relying upon the diversion of a portion of the waters of the Laramie River and its tributaries in Colorado by means of the tunnel system, citizens have filed upon large bodies of public lands therein under the laws of the United States and have placed valuable improvements and homes thereupon; and that if said diversion is permitted it will enhance the value of the lands within the irrigation district about $50,000,000, but if denied it will largely destroy the value of said lands and also defeat the

acquisition of title to large areas thereof under the public land laws of the United States.

Colorado further avers that at the time of the initiation of the irrigation enterprise complained of there was, and, if the proposed diversion shall be made there will be, abundant water remaining in the Laramie River and its tributaries to supply all the lands in Wyoming claiming water from said stream under rights which had their origin prior to the commencement of the Colorado enterprise; that the lands within Wyoming to the irrigation of which the water of the Laramie River and its tributaries has been and can be supplied are greatly inferior in productiveness to the lands in Colorado to which the waters herein involved will be applied; and that a greater quantity of water will be used upon the Wyoming lands than upon a like area in Colorado, and that the same quantity of water would produce less returns when applied to Wyoming lands than if applied to lands in Colorado; and that Colorado by diverting a portion of the waters of the river within her borders is not unreasonably exercising her right as a state so to do, and prays that the complaint be dismissed.

The corporate defendants filed like answer and further, after denying the claims of Wyoming, justified their acts under the Constitution and laws of Colorado and claim that in making the diversion complained of they are acting under the authority and with the approval of the defendant State, and that in so doing they are exercising, with the approval of the State, one of its inalienable and sovereign rights, that is, the right to avail itself, through its citizens, of one of its great natural resources; that construction of the enterprise complained of was commenced August 25, 1902, and that since hitherto

the corporate defendants and their predecessors have diligently pursued the work of construction and completion thereof; that about $2,700,000 of bonds of the irrigation district have been sold to innocent purchasers for value throughout the United States and the proceeds thereof expended upon purchase and completion of said irrigation system; that the payment of said bonds is dependent upon diversion and use of water from the Laramie River; that defendant Irrigation Company, as prior owner of said irrigation system, has contracted to complete the same for the defendant Irrigation District; that said irrigation system will never be able to divert more than 70,000 acre feet of water from the Colorado portion of the Laramie River, and that it is impossible, owing to natural physical conditions, to divert within the State of Colorado, by this and all other irrigation systems, more than 90,000 acre feet of water per annum and that the run-off of said stream and its tributaries furnishes abundant water to satisfy all appropriations in Wyoming earlier in date than those sought to be enjoined herein even after the defendant Irrigation District shall have diverted all available waters by its irrigation system.

Evidence was taken and case presented both on brief and by oral argument December, 1916. Defendants file this suplemental brief pursuant to order for reargument entered herein.

For greater convenience we separate this brief into two volumes: **VOLUME I** is devoted to a discussion of the law of the case, **VOLUME II** to the facts.

ORDER FOR REARGUMENT.

The order restoring this case to the docket for reargument provides:

> "1. Counsel are requested to specially direct their attention to the rule which they deem should properly be applied to a solution of the controversy for decision: That is, whether the rights asserted are to be tested and determined solely by the application of the general principles of prior appropriation, without regard to state boundaries, or whether, on the contrary, the general principles of prior appropriation are subject to be restricted or their operation limited in this case by state lines, and if so, by what principles, under that assumption, the case is to be controlled.
>
> 2. They are moreover requested not merely by generalizations to state the facts relied upon, but specifically, by careful reference to the pages of the record, and to group them under the various propositions relied upon, including the extent of the use of water in both states when the work complained of was begun and when this suit was commenced, and the extent of appropriation made or authorized in either or both states since its commencement.
>
> 3. In view of the legislation of Congress concerning reclamation and the extensive public works which have been constructed under that legislation and the possible consequences which may result from the rule to be applied in the solution of this controversy, the clerk is instructed to notify

the Attorney General of the United States of this order for reargument."

We shall confine ourselves to discussion of the first two paragraphs or subdivisions of the order.

We feel that the third paragraph calls for a statement from the United States in the first instance and we should not anticipate their position but rather make reply, if occasion so requires.

The first two paragraphs naturally subdivide the discussion into (I) the law of interstate water rights and (II) the facts of this particular case. We shall deal with each of these in their order and separate volumes.

PART I.

THE LAW OF INTERSTATE WATER RIGHTS.

This subdivision demands more than limited notice and citation of authorities.

In order that we may be of any aid to the court in ascertaining the rule of law which shall govern this and similar cases, we must undertake a thorough and exhaustive treatment of the fundamental principles of state and national government, the relations of the states to one another, and the relation of the individual to the state. We realize that the rule of interstate law to be announced in this case may affect not alone Wyoming and Colorado, in their realtions one to the other, but more important still, may control the future relation of the states one to the other and to the United States.

The continued development of our resources, and the growing demands of our citizens and of each of the states must, from time to time in the future, call

for adjustment of controversies between the states which, under the law of nations, treaty or arbitration failing, would be determined by the sword. With this situation before us we shall not limit our presentation of the law to that which we believe should govern this particular case but rather to the broader field of interstate law governing the relation of all the states of the Union in their full or limited jurisdiction over waters within their borders.

1. STATES—NOT INDIVIDUALS—INVOLVED.

Here the rights of two states of the Union are involved and all individual citizens of either and the private rights or claims of any thereof, are necessarily included within whatever rights the respective states may be held to possess.

The State of Colorado and The Greeley-Poudre Irrigation District, a public corporation of Colorado, diverting and applying the waters of the Laramie river through the tunnel system here involved, and The Laramie-Poudre Reservoirs and Irrigation Co., a Colorado corporation previously owning and engaged in construction of the tunnel irrigation system and contracting to complete the same and turn it over to the irrigation district, are parties defendant. The character of parties is the same as in Kansas v. Colorado (185 U. S. 125, 206 U. S. 46). In that case Mr. Justice Brewer observed:

> "While several of the defendant corporations have answered, it is unnecessary to specially consider their defences, for if the case against Colorado fails it fails also as against them."
>
> Kansas v. Colorado, 206 U. S. 46, 85.

Whatever the rights of these corporate defendants may be, the controversy is one between two sov-

ereign states (Wyoming and Colorado) and whatever rights the corporate defendants may have or claim, are necessarily included within the greater rights of Colorado. For,

> "The creature cannot rule the creator."
> 206 U. S. 46, 85.

and the controversy rises above a mere question of local private interest or adjustment of private property rights of citizens of the two states, and is such a controversy as would obtain between independent nations.

> Missouri v. Illinois, 180 U. S. 208; 200 U. S. 496;
> Kansas v. Colorado, 185, U. S. 125; 206 U. S. 46;
> Richey Land & Cattle Co. v. Miller & Lux, 218 U. S. 258.

In fact, were not such the case, the action would, no doubt, have been dismissed on demurrer.

In determining rights between states, private property rights of citizens of each become of secondary importance, the controversy presents itself along broader lines of sovereign rights and powers of the states under whose jurisdiction the citizen obtains and enjoys his private property and the decision determining the rights of the state necessarily includes those of the private citizens. As well said by Mr. Justice Brewer in *Kansas v. Colorado:*

> "Here is a dispute of a justiciable nature which might and ought to be tried and determined. If the two states were absolutely independent nations it would be settled by treaty or by force. Neither of these ways being practicable, it must be settled by decision of this court.

It will be perceived that Kansas asserts a pecuniary interest as the owner of certain tracts along the banks of the Arkansas and as owner of the bed of the stream. We need not stop to consider what rights such private ownership of property might give. * * *

It is the state of Kansas which invokes the action of this court, charging that, through the action of Colorado, a large portion of its territory is threatened with disaster. * * * It is not acting directly and solely for the benefit of any individual citizen to protect his riparian rights. Beyond its property rights it has an interest as a state * * *. Its prosperity affects the general welfare of the state.

The controversy rises therefore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint. Georgia v. Tennessee Copper Co., 206 U. S. 230.

This changes in some respects the scope of our inquiry. It is not limited to the simple matter of whether any portion of the waters of the Arkansas is withheld by Colorado. We must consider the effect of what has been done upon the conditions in the respective states, and so adjust the dispute upon the basis of equality of rights as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beneficial effects of a flowing stream."

Kansas v. Colorado, 206 U. S. 46, 98.

In the language of Mr. Justice Holmes:

"The case has been argued largely as if it were one between two private parties; but it is not * * *. This is a suit by a state for an injury to it in its capacity of a quasi-sovereign. In that capacity the state has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. * * * When the states by their union made the forcible abatement of outside nuisance impossible to each, they did not thereby agree to submit to whatever might be done. They did not renounce the possibility of making reasonable demands on the ground of their still remaining quasi-sovereign interests. An alternative to force is a suit in this court.

The states by entering the union, did not sink to the position of private owners, subject to one system of private law. This court has not quite the same freedom to balance the harm that will be done by an injunction against that of which the plaintiff complains, that it would have in deciding between two subjects of a single political power. * * * It is a fair and reasonable demand on the part of a sovereign that the air over its territory shall not be polluted * * *. If any such demand is to be enforced this must be notwithstanding the hesitation that we might feel if the suit were between private parties."

Georgia v. Tennessee Copper Co., 206 U. S. 230, 237-238.

As previously noted, The Greeley Poudre Irrigation District is a public corporation of Colorado

organized for the purpose of completing the enterprise theretofore undertaken by the other corporate defendant, and of using a relatively small portion of the waters of the Laramie river (as it rises and flows in Colorado) for the irrigation of part of the arid lands of the state. As such it is an agency of the state and whatever powers or rights it may possess it derives from the state. It is similar in this respect to the Sanitary District of Chicago, whose position was thus defined by Mr. Justice Shiras:

> "The averment and conceded facts are that the corporation is an agency of the state to do the very things which, according to the theory of the complainants' case, will result in the mischief to be apprehended. It is state action and its results that are complained of * * *."
>
> Missouri v. Illinois, 180 U. S. 208, 242.

As observed by Mr. Justice Holmes in a suit involving the private property interests of citizens in different states:

> "But whatever this court may decide, if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his state."
>
> Rickey Land & Cattle Co. v. Miller & Lux, 218 U. S. 258, 261.

Such being the nature of the controversy, we shall consider property rights of private citizens to the use of waters of flowing streams (within the state) to the better ascertain the greater rights of the state itself. The law of states, not individuals, is here involved and we shall but incidentally refer to rules of private usufructuary property of citizens.

II. INDEPENDENT NATIONS — THEIR DIGNITY AND EQUALITY—THEIR RELATION TO ONE ANOTHER AND THE RELATION OF THE CITIZEN TO THE STATE.

Nations have absolute dominion of everything within their boundaries, including the rivers, streams and waters therein, unless voluntarily surrendered, and the individual property rights of the citizen are only such as the State may grant him. The citizen and his property rights are at all times inferior and subordinate to the state or nation.

Vattel in his "Law of Nations" (1872 Ed. Chitty) thus defines the rights of independent nations; their dignity and equality, their relation to one another, to their own citizens and to the citizens of one another;—and the relation of the citizen to the state in his property rights:

> "Every nation, every sovereign and independent state, deserves consideration and respect, because it makes an immediate figure in the grand society of the human race, is independent of all earthly power, and is an assemblage of a great number of men, which is, doubtless, more considerable than any individual. The sovereign represents his whole nation; he unites in his person all its majesty. No individual, though ever so free and independent, can be placed in competition with a sovereign; this would be putting a single person upon an equality with a united multitude of his equals. Nations and sovereigns are, therefore, under an obligation, and at the same time have a right, to maintain their dignity, and to cause it to be respected, as being of the utmost importance to their safety and tranquility.

We have already observed that nature has established a perfect equality of rights between independent nations. Consequently, none can naturally lay claim to any superior prerogative; for, whatever privileges any one of them derives from freedom and sovereignty, the others equally derive the same from the same source." (pp. 148-9.)

"It is a settled point with writers on the *natural* law, that all men inherit from *nature* a perfect *liberty* and *independence*, of which they cannot be deprived without their own consent. In a state, the individual citizens do not enjoy them *fully* and absolutely, because they have made a *partial* surrender of them to the sovereign. But the body of the nation, the state, remains absolutely free and independent with respect to all other men, and all *other* nations, as long as it has not voluntarily submitted to them." (p. 53.)

"We have explained how a nation takes possession of a country, and at the same time gains possession of the domain and government thereof. That country, everything included in it, becomes the property of the nation in general. Let us now see what are the effects of this property, with respect to other nations. The full domain is necessarily a peculiar and exclusive right; for, if I have a full right to dispose of a thing as I please, it thence follows that others have no right to do it at all, since if they had any, I could not freely dispose of it. The private domain of the citizens may be limited and restrained in several

ways by the laws of the state, and it always is so by the eminent domain of the sovereign; but the general domain of the nation is full and absolute; since there exists no authority upon earth by which it can be limited; it therefore excludes all right on the part of foreigners. And, as the rights of a nation ought to be respected by all others, none can form any pretensions to the country which belongs to that nation, nor ought to dispose of it without her consent, any more than of the things contained in the country.

The domain of the nation extends to everything she possesses by a just title; it comprehends her ancient and original posessions, and all her acquisitions made by means which are just in themselves, or admitted as such among nations,—concessions, purchases, conquests made in the regular war, etc. And by her possessions we ought not only to understand her territories, but all the rights she enjoys.

Even the property of the individuals is, in the aggregate, to be considered as the property of the nation, with respect to other states. It, in some sort, really belongs to her, from the right she has over the property of her citizens, because it constitutes a part of the sum total of her riches, and augments her power. She is interested in that property by her obligation to protect all her members. In short, it cannot be otherwise, since nations act and treat together as bodies in their quality of political societies, and are considered as so many moral persons.

All those who form a society, a nation being considered by foreign nations as constituting only one whole, one single person all their wealth together can only be considered as the wealth of that same person. And this is so true, that each political society may, if it pleases, establish within itself a community of goods, as Campanella did in his republic of the sun. Others will not inquire what it does in this respect; its domestic regulations make no change in its rights with respect to foreigners nor in the manner in which they ought to consider the aggregate of its property, in what way soever it is possessed." (pp. 163-4.)

In the early case of *Schooner Exchange v. McFadden,* Chief Justice Marshall thus defined the jurisdiction of a nation within its own territory.

"The jurisdiction of the nation within its own territory is necessarily exclusive and absolute. It is susceptible of no limitation not imposed by itself. Any restriction upon it, deriving validity from an external source, would imply a diminution of its sovereignty to the extent of the restriction, and an investment of that sovereignty to the same extent in that power which would impose such restriction. All exceptions, therefore, to the full and complete power of a nation, within its own territories, must be traced up to the consent of the nation itself. They can flow from no other legitimate source."

Schooner Exchange v. McFaddon, 7 Cranch. 116, 136.

In *Rhode Island v. Massachusetts* (1838) Mr. Justice Baldwin said:

"Neither state can have any right beyond its territorial boundary. It follows, that when a place is within a boundary, it is a part of the territory of a State; title, jurisdiction, and sovereignty are inseparable incidents, and remain so till the State makes some cession. * * * 'The jurisdiction of a State is co-extensive with its territory, co-extensive with its legislative power.' * * Whether the sovereignty of the United States, of a State, or the property of an individual, depends on the locality of a tree, a stone, or watercourse; whether the right depends on a charter, treaty, cession, compact, or a common deed; the right is to territory great or small in extent, and power over it, either of government or private property; the title of a State is sovereignty, full and absolute dominion; 2 Pet. 300, 301; the title of an individual is such as the State makes it by its grant and law."

Rhode Island v. Massachusetts, 12 Pet. 657, 733-4.

Vattel thus speaks of rivers, streams and lakes:

"When a nation takes possession of a country, with a view to settle there, it takes possession of everything included in it, as lands, lakes, rivers, etc."

He then treats of the various uses of rivers and the relations of the State and citizens thereto and continues:

"What we have said of rivers and streams, may be easily applied to lakes. Every lake, entirely included in a country, belongs to the nation that is the proprietor of that country; for in taking possession of

a territory a nation is considered as having appropriated to itself everything included in it; and, as it seldom happens that the property of a lake of any considerable extent falls to the share of individuals, it remains common to the nation. * * * The empire or jurisdiction over lakes and rivers is subject to the same rules as the property of them, in all of the cases which we have examined. Each State naturally possessed it over the whole or the part of which it possesses the domain. We have seen that the nation, or its sovereign, commands in all places in its possession."

Vattel's Law of Nations (1872 Edition), 120, 123, 125.

III. STATES OF THE UNITED STATES INDEPENDENT NATIONS, SAVE FOR POWERS SURRENDERED TO THE UNITED STATES.

Each state of the Union, new or original, has the same unlimited jurisdiction over all persons and things, within its territorial limits, as any foreign nation, where that jurisdiction has not been surrendered to the United States by the Constitution. This rule has been so frequently announced and confirmed by this court that limited citation will for the present suffice.

The many cases dealing with state jurisdiction over waters, next to be reviewed, are likewise authority for this fundamental principle of our government.

In the early case of *New York v. Miln*, Mr. Justice Barbour thus defines the sovereignty of a state of the United States:

"That a state has the same undeniable and unlimited jurisdiction over all persons

and things, within its territorial limits, as any foreign nation where that jurisdiction is not surrendered or restrained by the Constitution of the United States. That, by virtue of this, it is not only the right, but the bounden and solemn duty of a state, to advance the safety, happiness and prosperity of its people, and to provide for its general welfare, by any and every act of legislation, which it may deem to be conducive to these ends; where the power over the particular subject or the maner of its exercise is not surrendered or restrained, in the manner just stated."

New York v. Miln, 11 Pet. 102, 139.

In *Chisholm v. Georgia*, 2 Dall. 419, 435:

"Every state in the Union, in every instance where its sovereignty has not been delegated to the United States, I consider it to be as completely sovereign as the United States are in respect to the powers surrendered. The United States are sovereign as to all the powers of government actually surrendered. Each state in the Union is sovereign as to all the powers reserved. It must necessarily be so, because the United States have no claim to any authority but such as the states have surrendered to them. Of course the part not surrendered must remain as it did before."

In *Texas v. White*, 7 Wall. 700, 725:

"But the perpetuity and indissolubility of the Union, by no means implies the loss of distinct and individual existence, or of the right of self-government by the states. Under the Articles of Confederation each

state retained its sovereignity, freedom, and independence, and every power, jurisdiction, and right not expressly delegated to the United States. Under the Constitution, though the powers of the states were much restricted, still, all powers not delegated to the United States, nor prohibited the states, are reserved to the states respectively, or to the people. And as we have already had occasion to remark at this term, that 'the people of each state compose a state, having its own government, and endowed with all the functions essential to separate and independent existence,' and that 'without the states in union, there could be no such political body as the United States.' (Citing County of Lane v. State of Oregon, 7 Wall. 76.) 'Not only, therefore, can there be no loss of separate and independent autonomy to the states, through their union under the Constitution, but it may be not unreasonably said that the preservation of the states, and the maintenance of their governments, are as much within the design and care of the Constitution as the preservation of the Union and the maintenance of the National Government. The Constitution, in all its provisions, looks to an indestructible Union, composed of indestructible states.''

See also:

Taylor on International Law, Sec 124;
1st Wharton Dig. International Law, Sec. 1;
Pennoyer v. Neff, 95 U. S. 722.

As we shall next observe, in the many authorities we shall review, no surrender is made of the un-

limited jurisdiction of each of the states over the rivers, streams and waters within its boundaries, save for regulation of navigation. This is thus reannounced and affirmed by Mr. Justice Brewer:

> "We have within our borders extensive tracts of arid lands which ought to be reclaimed, and it may well be that no power is adequate for their reclamation other than that of the national government. *But if no power has been granted, none can be exercised.* * * * While arid lands are to be found mainly, if not only, in the Western and newer states, yet the powers of the national government within the limits of those states are the same (no greater and no less) than those within the limits of the original thirteen; and it would be strange if, in the absence of a definite grant of power, the national government could enter the territory of the states along the Atlantic and legislate in respect to improving, by irrigation or otherwise, the lands within their borders. * * *
>
> It is enough for the purposes of this case that *each state has full jurisdiction over the lands within its borders, including the beds of streams and other waters.*" (Italics ours.)
>
> Kansas v. Colorado, 206 U. S. 46, 93.

All laws for regulation and control of uses of or usufructuary titles in water necessarily come from some law making sovereign power, state or national, and a more extensive review of the authorities upon the jurisdiction of the states over the waters within their borders is necessary before proceeding to a

discussion of the doctrine of prior appropriation as one of local, not interstate law.

IV. JURISDICTION OF STATES OF THE UNITED STATES OVER THE STREAMS AND WATERS WITHIN THEIR BORDERS.

Analytical treatment of the general subject of the jurisdiction of each state of the Union over the use of waters within its domain and the acquisition by the citizen of usufructuary titles therein, subject at all times to the paramount title of the state, would doubtless lead to a clearer discussion; but we are confronted at the very threshold with such an abundance of authority and such a wealth of precedent and discussion, involving necessarily the individual methods of treatment by each jurist and author, that so to subdivide the discussion, would necessitate so frequent duplication and repetition as to tire and annoy and thus make sacrifice of the benefits otherwise gained. We shall accordingly treat the subject generally, rather than in specific subdivisions, quoting more liberally than we would were the subject of less importance.

A comprehensive discussion necessarily involves consideration of the fundamental principles of government, the rights and powers of independent states and of states of the United States, in their relations not alone to their own citizens and the citizens of other states, but more essentially to each other and to the United States. The power to regulate the use of waters within its domain must necessarily rest with the state, unless in some manner limited by voluntary surrender of all or some portion of such power to the other states or to the United States in the Constitution.

(1) GENERAL STATEMENT.

At the outset, rather than in conclusion, we find that the authorities with remarkable unanimity announce and affirm certain general principles and conclusions which may be summarized as follows:

Each nation has jurisdiction and sovereign control over the waters of the flowing streams within its domain. Each of the original thirteen states of the United States possessed all of the powers of separate nations at the time of the formation of the Union. After the Union each of these original states retained and thereafter continued to exercise all of such rights, powers and jurisdiction formerly held, save as surrendered to the United States by the Constitution. Each of the original thirteen states, before the Constitution, was in all respects equal with the other independent states and each had the same sovereign powers of independent nations. After the adoption of the Constitution each state continued equal in all respects with all the rest. Each of the new states was admitted to the Union on an absolute equality with the original thirteen states and was and is possessed of the same powers and jurisdiction over the streams within its borders as were retained by the original states at the time of the adoption of the Constitution. Each state, old or new, stands upon an equality with all of the rest and the powers of the new states are no less and no greater than those of the original thirteen.

Whatever sovereign jurisdiction the United States may have exercised over the territories, upon admission to the Union, the sovereign powers theretofore exercised by Congress over the territories ceased to exist and passed to the new states upon admission. This sovereign jurisdiction extended to the

waters and streams within their borders to the same degree as with the original thirteen states. This control of the streams included the right to determine the use that may be made of the waters of the state by its citizens whether for navigation (except as delegated to Congress), fisheries, power, municipal supply, and domestic, irrigation, or any other use necessary to the state or its citizens according to the varying demands and conditions of the territory included within each of the new states, including the right to fix by local laws, rules and regulations the extent to which a usufructuary property in such waters may be obtained and enjoyed and the class of property owners (i. e., riparian, non-riparian, etc.) who may so possess and enjoy the use thereof, subject at all times to the greater right of the sovereign control remaining within the state. The uses thus recognized as limited property rights in the citizens of the respective states, and, so controlled by the conditions obtaining, have been determined by each state according to its own necessities and fixed by its local laws and decisions, and the United States and its courts have adopted the state laws, regulations and court decisions as the rules controlling within their respective jurisdictions.

No power was delegated to congress to determine the laws, rules or methods of use that should apply within the states and Congress, wherever it has legislated upon the subject with respect to public lands, has not only refused to infringe upon the powers of the states, but has specifically recognized the local laws, customs and court decisions as controlling upon the regulation of the streams within the states.

In the exercise of jurisdiction of the streams within their borders, each of the states of the Union

has fixed its own methods of regulation and control, varying to a greater or less degree in each thereof, according to the varied local conditions and necessities. In the states where irrigation is unnecessary, usufructuary titles under the common law rule of riparian rights have been recognized and permitted to a limited number of citizens (the owners of land bordering upon the streams) to the exclusion of other citizens, and even in such states the rules announced and the limits to the exercise of the usufructutary rights have varied in each of such states according to the local conditions and the necessities of the state and its people. In other states where the rainfall is insufficient to supply the necessities of the state and its citizens, usufructuary titles to the waters of the streams have been permitted to a limited class of citizens (viz.: the first appropriator for use on any lands, riparian or non-riparian, according to the extent of his beneficial use) under the arid region doctrine of appropriation. While in still others combining both humid and arid natural conditions (as California, Nebraska, etc.) usufructuary titles have been recognized under both the common law doctrine of riparian rights and the arid region doctrine of appropriation; and in all the states of the Union the doctrines, varied by local conditions, have been from time to time modified, enlarged or restricted according to the necessities obtaining, to such a degree that in no two of the states adopting a given general rule or combination of rules, are the laws, decisions or manner of regulating these usufructury rights identical.

An extended review of the history of the development of the law of waters of each of the states reveals an ever changing progression conforming to the conditions there prevailing, written by legisla-

tion and decisions of her courts and varying or departing to a greater or less degree, especially in the application of the fundamental principles, from the rules of similar states where like conditions generally obtain (for example, the variance between the application of the common law doctrine in New Jersey and California, California and Oregon, Oregon and Nebraska, or the variance in the application of the arid region doctrine in Nevada and Wyoming, and Wyoming and Colorado).

Finally each state has the right to adopt laws of her choice and thereafter to alter, enlarge or modify the same according to her conditions and her necessities and those of her people. Irrespective of the distinguishing features of the laws of each of the states the one predominant feature remains that all of the states have from the first history of the United States executed full control, save as surrendered in the federal Constitution, over the waters within their borders, and no state has imposed or could, if she would, impose her doctrines upon her neighbor and Congress cannot enforce any doctrine upon any state or group of states. Each state has at all times jealously guarded her paramount and sovereign powers and title over the waters within her borders and has at all times limited the enjoyment of this her ofttimes greatest natural resource, to usufructuary uses to only limited numbers of her citizens for the development of such limited portions of her area as would best serve the state and all her people. In humid states she has with equality recognized the usufructuary rights of riparian owners and excluded, to a greater or less degree, all others not included within this particular class. In arid states she has limited the beneficial use of her waters to the first to make use thereof, without respect to the location of the

lands, to the exclusion of those who subsequently desired the same; and at all times in her paramount and reserved right and power, she had modified, enlarged or restricted her rules and doctrines to suit her local conditions and growing necessities.

(2) DISCUSSION OF AUTHORITIES—STATE JURISDICTION OF WATERS.

From the abundance of authority, we shall confine ourselves primarily to a discussion of and citations from the decisions of this Court and of other Federal courts, and shall refrain from reference to numerous decisions of State courts, except where properly involved in the consideration of some decision of this Court or, in a few instances, where decisions of this Court have been relied upon by the state courts in applying the principles here involved. But limited reference will be made to accredited authors and then only for brevity and to avoid unduly prolonging the quotations from decisions, already extended out of ample caution and a consideration of the importance of the subject.

While an arrangement of authorities in groups according to the principles involved, might, to some degree, be more satisfactory, nevertheless we have preferred to follow the history of interpretation of the law of state jurisdiction of waters in the order of announcement by the courts of the land. We shall refer to national legislation in a separate and subsequent portion of this brief.

(a) Decisions of the Courts.

From the earliest decisions of this court to the present time, all uses of water for navigation, fisheries, power, domestic, irrigation and other beneficial purposes have been treated as within the sovereign

jurisdiction and control of the several states of the Union, (save alone for the paramount right of Congress in its control of navigation) and the laws of the states and decisions of their courts, have been universally recognized as controlling, by this court. We shall, therefore, make no distinction by segregation of the cases dealing with the various uses, but shall treat them as governed by one general principle of state control.

Willson vs. The Blackbird Creek Marsh Co. (1829) involved the right of Delaware to permit a Delaware corporation to dam a navigable creek and thereby interfere with navigation. Opinion by Chief Justice Marshall:

> "The act of assembly by which the plaintiffs were authorized to construct their dam, shows plainly that this is one of those many creeks, passing through a deep level marsh adjoining the Delaware, up which the tide flows for some distance. The value of the property on its banks must be enhanced by excluding the water from the marsh, and the health of the inhabitants probably improved. Measures calculated to produce these objects, provided they do not come into collision with the powers of the general government, are undoubtedly within those which are reserved to the States. But the measure authorized by this act stops a navigable creek, and must be supposed to abridge the rights of those who have been accustomed to use it. But this abridgement, unless it comes in conflict with the constitution or a law of the United States, is an affair between the government of Dela-

ware and its citizens of which this court can take no cognizance."

Willson vs. Blackbird Creek Marsh Co. 2 Pet. 245.

Martin vs. Waddell (1842) involved the question of title in certain lands covered with water in New Jersey. Opinion by Mr. Justice Taney:

> "The English possessions in America were not claimed by right of conquest but by right of discovery * * * and the absolute rights of property and dominion were held to belong to the European nation by which any particular portion of the country was first discovered. * * * The discoveries made by persons acting under the authority of the government were for the benefit of the nation; and the crown, according to the principles of the British constitution, was the proper organ to dispose of the public domains; and upon these principles rest the various charters and grants of territory made on this continent."

Of sovereign rights to waters within the borders of the states it is said:

> "When the Revolution took place, the people of each State became themselves sovereign; and in that character hold the absolute right to all their navigable waters and the soils under them for their own common use, subject only to the rights since surrendered by the constitution to the general government."

Martin vs. Waddell, 16 Pet. 367, 409, 410.

Pollard vs. Hagan (1844) involved a question of title in certain lands in Mobile Bay, Alabama,

overflowed at high tide: Opinion by Mr. Justice M'Kinley:

> "And we now enter into its examination with a just sense of its great importance to all the States of the Union, and particularly to the new ones. Although this is the first time we have been called upon to draw the line that separates the sovereignty and jurisdiction of the government of the Union, and the state governments, over the subject in controversy, many of the principles which enter into and form the elements of the question have been settled by previous well considered decisions of this court, to which we shall have occasion to refer in the course of this investigation." (3 How. 212, 220.)

To the argument that the United States derived title from the King of Spain and succeeded to all his rights and jurisdiction over the territory ceded and therefore held the land and the soil under navigable waters according to the laws of Spain,—that Alabama, by her compact with the United States on admission to the Union, agreed that the people of Alabama forever disclaimed all title to unappropriated lands lying within the state and that by such compact the land under navigable waters, as well as the public domain above high water, were reserved to the United States, he said:

> "We think a proper examination of this subject will show that the United States never held any municipal sovereignty, jurisdiction, or right of soil in and to the territory, of which Alabama or any of the new states were formed, except for temporary

purposes, and to execute the trusts created by the acts of Virginia and Georgia legislatures, and the deeds of cession executed by them to the United States, and the trust created by the treaty with the French republic, of the 30th of April, 1803, ceding Louisiana" (page 221).

He then discusses the derivation of title to the territory of Alabama and the legislative acts of the United States and of the states of Georgia and Virginia and says:

> "When the United States accepted the cession of the territory, they took upon themselves the trust to hold the municipal eminent domain for the new States, and to invest them with it, to the same extent, in all respects, that it was held by the States ceding the territories. * * *
>
> When Alabama was admitted into the Union, on an equal footing with the original States, she succeeded to all the rights of sovereignty, jurisdiction, and eminent domain which Georgia possessed at the date of the cession, except so far as this right was diminished by the public lands remaining in the possession and under the control of the United States, for the temporary purpurposes provided for in the deed of cession and the legislative acts connected with it. Nothing remained to the United States, according to the terms of the agreement, but the public lands. And, if an express stipulation had been inserted in the agreement, granting the municipal right of sovereignty and eminent domain to the United States,

such stipulation would have been void and inoperative, because the *United States have no constituional capacity to exercise municipal jurisdiction, sovereignty or eminent domain within the limits of a State* or elsewhere, except in the cases in which it is expressly granted" (page 223).

After observing that only in the District of Columbia and other places purchased and used for forts, magazines, arsenals, dock-yards and other government buildings, "the national and municipal powers of the government, of every description, are united in the government of the Union," except in cases theretofore mentioned of temporary territorial governments and that even there such a local government existed, he further said:

> "The right of Alabama and *every other new State*, to exercise all the powers of government, which belong to, and may be exercised by the original States of the Union, must be admitted, and remain unquestioned, except so far as they are temporarily deprived of control over the public lands. * * * The right of the United States to these lands * * * originated in voluntary surrenders made by several of the old States, of their waste and unappropriated lands to the United States, under a resolution of the old congress, of the 6th of September, 1780, recommending such surrender and cession, to aid in paying the public debt, incurred by war of the Revolution. The object of all the parties to these contracts of cession was, to convert the land into money, for the payment of the debt, and to erect new States

over the territory thus ceded; and as soon as these purposes could be accomplished, the power of the United States over these lands, as property, was to cease. * * *

We, therefore, think the United States hold the public lands within the new States by force of the deeds of cession, and the statutes connected with them, and not by any municipal sovereignty which it may be supposed to possess, or have reserved by compact with the new States, for that particular purpose. The provision of the constitution above referred to, shows that no such power can be exercised by the United States within a State. Such a power is not only repugnant to the constitution, but it is inconsistent with the spirit and intention of the deeds of cession." (page 224.)

After discussing the power of Congress to make rules and regulations respecting its own territory, he said:

"And this brings us to the examination of the question, whether Alabama is entitled to the shores of the navigable waters, and the soils under them, within her limits. The principal argument relied on against this right, is, that the United States acquired the land in controversy from the king of Spain.

* * * * * * *

If it were true that the United States acquired the whole of Alabama from Spain, no such consequences would result as those contended for. It cannot be admitted that the king of Spain could, by treaty or otherwise, impart to the United States any of his royal prerogatives; and much less can it be

admitted that they have capacity to receive or power to exercise them. Every nation acquiring territory, by treaty or otherwise, must hold it subject to the constitution and laws of its own government, and not according to those of the government ceding it. Vat. Law of Nations, B. 1, c. 19 Secs. 210, 244, 245, and b. 2, c. 7, Sec. 80." (p. 225.)

After a discussion of the Spanish cession, the ordinance of 1787 and the treaty with France, all of which gave to the United States the whole of the territory, he said:

"Alabama is, therefore, entitled to the sovereignty and jurisdiction over all the territory within her limits. * * * To maintain any other doctrine, is to deny that Alabama has been admitted into the Union on an equal footing with the original States, the constitution, laws, and compact, to the contrary notwithstanding. But her rights of sovereignty and jurisdiction are not governed by the common law of England as it prevailed in the colonies before the Revolution, but as modified by our own institutions. In the case of Martin and others v. Waddell, 16 Pet. 410, the present chief justice, in delivering the opinion of the court, said:

'When the Revolution took place, the people of each State became themselves sovereign; and in that character hold the absolute right to all their navigable waters, and the soils under them, for their own common use, subject only to the rights since surrendered by the constitution.'

Then to Alabama belong the navigable

waters, and soils under them, in controversy in this case, subject to the rights surrendered by the constitution to the United States; and no compact that might be made between her and the United States could diminish or enlarge these rights." (page 229).

Of the provision in the enabling act of Alabama declaring that all navigable waters within the State should forever remain public highways, etc., and its alleged conflict with the federal constitution, he said:

> "By the 8th section of the 1st article of the constitution, power is granted to congress 'to regulate commerce with foreign nations and among the several States.' If, in the exercise of this power, congress can impose the same restrictions upon the original States, in relation to their navigable waters, as are imposed by this article of the compact on the State of Alabama, then this article is a mere regulation of commerce among the several States, according to the constitution, and, therefore, as binding on the other States as Alabama. * * * As the provision of what is called the compact between the United States and the State of Alabama does not, by the above reasoning, exceed the power thereby conceded to congress over the original States on the same subject, no power or right was, by the compact, intended to be reserved by the United States nor to be granted to them by Alabama.
>
> This supposed compact is, therefore, nothing more than a regulation of commerce

to that extent among the several states, and can have no controlling influence in the decision of the case before us.

This right of eminent domain over the shores and the soils under the navigable waters, for all municipal purposes, belongs exclusively to the States within their respective territorial jurisdictions, and they, and they only, have the constitutional power to exercise it. * * * But in the hands of the States this power can never be used so as to affect the exercise of any national right of eminent domain or jurisdiction with which the United States have been invested by the constitution."

He then concludes:

"By the preceding course of reasoning we have arrived at these general conclusions: First, the shores of navigable waters, and the soils under them, were not granted by the constitution to the United States, but were reserved to the States respectively. Secondly, the new States have the same rights, sovereignity, and jurisdiction over this subject as the original States. Thirdly, the right of the United States to the public lands, and the power of congress to make all needful rules and regulations for the sale and disposition thereof, conferred no power to grant to the plaintiffs the land in controversy in this case." (p. 230.)

Holyoke Water-Power Co. v. Lyman (1873) involved construction of certain acts of the Massachusetts legislature granting the right to dam the Connecticut River for power and other purposes. It also involved the question of the interference with the

fisheries of the stream. Opinion by Mr. Justice Clifford:

> "Rivers, though not navigable even for boats or rafts, and even smaller streams of water, may be and often are regarded as public rights, subject to legislative control, as the means for creating power for operating mills and machinery, or as the source for furnishing a valuable supply of fish, suitable for food and sustenance. Such water-power is everywhere regarded as a public right, and fisheries of the kind, even in waters not navigable, are also so far public rights that the Legislature of the State may ordain and establish regulation to prevent obstructions to the passage of the fish and to promote the usual and uninterrupted enjoyment of the right by the riparian owners. * * * Water rights of the kind, whether the streams are used for mill purposes or merely as fisheries, are justly entitled to public protection, as they are in many cases of great value to the community where they exist."

> "Public rights, in all juridictions, are subject to legislative control, and it is settled law in Massachusetts, and has been for a century and a half, including her colonial history, that the right of fishery in such rivers as the Connecticut and Merrimac, even above the point where they are navigable for boats or rafts, and the right to erect and maintain dams to create water-power for mill purposes, are public rights and that the owners of such rights are bound

by such reasonable regulations as the State may make and ordain for their protection and enjoyment."

Holyoke Water-Power Co. v. Lyman, 82 U. S. 133, 135, 136, 138; 15 Wall. 500.

Barney v. Keokuk (1877) involved the question of title in certain "made" lands on the water front of Keokuk. Opinion by Mr. Justice Bradley, who after considering the local law of Iowa, as interpreted by its courts, to the effect that the title of riparian proprietors on the Mississippi extends only to the high water mark and that the shore between the high and low water mark as well as the bed of the river, belongs to the State; and after observing that the confusion of navigable with tide waters found in the common law had long prevailed in this country, and had laid the foundation, in many States, of doctrines with regard to the ownership of soil in navigable waters above tide water, he said:

"Whether, as rules of property, it would now be safe to change these doctrines where they have been applied, as before remarked, is for the several States themselves to determine. If they choose to resign to the riparian proprietor rights which properly belong to them in their sovereign capacity, it is not for others to raise objections. In our view of the subject, the correct principles were laid down in *Martin v. Waddell*, 16 Pet. 367, *Pollard v. Hagan* (*supra*), and *Goodtitle v. Kibbe*, 9 How. 471.

It properly belongs to the States by their inherent sovereignty, and the United States has wisely abstained from extending (if it could extend) its survey and grants be-

yond the limits of high water. The cases in which this court has seemed to hold a contrary view depended, as most cases must depend, on the local laws of the States in which the lands were situated."

Barney v. Keokuk, 94 U. S. 324.

McCready v. Virginia (1877) involved the right of Virginia to prohibit the citizens of other States from planting oysters in the Ware River, when its own citizens have that privilege. Opinion by Mr. Chief Justice Waite:

"The principle has long been settled in this court, that each State owns the beds of all tide-waters within its jurisdiction, unless they have been granted away. * * * In like manner, the States own the tide-waters themselves, and the fish in them, so far as they are capable of ownership while running. For this purpose the State represents its People, and the ownership is that of the People in their united sovereignty. *Martin v. Waddell,* 16 Pet. 410.

The title thus held is subject to the paramount right of navigation, the regulation of which, in respect to foreign and interstate commerce, has been granted to the United States. There has been, however, no such grant of power over the fisheries. These remain under the exclusive control of the State, which has consequently the right, in its discretion, to appropriate it tide-waters, and their beds to be used by its People as a common for taking and cultivating fish, so far as it can be done without obstructing navigation.

Such an appropriation is, in effect,

> nothing more than a regulation of the use by the People of their common property. The right which the People of the State thus acquire comes not from their citizenship alone, but from their citizenship and property combined. It is, in fact, a property right, and not a mere privilege or immunity of citizenship."
>
> McCready v. Virginia, 94 U. S. 391.

Pound v. Turck (1878) involved the right of the State of Wisconsin to authorize the construction of dams across the Chippewa river and the interference thereof with navigation. After stating that the want of power was supposed to rest on the repugnance of the Wisconsin statute to the provisions of the federal constitution conferring authority upon Congress "to regulate commerce with foreign nations, and among the several States," Mr. Justice Miller said:

> "The principle established by the decisions to which we have referred is, that, in regard to the powers conferred by the commerce clause of the Constitution, there are some which by their essential nature are exclusive in Congress, and which the States can exercise under no circumstances; while there are others which from their nature may be exercised by the States until Congress shall see proper to cover the same ground by such legislation as that body may deem appropriate to the subject. Of this class are pilotage and other port regulations, *Cooley v. Bd. of Wardens*, 12 How. 299; bridges across navigable streams, *Gilman v. Philadelphia;* and, as specially applicable to the case before us, to erect dams across navigable streams, *Willson v. Black-*

bird Cr. M. Co., 2 Pet. 245. This general doctrine was very fully examined and sustained in *Gilman v. Philadelphia*, 3 Wall. 713, and again in *Crandall v. Nevada*, 6 Wall. 35. * * *

But to the Legislature of the State may be most appropriately confided the authority to authorize these structures where their use will do more good than harm, and to impose such regulations and limitations in their construction and use as will best reconcile and accommodate the interest of all concerned in the matter. And since the doctrine we have deduced from the cases recognizes the right of Congress to interfere and control the matter whenever it may deem it necessary to do so, the exercise of this limited power may all the more safely be confided to the local Legislatures."

Pound v. Turck, 95 U. S. 459, 462, 464.

Escanaba Co. v. Chicago, (1882) involved construction of a bridge across the Chicago River, a navigable stream of Illinois, under the laws of that State. Opinion by Mr. Justice Field:

"But the States have full power to regulate within their limits matters of internal police, including in that general designation whatever will promote the peace, comfort, convenience and prosperity of their people. This power embraces the construction of roads, canals, and bridges, and the establishment of ferries, and it can generally be exercised more wisely by the States than by a distant authority. * * * If the power of the State and that of the Federal government come in conflict, the latter must control

and the former yield. This necessarily follows from the position given by the Constitution to legislation in pursuance of it, as the supreme law of the land. But until Congress acts on the subject, the power of the State over bridges across its navigable streams is plenary. This doctrine has been recognized from the earliest period, and approved in repeated cases, the most notable of which are *Willson v. The Blackbird Creek Marsh Co.*, 2 Pet. 245, decided in 1829 and *Gilman v. Philadelphia*, 3 Wall. 713, decided in 1865."

In denying that the ordinance of July 13, 1787, for the government of the territory northwest of the Ohio River could bind the State of Illinois after its admission, he said:

"Its provisions could not control the authority and powers of the State after her admission. Whatever the limitation upon her powers as a government whilst in a territorial condition, whether from the ordinance of 1787 or the legislation of Congress, it ceased to have any operative force, except as voluntarily adopted by her, after she became a State of the Union. On her admission she at once became entitled to and possessed of all the rights of dominion and sovereignty which belonged to the original States. She was admitted and could be admitted, only on the same footing with them. The language of the resolution admitting her is 'on an equal footing with the original States *in all respects whatever.*' 3 Stat. 536. Equality of constitutional right and

power is the condition of all the States of the Union, old and new. Illinois, therefore, as was well observed by counsel, could afterwards exercise the same power over rivers within her limits that Delaware exercised over Black Bird Creek, and Pennsylvania over the Schuylkill River."

Escanaba Co. v. Chicago, 107 U. S. 678, 683, 687, 688.

Cardwell v. American Bridge Co. (1885), involved an action for the removal of a bridge across the American River, California, as an interference with *navigation*. Opinion by Mr. Justice Field:

"The questions thus presented are neither new nor difficult of solution. Except in one particular, they have been considered and determined in many cases, of which the most important are *Willson v. Blackbird Creek Marsh Co.*, 2 Pet. 245; *Pennsylvania v. Wheeling Bridge Co.*, 13 How. 518, 564; *Gilman v. Philadelphia*, 3 Wall. 713; *Pound v. Turck*, 95 U. S. 459; *Escanaba Co. v. Chicago*, 107 U. S. 678, and *Miller v. Mayor of New York*, 109 U. S. 385. In these cases the control of Congress over navigable waters within the States so as to preserve their free navigation under the commercial clause of the Constitution, the power of the States within which they lie to authorize the construction of bridges over them until Congress intervenes and supersedes their authority, and the right of private parties to interfere with their construction or continuance, have been fully considered, and we

are entirely satisfied with the soundness of the conclusions reached."

Of the contention that a clause in the enabling act admitting California as a State, declaring all navigable waters within the State to be common highways and forever free, etc., a declaration similar to that in the ordinance of 1787, he said:

> "And in *Escanaba Co. v. Chicago,* we held, with respect to the State of Illinois, that the clause was superseded by her admission into the Union, for she then became entitled to and possessed of all the rights of domain and sovereignty which belonged to the original States. The language of the resolution admitting her declared, that it was on 'an equal footing with the original States in all respects whatever;' so that, after her admission, she possessed the same power over rivers within her limits that Delaware exercised over Blackbird Creek and Pennsylvania over Schuylkill River. * * *
>
> The clause, therefore, in the act admitting California, quoted above, upon which the complainant relies, must be considered, according to these decisions, as in no way impairing the power which the State could exercise over the subject if the clause had no existence. * * * The act admitting California declares that she is 'admitted into the Union on an equal footing with the original States *in all respects whatever.*' She was not, therefore, shorn by the clause as to navigable waters within her limits of any of the powers which the original States

possessed over such waters within their limits."

Cardwell v. American Bridge Co., 113 U. S. 205, 208, 210-12.

In *St. Louis v. Myers* (1885), of rights of *riparian owners* it is said:

"They are left to be settled according to the principles of State law."

St. Louis v. Myers, 113 U. S. 566, 567.

Hamilton v. Vicksburg etc. R. R. (1886) involved repair of a bridge over Bouff River, Louisiana, temporarily interfering with navigation. Opinion by Mr. Justice Field:

"What the form and character of the bridges should be, * * * were matters for the regulation of the State, subject only to the paramount authority of Congress to prevent any unnecessary obstruction to the free navigation of the streams. Until Congress intervenes in such cases, and exercises its authority, the power of the State is plenary. When the State provides for the form and character of the structure, its directions will control, except as against the action of Congress, whether the bridge be with or without draws, and irrespective of its effect upon navigation."

In answer to the contention that the clause in the enabling act of Louisiana providing that the river Mississippi, etc., should be common highway and forever free, and that therefore Congress had previously acted in respect to the stream in question, he said:

"A similar provision is found in the acts admitting the States of California, Wisconsin, and Illinois into the Union, with re-

spect to the navigable rivers and waters in them, the purport and meaning of which have been the subject of consideration by this Court. Escanaba Co. v. Chicago, 107 U. S. 678, and Cardwell v. American Bridge Company, 113 U. S. 205. In the latter case, we had before us the clause in the act admitting California, and we held that it did not impair the power which the State could exercise over its rivers, even if the clause had no existence."

Hamilton vs. Vicksburg, etc., R. R. 119 U. S. 280, 281.

Willamette Iron Bridge Co. vs. Hatch (1888) involved construction of an act of the Oregon Legislature permitting the building of a bridge on Willamette River, Oregon. It was charged that the bridge obstructed *navigation* and that it was contrary to the act of Congress admitting the State of Oregon into the Union, wherein it was provided that all navigable waters of the state should be common highways, etc. Opinion by Mr. Justice Bradley:

"The power of Congress to pass laws for the regulation of the navigation of public rivers, and to prevent any and all obstructions therein, is not questioned. But until it does pass some such law, there is no common law of the United States, which prohibits obstructions and nuisances in navigable rivers, unless it be the mairtime law, administered by the courts of admiralty and maritime jurisdiction. * * * Such obstructions and nuisances are offenses against the laws of the states within which the navigable waters lie, and may be in-

dicted or prohibited as such; but they are not offenses against United States laws which do not exist; and none such exist except what are to be found on the statute book. * * * This is the result of so many cases, and expressions of opinion by this court, that it is almost superfluous to cite authorities on the subject. * * *

The usual case, of course, is that in which the acts complained of are clearly supported by a state statute; but that really makes no difference. Whether they are conformable or not conformable to the state law relied on is a state question, not a federal one."

Of the provision in the Oregon enabling act, claimed to vest authority in Congress, he said:

"The clause in question had its origin in the 4th article of the compact contained in the ordinance of the old Congress for the government of the territory northwest of the Ohio, adopted July 13, 1787; * * *

This court has held that when any new state was admitted into the Union from the Northwest Territory, the ordinance in question ceased to have any operative force in limiting its powers of legislation as compared with those posessed by the original states. On the admission of any such new state, it at once became entitled to and possessed all the rights of dominion and sovereignty which belonged to them. See the cases of *Pollard vs. Hagan* (*supra*); *Permoli vs. First Municipality of N. O.*, 44 U. S. 3 How. 589; *Escanaba Co. vs. Chicago;*

Cardwell vs. American Bridge Co.; Huse vs. Glover (*supra*).

In admitting some of the new states, however, the clause in question has been inserted in the law, as it was in the case of Oregon, whether the state was carved out of the territory northwest of the Ohio, or not; and it has been supposed that in this new form of enactment, it might be regarded as a regulation of commerce, which Congress has the right to impose.

* * * * * * *

It is obvious that if the clause in question does prohibit physical obstructions and impediments in navigable waters, the State Legislature itself, in a state where the clause is in force, would not have the power to cause or authorize such obstructions to be made without the consent of Congress. But it is well settled that the legislatures of such states do have the same power to authorize the erection of bridges, dams, etc., in and upon the navigable waters wholly within their limits, as have the original states in reference to which no such clause exists. It was so held in *Pound vs. Turck*, 95 U. S. 459, in reference to a dam in the Chippewa River in Wisconsin, in *Cardwell vs. American Bridge Co.*, 113 U. S. 205, in reference to a bridge without a draw, erected on the American River in California, which prevented steamboats from going above it; and in *Hamilton vs. Vicksburg, S. & P. R. Co.*, 119 U. S. 280, relating to railroad bridges in Louisiana; in all which cases the clause in question was in force in the

states where they arose, and in none of them was said clause held to restrain in any degree the full power of the state to make, or cause to be made, the erections referred to, which must have been more or less obstructions and impediments to the navigation of the streams on which they were placed."

Willamette Iron Bridge Co. vs. Hatch, 125 U. S. 1, 12.

We may here pause to suggest, that even had Congress insisted on the insertion of a clause in the enabling acts of each of the new states, surrendering full jurisdiction to the United States over all streams within the domain of each new state, such a clause would have been inoperative for the reasons assigned in the cases last reviewed.

Control by the states over game is in many respects similar to control over the waters within their domain and we digress for the moment to quote from a more recent decision of this court applying the same reasoning to game as this court applied to waters in the foregoing cases.

Ward vs. Race Horse (1896) involved question of right of Wyoming after admission as a state to control the killing of game within her borders notwithstanding prior treaty with Bannock Indians permitting hunting on government lands. Opinion by Mr. Justice White:

"The power of the state to control and regulate the taking of game cannot be questioned. Geer vs. Conn. 161 U. S. 519."

While discussing the Indian treaty of 1868 and the law of Wyoming passed subsequent to its admission to the Union:

"To suppose that the words of the treaty intended to give to the Indian the right to enter into already established states and seek out every portion of unoccupied government land and there exercise the right of hunting, in violation of the municipal law, would be to presume that the treaty was so drawn as to frustrate the very object it had in view. It would also render necessary the assumption that Congress, whilst preparing the way, by the treaty, for new settlements and new states, yet created a provision not only detrimental to their future well-being, but also irreconcilably in conflict with the powers of the states already existing."

And further:

"The act which admitted Wyoming into the Union, as we have said, expressly declared that that state should have all the powers of the other states of the Union, and made no reservation whatever in favor of the Indians. * * * But the language of the act admitting Wyoming into the Union, which recognized her co-equal rights, was merely declaratory of the general rule."

Of the power of the states to regulate the killing of game within their borders, even on unoccupied government land:

"The power of all states to regulate the killing of game within their borders will not be gainsaid, yet, if the treaty applies to the unoccupied land of the United States in the State of Wyoming, that state would be bereft of such power, since every isolated piece of land belonging to the United States

as a private owner, so long as it continued to be unoccupied land, would be exempt in this regard from the authority of the state. Wyoming, then, will have been admitted into the Union, not as an equal member, but as one shorn of a legislative power vested in all the others states of the Union, a power resulting from the fact of statehood and incident to its plenary existence. * * * The enabling act declares that the State of Wyoming is admitted on equal terms with other states, and this declaration, which is simply an expression of the general rule, which presupposes that states, when admitted into the Union, are endowed with powers and attributes equal in scope to those enjoyed by the states already admitted, repels any presumption that in this particular case Congress intended to admit the State of Wyoming with diminished governmental authority."

Ward vs. Race Horse, 163 U. S. 504, 507, 509, 511, 514.

No reservation of control over waters (other than those already cited concerning navigation) appear in any of the enabling acts admitting the new states to the Union. All specifically declare that the new states are admitted in all respects equal with the original thirteen states so that neither the United States nor any other state may lay claim to any waters within the borders of any new state, but even had such a reservation been attempted it would be inoperative, if for no other reason, as in violation of that provision of the Constitution guaranteeing equality of the new states with the old, in all respects.

Manchester vs. Massachusetts (1891) involved

the right of Massachusetts to control *fisheries* within Buzzard's Bay lying wholly within the territory of that state. Opinion by Mr. Justice Blatchford, wherein he affirms the right of Massachusetts to control the waters of the bay in her sovereign capacity, is in part as follows:

> "By the definitive Treaty of Peace of September 3, 1783, between the United States and Great Britain (8 Stat. 81), His Britannic Majesty acknowledged the United States, of which Massachusetts Bay was one, to be free, sovereign and independent States, and declared that he treated them as such, and, for himself, his heirs and successors, relinquished all claims to the government, propriety and territorial rights of the same and every part thereof. *Therefore, if Massachusetts had continued to be an independent nation, her boundaries on the sea, as defined by her statutes, would unquestionably be acknowledged by all foreign nations, and her right to control the fisheries within those boundaries would be conceded.*" (Italics ours.)

He then speaks of the limits within which by international law Massachusetts is entitled to claim jurisdiction, and continued:

> "We think it must be regarded as established that, as between nations, * * * included in this territorial jurisdiction is the right of control over fisheries, whether the fish be migratory, free-swimming fish, or free-moving fish, or fish attached to or imbeded in the soil."

He then quotes with approval from McCready

vs. Virginia, supra, that the states own all tide waters within their jurisdiction, the fish in them and the soil beneath them and further quotes as follows from Smith vs. Maryland, 59 U. S. 18 How. 71, 74:

> " 'Whatever soil below low-water mark is the subject of exclusive propriety and ownership belongs to the state on whose maritime border and within whose territory it lies, subject to any lawful grants of that soil by the state, or the sovereign power which governed its territory before the declaration of independence. *Pollard vs. Hagan*, 44 U. S. 3 How. 212; *Martin vs. Waddell*, 41 U. S. 16 Pet. 367; *Den vs. Jersey Co.* 56 U. S. 15 How. 462. But this soil is held by the state, not only subject to, but in some sense in trust for, the enjoyment of certain public rights, among which is the common liberty of taking fish, as well shell fish as floating fish.' "

It having been urged that the Massachusetts act was unconstitutional:

> "*In United States vs. Bevans,* Marshall Ch. J., said: 'The jurisdiction of a state is co-extensive with its territory; co-extensive with its legislative power. The place described is unquestionably within the original territory of Massachusetts. It is then within the jurisdiction of Massachusetts, unless that jurisdiction has been ceded to the United States.' If the place where the offense charged in this case was committed is within the general jurisdiction of Massachusetts, then, according to the principles declared in *Smith vs. Maryland*, the statute

in question is not repugnant to the constitution and laws of the United States."

The extent of the territorial jurisdiction of Massachusetts is thus defined:

> "The extent of the territorial jurisdiction of Massachusetts over the sea adjacent to its coast is that of an independent nation; and, except so far as any right of control over this territory has been granted to the United States, this control remains with the state."
>
> Manchester vs. Massachusetts, 139 U. S. 240, 35 U. S. Sup. Ct. Rep. 159, 164, 165, 166.

The leading case of *Hardin vs. Jordan* (1891) involved interpretation of *riparian rights* to lands underlying a small lake in Cook County, Illinois, and whether or not the title of the riparian owner on such lake extended to the center of the lake or the water's edge. Mr. Justice Bradley in an exhaustive opinion reviewed the law as already announced in the foregoing cases and in part said:

> "Such being the form of the title granted by the United States to the plaintiff's ancestor, the question is as to the effect of that title in reference to the lake and the bed of the lake in front of the lands actually described in the grant. This question must be decided by some rule of law, and no rule of law can be resorted to for the purpose except the local law of the State of Illinois. If the boundary of the land granted had been a fresh-water river, there can be no doubt that the effect of the grant would have been

such as is given to such grants by the law of the state, extending either to the margin or center of the stream, according to the rules of that law."

After treating of the effect of meander line surveys and having stated: "It has never been held that the lands under water, in front of such grants, are reserved to the United States or that they can afterwards be granted out to other persons, to the injury of the original grantees," Justice Bradley continued:

> "With regard to grants of the government for lands bordering on tide water, it has been distinctly settled that they only extend to high-water mark, and that the title to the shore and lands under water in front of lands so granted enures to the state within which they are situated, if a state has been organized and established there. Such title to the shore and lands under water is regarded as incidental to the sovereignty of the state—a portion of the royalties belonging thereto and held in trust for the public purposes of navigation and fishery—and cannot be retained or granted out to individuals by the United States. *Pollard vs. Hagan,* 3 How. 212; *Goodtitle vs. Kibbe,* 9 How. 471; *Weber vs. Harbor Commissioners,* 18 Wall. 57. Such title being in the state, the lands are subject to state regulation and control, under the condition, however, of not interfering with the regulations which may be made by Congress with regard to public navigation and commerce. The state may even dispose of the usufruct of such lands,

as is frequently done by leasing oyster beds in them and granting fisheries in particular localities; also, by the reclamation of submerged flats, and the erection of wharves and piers and other adventitious aids of commerce. Sometimes large areas so reclaimed are occupied by cities, and are put to other public or private uses, state control and ownership therein being supreme, subject only to the paramount authority of Congress in making regulations of commerce, and in subjecting the lands to the necessities and uses of commerce. See *Manchester vs. Massachusetts,* 139 U. S. 240; *Smith vs. Maryland,* 18 How. 71; *McCready vs. Virginia,* 94 U. S. 391; *Martin vs. Waddell,* 16 Pet. 367; *Den vs. Jersey Co.,* 15 How. 426.

This right of the states to regulate and control the shores of tide waters, and the land under them, is the same as that which is exercised by the Crown of England. * * * But it depends on the law of each state to what waters and to what extent this prerogative of the state over the lands under water shall be exercised. In the case of *Barney vs. Keokuk,* 94 U. S. 324, we held that it is for the several states themselves to determine this question, and that if they choose to resign to the riparian proprietor rights which properly belong to them, in their sovereign capacity, it is not for others to raise objections."

The Court then reviews the different rules of interpretation of riparian rights obtaining in Iowa

on the one hand and Illinois and Mississipi on the other, and reviews the law of Illinois and authorities from England, Scotland, New York, Massachusetts, New Jersey, Michigan and other states and nations, in their departure or lack of departure from the English common law rules of riparian rights, and the rules adopted by each of the several states in their sovereign jurisdiction of regulation of waters within the borders, as governed and controlled by the local conditions.

The dissenting opinion by Mr. Justice Brewer and Justices Gray and Brown was based entirely upon the interpretation of local laws, but the dissenting justices concurred in the underlying principle that the local law of Illinois must govern, using the following language:

> "Beyond all dispute the settled law of this court, established by repeated decisions, is that the question how far the title of a riparian owner extends is one of local law. For a determination of that question the *statutes of the state and the decisions of its highest court furnished the best and the final authority.* In the case of *St. Louis vs. Rutz*, decided at the present term, 138 U. S. 226, 242, it was said by Mr. Justice Blatchford, speaking for the court: 'The question as to whether the fee of the plaintiff, as a riparian proprietor on the Mississippi River, extends to the middle thread of the stream, or only to the water's edge, is a question in regard to a rule of property, which is governed by the local law of Illinois, *Barney vs. Keokuk*, 94 U. S. 324, 338; *St. Louis vs. Myers*, 113 U. S. 566; *Packer vs. Bird*, 137

U. S. 661. In *Barney vs. Keokuk,* it is said that if the states 'choose to resign to the riparian proprietor rights which properly belong to them in their sovereign capacity, it is not for others to raise objection.' The cases referred to in this quotation affirm the same doctrine."

Mr. Justice Bradley then concludes as follows:

"Believing that the law of Illinois has been determined by its Supreme Court, we think that determination is conclusive on this court. * * * The long judicial experience of those judges and their familiarity with the laws of Illinois give to these opinions great weight."

Hardin vs. Jordan, 140 U. S. 371, 380-2, 384, 402, 405.

Kaukauna Water Power Co. vs. Green Bay & Miss. Canal Co. (1891) involved the use of water *for power* on Fox River, Wisconsin. Opinion by Mr. Justice Brown. After stating that the rights of riparian proprietors have been determined by the courts of Wisconsin, it is said:

"With respect to such rights, we have held that the law of the state, as declared by its Supreme Court, is controlling as a rule of property."

By an act of the legislature of 1848, authorizing the construction of the dam in question, it had been enacted that:

"When a water power shall be created by reason of any dam erected * * * such power shall belong to the state, subject to future action of the legislature."

The validity of the act was questioned. Upon this subject the Court said:

> "The improvement of the navigation of a river is a public purpose, and the sequestration or appropriation of land or other property, therefore, for such purpose is doubtless a proper exercise of the authority of the state under its power of eminent domain.
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> * * * * * * *
>
> But if, in the erection of a public dam for a recognized public purpose, there is necessarily produced a surplus of water, which may properly be used for manufacturing purposes, there is no sound reason why the state may not retain to itself the power of controlling or disposing of such water as an incident of its right to make such improvements."
>
> Kaukauna Water Power Co. vs. Green Bay & Miss. Canal Co. 142 U. S. 254.

The leading case of *Shively vs. Bowlby* (1894) involved title to lands below the high water mark in Astoria, Oregon. The exhaustive opinion of Mr. Justice Gray reviews the law of England and the United States from the earliest times to the date of the decision, including many of the cases already cited in this brief. Like the case of Kansas vs. Colorado, *infra*, a synopsis of the opinion is inadequate.

In part the Court said, quoting from *Martin vs. Waddell, supra:*

> " 'When the Revolution took place, the people of each state became themselves sov-

ereign; and in that character hold the absolute right to all their navigable waters, and the soils under them, for their own common use, subject only to the rights since surrendered by the Constitution to the general government.' " (p. 16.)

Of the rights of riparian owners in the several colonies:

> "But the nature and degree of such rights and privileges differed in the different colonies, and in some were created by statute, while in others they rested upon usage only." (p. 18.)

Then follows an exhaustive review of the decisions of the courts of the original states. He quotes with approval, in part as follows from *Stevens vs. Patterson & Newark Ry.* 5 Vroom (34 N. J. Law) 532, 549:

> " 'That all navigable waters within the territorial limits of the state, and the soil under such waters, belong in actual propriety to the public, that the riparian owner, by the common law, has no peculiar rights in this public domain as incidents of his estate; and that the privileges he possessed by the local custom or by force of the wharf act to acquire such rights, can, before a possession has been taken, be regulated or revoked at the will of the legislature.' " (p. 22).

From *Bailey vs. Philadelphia, Wilmington & Baltimore R. R.*, 4 Harrison (Del.) 389, 395:

" 'All navigable rivers within the state belong to the state, not merely in right of eminent domain, but in actual propriety.' " (p. 23)

The review of the decisions of the courts of the original thirteen states is then concluded as follows:

"The foregoing summary of the laws of the original thirteen states shows that there is no universal and uniform law upon the subject; but that each state has dealt with the lands under the tide waters within its borders according to its own views of justice and policy, reserving its own control over such lands, or granting rights therein to individuals or corporations, whether owners of the adjoining upland or not, as it is considered for the best interests of the public. Great caution, therefore, is necessary in applying precedents in one state to cases arising in another." (p. 26.)

Of the new states:

"The new states admitted into the Union since the adoption of the Constitution have the same rights as the original states in the tide waters, and in the lands below the high water mark, within their respective jurisdictions." (p. 26.)

He then quotes with approval from *Pollard vs. Hagan, supra:*

" 'Alabama is therefore entitled to the sovereignty and jurisdiction over all the territory within her limits, subject to the common law to the same extent that Georgia possessed it before she ceded it to the United

States. To maintain any other doctrine is to deny that Alabama has been admitted into the Union on an equal footing with the original states, the Constitution, laws and compact to the contrary notwithstanding.' 'Then to Alabama belong the navigable waters, and soils under them in controversy in this case, subject to the rights surrendered by the Constitution to the United States.'" (pp. 27-28.)

The following discussion had been predicated upon the various acts of cession of Virginia and Georgia, but it is then said:

"That these decisions do not, as contended by the learned counsel for the plaintiff in error, rest solely upon the terms of the deed of cession from the State of Georgia to the United States, clearly appears from the constant recognition of the same doctrine as applicable to California, which was acquired from Mexico by the treaty of Guadalupe Hidalgo of 1848." (p. 28.)

Quoting from *Knight vs. U. S. Land Association*, 142 U. S. 183:

"'It is the settled rule of law in this court that absolute property in, and dominion and sovereignty over, the soils under the tide waters in the original states were reserved to the several states; and that the new states since admitted have the same rights, sovereignty and jurisdiction in that behalf, as the original states possess within their respective borders. Upon the acquisi-

tion of the territory from Mexico, the United States acquired the title to tide lands, equally with the title to upland; but with respect to the former they held it only in trust for the future states that might be erected out of such territory.' " (p. 30.)

From *Withers vs. Buckley*, 20 How. 84, he quoted from the opinion of Mr. Justice Daniel, as follows:

" 'It cannot be imputed to Congress that they ever designed to forbid, or to withhold from the state of Mississippi, the power of improving the interior of that state, by means either of roads or canals, or by regulating the rivers within its territorial limits, although a plan of improvement to be adopted might embrace or affect the course or the flow of rivers situated within the interior of the state. Could such an intention be ascribed to Congress, the right to enforce it may be confidently denied. Clearly, Congress could exact of the new state the surrender of no attribute inherent in her character as a sovereign independent state, or indispensable to her equality with her sister states, necessarily implied and guaranteed by the very nature of the Federal compact. Obviously, and it may be said primarily, among the incidents of that equality is the right to make improvements in the rivers, watercourses and highways, situated within the state.' " (p. 34.)

From *St. Clair vs. Lovingston*, 23 Wall 46:

" 'By the American Revolution, the people of each state, in their sovereign char-

acter, acquired the absolute right to all their navigable waters and the soil under them. The shores of navigable waters and the soil under them were not granted by the Constitution to the United States, but were reserved to the states respectively. And new states have the same rights of sovereignty and jurisdiction over this subject as the original ones.' " (p. 36.)

Of the policy of the United States in disposing of public lands:

"And the territories acquired by Congress, whether by deed of cession from the original states, or by treaty with a foreign country, are held with the object, as soon as their population and condition justify it, of being admitted into the Union as states, upon an equal footing with the original states in all respects; and the title and dominion of the tide waters and the lands under them are held by the United States for the benefit of the whole people, and, as this court has often said, in cases above cited, 'in trust for the future states.' * * *

The Congress of the United States, in disposing of the public lands, has constantly acted upon the theory that those lands, whether in the interior or upon the coast, above high water mark, may be taken up by actual occupants, in order to encourage the settlement of the country; but that the *navigable waters*, and the soils under them, whether within or above the ebb and flow of the tide, shall be and remain public highways; and, being chiefly valuable for the pub-

lic purposes of commerce, navigation and fishery, and for the improvements necessary to secure and promote those purposes, shall not be granted away during the period of territorial government; but, unless in case of some international duty or public exigency, shall be held by the United States in trust for the future states, and shall vest in the several states, when organized and admitted into the Union, with all the powers and prerogatives appertaining to the older states in regard to such waters and soils within their respective jurisdictions; in short, shall not be disposed of piecemeal to individuals as private property, but shall be held as a whole for the purpose of being ultimately administered and dealt with for the public benefit by the state, after it shall have become a completely organized community." (pp. 49-50.)

In conclusion:

"At common law, the title and dominion in lands flowed by the tide were in the King for the benefit of the nation. Upon the settlement of the Colonies, like rights passed to the grantees in the royal charters, in trust for the communities to be established. Upon the American Revolution, these rights, charged with a like trust, were vested in the original states within their respective borders, subject to the rights surrendered by the Constitution to the United States.

Upon the acquisition of a territory by the United States, whether by cession from

one of the states, or by treaty with a foreign country, or by discovery and settlement, the same title and dominion passed to the United States for the benefit of the whole people, and in trust for the several states to be ultimately created out of the territory.

The new states admitted into the Union since the adoption of the Constitution have the same rights as the original states in the tide waters, and in the lands under them, within their respective jurisdictions. The title and rights of riparian or littoral proprietors in the soil below high water mark, therefore, are governed by the laws of the several states, subject to the rights granted to the United States by the Constitution.

The United States, while they hold the country as a territory, having all the powers both of national and municipal government, may grant, for appropriate purposes, titles or rights in the soil below high water mark of tide waters. But they have never done so by general laws; and, unless in some case of international duty or public exigency, have acted upon the policy, as most in accordance with the interest of the people and with the object for which the territories were acquired, of leaving the administration and disposition of the sovereign rights in navigable waters, and in the soil under them, to the control of the states, respectively, when organized and admitted into the Union.

Grants by Congress of portions of the public lands within a territory to settlers thereon, though bordering on or bounded by navigable waters, convey, of their own force, no title or right below high water mark, and do not impair the title and dominion of the future state when created; but leave the question of the use of the shores by the owners of uplands to the sovereign control of each state, subject only to the rights vested by the Constitution in the United States." (pp. 57-8.)

Shively vs. Bowlby, 152 U. S. 1.

Grand Rapids & Indiana R. R. Co. vs. Butler (1895) involved title of riparian owners of Grand River, Michigan, a meandered stream, to islands in the channel. Quoting with approval from *Middleton vs. Pritchard,* 3 Scammon 510, 520, and *Hardin vs. Jordan, supra:*

" 'The United States have not repealed the common law as to the interpretation of their own grants, nor explained what interpretation or limitation should be given to or imposed upon the terms of the ordinary conveyances which they use, except in a few special instances; but these are left to the principles of law, and rules adopted by each local government, where the land may lie. We have adopted the common law, and must, therefore, apply its principles to the interpretation of their grant.' "

Further he said:

"*Hardin vs. Jordan* was a case from Illinois, and the question was to the effect of the

title granted by the United States along a small lake, in respect of the bed of the lake in front of the land actually described in the grant, and we said (p. 380): 'The question must be decided by some rule of law, and no rule of law can be resorted to for the purpose except the local law of the State of Illinois. If the boundary of the land granted had been a fresh-water river, there can be no doubt that the effect of the grant would have been such as is given to such grants by the law of the state, extending either to the margin or center of the stream, according to the rules of that law.' "

Grand Rapids & Indiana R. R. Co. vs. Butler, 159 U. S. 87, 93.

Lake Shore & Michigan Southern Ry. Co. vs. Ohio (1897), proceedings by *quo warranto* ordering the removal of a bridge across Ashtabula River, Ohio. The case came before this court on jurisdiction of Ohio or its courts to control the subject matter of the controversy on the theory that a federal and not a state question was presented by reason of act of Congress, Sept. 19, 1890 (26 Stat. 426,453), fixing national regulation of construction of bridges over rivers involving *interstate navigation*. Opinion by Mr. Justice White:

"The contention is that the statute in question manifests the purpose of Congress to deprive the several states of all authority to control and regulate any and every structure over all navigable streams, although they be wholly situated within their territory. That full power resides in the states

as to the erection of bridges and other works in navigable streams wholly within their jurisdiction, in the absence of the exercise by Congress of authority to the contrary, is conclusively determined. *Wilson vs. Blackbird Creek Co.*, 2 Pet. 245; *Withers vs. Buckley*, 20 How. 84; *Cardwell vs. American Bridge Co.*, 113 U. S. 205; *Willamette Bridge Co. vs. Hatch*, 125 U. S. 1; *Shively vs. Bowlby*, 152 U. S. 1, 33, and authorities there cited. Indeed, the argument at bar does not assail the rule settled by the foregoing cases, but asserts that as the power which it recognizes as existing in the states is predicated solely upon the failure of Congress to exert its paramount authority, therefore the rule no longer obtains, since the act of 1890, relied on, substantially amounts to an express assumption by Congress of entire control over all and every navigable stream, whether or not situated wholly within a state."

The Court then discusses the act of 1890 and holds that the purpose of the federal statute was not to deprive the states of all power over navigable streams wholly within their borders but that the federal act simply created an "additional and accumulative remedy to prevent such structures, although lawfully authorized, from interfering with commerce."

Lake Shore & Michigan Southern Ry.
vs. Ohio, 165 U. S. 365, 366, 369.

St. Anthony Falls Water Power Co. vs. St. Paul Water Commissioners (1897) involved damages for alleged injuries to the owners of a certain *power*

plant on the Mississippi River. who claimed right to use of *all the water* that would naturally flow past their land in the Mississippi River, under charter granted by Minnesota, and as riparian land owners. Opinion by Mr. Justice Peckham:

> "In regard to the first proposition, we are of opinion that the property rights of the plaintiff in error, as riparian owners, are to be measured by the rules and decisions of the state courts of Minnesota. This principle, we think has been announced and adhered to by this court from its very early days, and no distinction has been made between the rights of the original states and those which were subsequently admitted to the Union under the provisions of the Federal Constitution. The provisions of the act of Congress, already cited (act of February 26, 1857, C. 60, Sec. 2, 11 Stat. 166), making the Mississippi River a common highway for the inhabitants of the state and all other citizens of the United States, do not impair the title and jurisdiction of the state over the navigable waters within her boundaries more than rights of that nature are limited with regard to the original states. This has been uniformly held, and is so stated in many of the cases hereinafter cited where similar language has been used in the acts admitting states into the Union." (p. 358.)

The cases of *Martin vs. Waddell, supra; Pollard vs. Hagan, supra; Goodtitle vs. Kibbe,* 9 How. 471; *Barney vs. Keokuk, supra; St. Louis vs. Myers,*

supra; Packer vs. Bird, 137 U. S. 661; *Hardin vs. Jordan*, supra; *St. Louis vs. Rutz*, 138 U. S. 226, 242; *Kaukauna Water Power Co. vs. Green Bay & Mississippi Canal Co., supra;* and *Shively vs. Bowlby, supra;* are then reviewed with approval. Of these cases, and particularly the last mentioned, Mr. Justice Peckham then said:

> "The opinion refers to all the cases which we have above recited and many others, upon the various questions which are discussed in the case, and recognizes the rule that it belongs to the states to decide as to the character and extent of the riparian rights of owners upon navigable waters within the states.
>
> * * * The dispute has generally been as to the extent and character of the title as between the United States or the state and the riparian owner to lands under water, and as to the right of the riparian owner to build out from the shore piers or wharves so as to reach the navigable portion of the stream; but the principles laid down in all of these cases necessarily include the right of the state courts to decide, as a matter of local law, the point now under discussion, subject to the acknowledged jurisdiction of the United States under the Constitution in regard to commerce and the navigation of the waters of rivers. The jurisdiction of the state over this question of riparian ownership has been always, and from the foundation of the government, recognized and admitted by this court. The extent of the plaintiff's

riparian right of property was therefore the subject of adjudication by the state court, and the rule has been definitely stated by that court in its judgment, which is now under review." (pp. 365-66.)

Of the claim by the Power Company to the uninterrupted flow of *all* the waters of the Mississippi would naturally pass its plant, free from interference by diversion for municipal purposes subsequent in time to construction of the power plant, it is said:

"They were grants of power to the respective companies, under which they were licensed to build their dams out into the river for the purposes of utilizing the power, and of using the water that flowed down the river. These grants were in legal effect subject at all times to the paramount right of the state as trustee for the public to divert a portion of the waters for public uses, and they were also subject to the rights in regard to navigation and commerce existing in the general government under the Constitution of the United States. * * * But there is nothing in the language of the charters showing or implying that it was the intention of the state to grant to these parties the rights now claimed by them. It is difficult to believe that a legislature would ever grant to individuals or companies rights of that nature, even if it be assumed it had the power. It was proper and in accordance with a wise public policy to grant a privilege to these companies to build dams, etc., as

stated in the charters, and to permit them, by virtue of the dams and sluices, to use the water that in fact and from time to time might come down the river, but it cannot be supposed that the legislature meant by any grant of this kind to warrant that for all future time no part of the water that might otherwise naturally flow down the river should ever be used under the authority of the state for any public purpose, without compensating the plaintiffs for that diversion." (pp. 372-3.)

St. Anthony Falls Water Power Co. vs. St. Paul Water Commissioners, 168 U. S. 349, 358, 372.

United States Freehold Land and Emigration Co. vs. Diego Gallegos, et al. (1898), (No. 2545, U. S. Circuit Court, District of Colorado), involved the question of whether the doctrine of *riparian rights or the doctrine of apprporiation prevails* on the Culebra river, *in Colorado*, all of which stream and its tributaries are located upon the Sangre de Cristo Mexican Land Grant. Opinion by Judge Riner of Cheyenne, Wyoming:

"The demurrer presents the question whether the plaintiff can claim the right to use the water of the Culebra River as riparian proprietor, the river having its source and flowing its entire length through the land of the plaintiff. There is no allegation in the bill that the plaintiff has ever applied any of this water to a beneficial use, and no claim is made based upon its right as a prior appropriator. Its claim is made upon the sole ground that the stream has its

source and flows its entire length through the lands of the plaintiff, and that the grant, the treaty and the act of Congress secure to it the rights of a riparian owner.

Without discussing the question at length, I am inclined to the view that the riparian rights of such a riparian proprietor do not differ in any respect from those held by any other riparian proprietor who derives his title immediately, or mediately, from the United States, and *that the power to prescribe the rules which define and regulate the water rights of private riparian proprietors upon unnavigable streams belongs exclusively to the legislature of the state.* (Italics ours.)

Colorado was admitted into the Union upon an equal footing with the original states. Whatever the limitation upon her powers as a government may have been, while in a territorial condition, it ceased to have any operative force, except as voluntarily adopted by her after she became a state of the Union. On her admission she at once became entitled to and possessed of all the rights of dominion and sovereignty which belonged to the original states."

Of limitations of title through Mexican grant:

"The treaty with Mexico, while it secured to private owners the title and ownership of the tracts of land which had been granted them by Mexico, did not attempt to provide that this ownership should be governed by rules of law different from those

which govern and control all private ownership of lands within the territorial jurisdiction of the United States or of any particular state. And the source of the plaintiff's title can, I think, make no difference as to the rights of property which accompany and flow from its ownership.

The constitution of the State of Colorado provides that 'the water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided.' It further provides that 'the right to divert unappropriaetd waters of any natural stream for beneficial uses shall never be denied,' and that priority of appropriation shall give the better as between those using the water for the same purpose. (Art. 16, Sec. 5-6.)

It was early held in Colorado that the common law doctrine as to the riparian rights by which the riparian proprietor is entitled to the flow of water in its natural channel upon and over his lands, whether he makes any beneficial use of it or not, is inapplicable to Colorado (Coffin vs. Left Hand Ditch Company, 6 Colo. 447). This doctrine is sustained in most, if not all, of the states (except California) within what is known as the arid region.

The common law doctrine relating to the rights of a riparian proprietor in the water of a natural stream, and the use

thereof, is unsuited to our requirements and necessities and never did obtain in this region of country. A different principle, viz., that the right to use water for beneficial purposes depends upon a prior appropriation, is much better adapted to the material conditions existing in this and adjoining states. * * * That the state has the power to regulate the use of water within its boundaries I have no doubt. And to the legislature of the state the authority is most properly confided, to authorize the use of water and to impose such regulations and limitations upon its use as will best reconcile and accommodate the interests of all concerned."

United States Freehold Land & Emigration Co. vs. Diego Gallegos, 1 Legal Adviser (Mills Pub. Co., Denver), 412.

(Note: The above opinion is particularly interesting in view of the fact that it was written by a Wyoming judge sitting for a Colorado court and determining the right of Colorado to control the waters of her streams, prior to the decisions of this Court, which we hereafter cite, which affirm the rules so announced by Judge Riner.)

In *United States vs. Rio Grande Dam & Irrigation Co.* (1899), this court reviewed decisions of the Supreme Court of the Territory of New Mexico in an action brought by the United States to restrain the defendant from constructing a dam for irrigation across the Rio Grande River in the territory in obstruction of navigation. The Territorial courts de-

cided adversely to the contention of the United States. Opinion by Mr. Justice Brewer.

After discussing the question of the navigability of the Rio Grande River in New Mexico, of the right to appropriate the greater portion of the flow of the Rio Grande at the dam, said:

> "The unquestioned rule of the common law was that every riparian owner was entitled to the continued natural flow of the stream." (Quoting 3 Kent Com. Sec. 439.)
>
> "While this is undoubted, and the rule obtains in those states in the Union which have simply adopted the common law, it is also true *that as to every stream within its dominion a state may change this common law rule and permit the appropriation of the flowing waters for such purposes as it deems wise.* Whether this power to change the common law rule and permit any specific and separate appropriation of the waters of a stream belongs also to the legislature of a territory, we do not deem it necessary for the purposes of this case to inquire. We concede *arguendo* that it does.
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> Although this power of changing the common law rule as to streams within its dominion belongs to each state, yet *two limitations* must be recognized:
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> First, that in the absence of specific atubority from Congress a state cannot by its legislation destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far at least as may be necessary

for the beneficial uses of the government property. Second, that it is limited by the superior power of the general government to secure the uninterrupted navigability of all navigable streams within the limits of the United States. In other words, the jurisdiction of the general government over interstate commerce and its natural highways vests in that government the right to take all needed measures to preserve the countryeve n against any state action. * * *

Notwithstanding the unquestioned rule of the common law in reference to the right of a lower riparian proprietor to insist upon the continuous ffow of the stream as it was, and although there has been in all the western states an adoption or recognition of the common law, it was early developed in their history that the mining industry in certain states, the reclamation of arid lands in others, compelled a departure from the common law rule, and justified an appropriation of flowing waters both for mining purposes and for the reclamation of arid lands, and there has come to be recognized in those states, by custom and by state legislation, a different rule—a rule which permits, under certain circumstances, the appropriaton of the waters of a flowing stream for other than domestic purposes."

After quoting from the Acts of Congress of July 26, 1866; March 3, 1877 and March 3, 1891 (which we shall hereafter quote at length), wherein the rights of the states to control their waters are recognized and confirmed, he concluded:

"Obviously by these acts, so far as they extended, *Congress recognized and assented to the appropriation of water in contravention of the common law rule as to continuous flow.* * * * This legislation must be interpreted in the light of existing facts—that all through this mining region in the West were streams, not navigable, whose waters could safely be appropriated for mining and agricultural industries, without serious interference with the navigability of the rivers into which those waters flow. *And, in reference to all these cases of purely local interest the obvious purpose of Congress was to give its assent, so far as the public lands were concerned, to any system, although in contravention to the common law rule, which permitted the appropriation of those waters for legitimate industries.*" (Italics ours.)

The remainder of the opinion, construing the act of 1890 concerning navigation, and the paramount rights of the United States to control interference with navigation, we shall quote in a later portion of this brief.

United States vs. Rio Grande Dam & Irrigation Co., 174 U. S. 690, 702-6.

Gutierres vs. Albuquerque Land & Irrigation Co. (1903) involved the validity of certain statutes in the territory of New Mexico concerning construction of irrigation works. Two contentions were urged, first, that the territorial act was invalid because it assumed to dispose of property of the United States without its consent; and, second, that the territorial act was inconsistent with the legislation of Congress and therefore void. We shall later have occasion

to quote at greater length from the opinion of Mr. Justice White. In part he said:

> "The argument in support of the first proposition proceeds upon the hypothesis that the waters affected by the statute are public waters, the property, not of the territory or of private individuals, but of the United States; that by the statute private individuals, or corporations, for their mere pecuniary profit, are permitted to acquire the unappropriated portion of such public waters, in violation of the right of the United States to control and dispose of its own property wheresoever situated. Assuming that the appellants are entitled to urge the objection referred to, we think, in view of the legislation of Congress on the subject of the appropriation of water on the public domain, particularly referred to in the opinion of this court in United States vs. Rio Grande Dam & Irrigation Co., 174 U. S. 704-706, the objection is devoid of merit."

After quoting from the various acts of Congress to which we shall refer, he continued:

> "That the purpose of Congress was to recognize as well the legislation of a territory as of a state with respect to the regulation of the use of public waters, is evidenced by the act of March 3, 1891 (26 Stat. at L. 1095, Chap. 561, U. S. Comp. Stat. 1901, p. 1570)."

Gutierres vs. Albuquerque L. & I. Co.
188 U. S. 545, 552, 553.

Clark vs. Nash (1904) reviewed a decision of the Supreme Court of Utah affirming a judgment of condemnation for right of way in favor of an individual land-owner across his neighbor's land for enlargement of an irrigation ditch. Objection was raised on the ground that the proposed use of the enlarged ditch by a private land-owner was not a public use, even though the statute permitted it. Opinion by Mr. Justice Peckham:

> "In some states, probably in most of them, the proposition contended for by the plaintiffs in error would be sound. But whether a statute of a state permitting condemnation by an individual for the purpose of obtaining water for his land or for mining should be held to be a condemnation for a public use, and, therefore, a valid enactment, may depend upon a number of considerations relating to the situation of the state and its possibilities for land cultivation, or the successful prosecution of its mining or other industries. Where the use is asserted to be public, and the right of the individual to condemn land for the purpose of exercising such use is founded upon or is the result of some peculiar condition of the soil or climate, or other peculiarity of the state, where the right of condemnation is asserted under a state statute, we are always, where it can be fairly be done, strongly inclined to hold with the state courts, when they uphold a state statute providing for such condemnation. * * * Those facts must be general, notorious, and acknowledged in the state, and the state courts

may be assumed to be exceptionally familiar with them. They are not the subject of judicial investigation as to their existence, but the local courts know and appreciate them. They understand the situation which led to the demand for the enactment of the statute, and they also appreciate the results upon the growth and prosperity of the state which, in all probability, would flow from a denial of its validity. * * * With all these the local courts must be presumed to be more or less familiar.

This court has stated that what is a public use may frequently and largely depend upon the facts surounding the subject, and we have said that the people of a state, as also its courts, must, in the nature of things, be more familiar with such facts, and with the necessity and occasion for the irrigation of the lands, than can any one who is a stranger to the soil of the state, and that such knowledge and familiarity must have their due weight with the state courts. *Fallbrook Irrig. District vs. Bradley*, 164 U. S. 112, 159."

After concluding that the use of water for irrigation under the state of facts presented was a "public use," the necessity of the adoption of the rule of appropriation for local administration of water rights in the Western states is thus affirmed:

"The rights of a riparian owner in and to the use of the water flowing by his land are not the same in the arid and mountainous states of the West that they are in the states of the East. These rights have been

altered by many of the Western states by their constitutions and laws, because of the totally different circumstances in which their inhabitants are placed, from those that exist in the states of the East, and such alterations have been made for the very purpose of thereby contributing to the growth and prosperity of those states, arising from mining and the cultivation of an otherwise valueless soil, by means of irrigation. This court must recognize the difference of climate and soil, which render necessary these different laws in the states so situated."

Clark vs. Nash, 198 U. S. 361, 367-9, 370.

Manigault vs. Springs, (1905) involved the damming and obstructing of *navigation* on Kinloch Creek, South Carolina, and the impairment of a stipulation between two *riparian owners* at the mouth of the Creek. Opinion by Mr. Justice Brown:

"As an original proposition we have repeatedly held that, in the absence of legislation by Congress, a state has power to improve its lands and promote the general health by authorizing a dam to be built across its interior streams, though they were previously navigable to the sea by vessels engaged in the coastwise trade."

After quoting with approval from *Willson vs. Blackbird Creek Marsh Co.*, *Pound vs. Turck*, *Escanaba Co. vs. Chicago*, *Cardwell vs. Bridge Co.*, *Willamette Iron Bridge Co. Hatch*, and other cases, *supra*, he continued:

"While all of these cases turned upon the power of the state to authorize the erec-

tion of bridges, *the same principle* applies where the legislature deems it necessary to the public welfare to make *other improvements* for the reclamation of swampy and overflowed lands, though certain individual proprietors may thereby be subjected to expense."

Two of the defendants and another joint riparian owners at the mouth of the creek, entered into a contract in 1898 compromising certain differences relative to a former damming of the creek. In 1903 the General Assembly passed an act deciding the necessity of draining the lowlands in that vicinity and authority was given the defendants to erect and maintain a dam across the creek. To the argument that the act of 1903 impaired the contract between the riparian owners of 1898 the court said:

> "It is the settled law of this court that the interdiction of statutes impairing the obligation of contracts does not prevent the state from exercising such powers as are vested in it for the promotion of the common weal, or are necessary for the general good of the public, though contracts previously entered into between individuals may thereby be affected. This power, which in its various ramifications is known as the police power, is an exercise of the sovereign right of the Government to protect the lives, health, morals, comfort and general welfare of the people, and is paramount to any rights under contracts between individuals.
>
> * * * * * * * *
>
> While this power is subject to limitations in certain cases, there is wide discre-

tion on the part of the legislature in determining what is and what is not necessary—a discretion ordinarily will not interfere with.

* * * * * * * *

It only remains to consider in connection with this branch of the case, whether the act of the General Assembly of 1903 was a proper exercise of the police power of the state. Of this we have no doubt. Although it was not an exercise of that power in its ordinarily accepted sense of protecting the health, lives and morals of the community, it is defensible in its broader meaning of providing for the general welfare of the people, by the reclamation of swampy, overflowed and infertile lands, and the erection of dams, levees and dikes for that purpose. We have often held that private interests are subservient to that right, except where property is taken for which compensation must be paid, and must give way to any general scheme for the reclamation or improvement of such lands."

The Court then concluded the discussion of this phase of the case, as follows:

> "We are of the opinion that the state had full power, in the absence of legislation by congress, to authorize the construction of this dam for the avowed purposes of this act."

Manigault vs. Springs, 199 U. S. 473, 478-9, 480-1, 483.

(Note: By the foregoing, riparian rights are

treated as inferior to the paramount sovereign right of the state.)

Whitaker vs. McBride (1905) involved title of *riparian land owners* along the Platte river in Nebraska, a meandered stream, to an island in the stream. Opinion by Mr. Justice Brewer:

> "It is the settled rule that the question of the title of a riparian owner is one of local law. In *Hardin vs. Jordan*, 140 U. S. 371, the matter was discussed at some length, the authorities cited, and the conclusion thus stated by Mr. Justice Bradley, delivering the opinion of the court (p. 384):
>
> 'In our judgment the grants of the Government for lands bounded on streams and other waters, without any reservation or restriction of terms, are to be construed as to their effect according to the law of the state in which the lands lie.'"
>
> Whitaker vs. McBride, 197 U. S. 510, 511-12.

We have omitted references to the following cases which we shall consider in another portion of this brief:

> Missouri vs. Illinois, (1901) 180 U. S. 208;
>
> Missouri vs. Illinois, (1906) 200 U. S. 496;
>
> Kansas vs. Colorado, (1902) 185 U. S. 125; and
>
> In re Withdrawal of Public Lands, (1903) 32 L. D. 254

Bacon vs. Walker, (1907) involved the construction of a state statute prohibiting the grazing of

sheep on the public domain in Idaho. In the opinion by Mr. Justice McKenna the right of the state to frame its laws and shape its policies to suit its conditions was thus confirmed:

> "The laws and policy of a state may be framed and shaped to suit its conditions of climate and soil. Illustrations of this power are afforded by recent decisions of this court. In Clark vs. Nash, 198 U. S. 361, a use of property was declared to be public which, independent of the conditions existing in the state, might otherwise have been considered as private. See also in Strickley vs. Highland Boy Gold Min. Co., 200 U. S. 527. In the first case there was a recognition of the power of the state to deal with and accommodate its laws to the conditions of an arid country and the necessity of irrigation to its development. The second was the recognition of the power of the state to work out from the conditions existing in a mining region the largest welfare of its inhabitants. And again, in Offield vs. New York N. H. & H. R. R. Co., 203 U. S. 372, the principle of those cases was affirmed and applied to conditions entirely dissimilar."
>
> Bacon vs. Walker, 204 U. S. 311-315.

Kansas vs. Colorado, (1907) involved a determination of the respective rights of the United States, the State of Kansas and the State of Colorado, to the use of the waters of the Arkansas river rising in Colorado and and flowing into Kansas. We shall quote at considerable length from the opinion by Mr. Justice Brewer in a subsequent portion of this brief dealing with the rules for interstate

streams and for the present shall make brief reference to that portion relating to state control of waters:

> "*While arid lands are to be found mainly, if not only, in the Western and newer states, yet the powers of the national government within the limits of those states are the same* (*no greater and no less*) *than those within the limits of the original thirteen;* and it would be strange if, in the absence of a definite grant of power, the national government could enter the territory of the states along the Atlantic and legislate in respect to improving, by irrigation or otherwise, the lands within their borders."

After discussing the claims to national control he concludes:

> "But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that each state has full jurisdiction over the lands within its borders, including the beds of streams and other waters." (Citing many of the decisions of this court already quoted in this brief).

Mr. Justice Brewer then quotes with approval from *Barney vs. Keokuk* and *Hardin vs. Jordan supra*, to the effect that the states in their inherent sovereignty have full jurisdiction over the waters within their borders, save that juridiction conferred upon Congress to regulate public navigation, and says:

"It may determine for itself whether the common law in respect to riparian rights or that doctrine which obtains in the arid regions of the West of the appropriations of waters for the puproses of irrigation shall control. Congress cannot enforce either rule upon any state. * * * *

In the argument on the demurrer counsel for plaintiff endeavored to show that Congress had expressly imposed the common law on all this territory prior to its formation into states. * * * But when the states of Kansas and Colorado were admitted into the Union they were admitted with the full powers of local sovereignty which belonged to other states (Pollard vs. Hagan and Shively vs. Bowlby, supra; Hardin vs. Shedd, 190 U. S. 508, 519) and Colorado by its legislation, has recognized the right of appropriating the flowing waters to the purposes of irrigation."

Kansas vs. Colorado, 206 U. S. 46, 92, 93, 94, 95.

Georgia vs. Tennessee Copper Co. (1907) involved injunction to prevent continued damage to the domain of Georgia. It is decisive of the greater right of the sovereign state to protect her domain irrespective of the private property rights of citizens. We shall quote more at length elsewhere. Mr. Justice Holmes in part said:

"This is a suit by a state for an injury to it in its capacity of quasi-sovereign. In that capacity the state has an interest independent of and behind the titles of its citi-

zens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air.

Some peculiarities necessarily mark a suit of this kind. If the state has a case at all, it is somewhat more certainly entitled to specific relief than a private party might be. It is not lightly to be required to give up quasi-sovereign rights for pay, and apart from the difficulty of valuing such rights in money, if that be its choice it may insist that an infraction of them shall be stopped. The states, by entering the Union, did not sink to the position of private owners, subject to one system of private law. This court has not quite the same freedom to balance the harm that will be done by an injunction against that of which the plaintiff complains, that it would have in deciding between two subjects of a single political power."

Georgia vs. Tennessee Copper Co., 206 U. S. 230, 237-8.

In *Hudson Water Co. vs. McCarter* (1908) this Court reviewed the decisions of the Court of Errors and Appeals of New Jersey. The opinion by Mr. Justice Holmes clearly defines the sovereign rights of the state in the control of waters within its borders and also the line of demarcation between the private rights of riparian owners and the greater rights of the state:

"The courts below assumed or decided and we shall assume that the defendant represents the rights of a riparian proprietor,

and on the other hand, that it represents no special chartered powers, that give it greater rights than those. On these assumptions the Court of Errors and Appeals pointed out that a riparian proprietor has no right to divert waters for more than a reasonable distance from the body of the streaam or for other than the well-known ordinary uses, and that for any purpose anywhere he is narrowly limited in amount. It went on to infer that his only right in the body of the stream is to have the flow continue, and that there is a residuum of public ownership in the state."

After further discussion of the facts:

"But we prefer to put the authority which cannot be denied to the state upon a broader ground than that which was emphasized below, since in our opinion it is independent of the more or less attenuated residuum of title that the state may be said to possess. * * * * * *

It sometimes is difficult to fix boundary stones between the private right of property the police power when, as in the case at bar, we know of few decisions that are very much in point. But it is recognized that the State as *quasi-soverign* and representative of the interests of the public has a standing in court to protect the atmosphere, the *water* and the forests within its territority, irrespective of the assent or dissent of the private owners of the land most immediately concerned. *Kansas vs. Colorado*, 185 U. S. 125, 141, 142; S. C., 206 U. S. 46, 99; *Georgia*

vs. Tennessee Copper Co., 206 U. S. 230, 238. What it may protect by suit in this court from interference in the name of property outside of the state's jurisdiction, one would think that it could protect by statute from interference in the same name within. On the principle of public interest and the police power and not merely as the inheritor of a royal prerogative, the State may make laws for the preservation of game, which seems a stronger case. *Geer vs. Connecticut*, 161 U. S. 519, 534.

The problems of irrigation have no place here. Leaving them on one side, it appears to us that few public interests are more obvious, indisputable and independent of particular theory than the interest of the public of a State to maintain the rivers that are wholly within it substantially undiminished, except by such drafts upon them as the guardian of the public welfare may permit for the purpose of turning them to a more perfect use. This public interest is omnipresent wherever there is a State, and grows more pressing as population grows. It is fundamental, and we are of opinion that the private property of riparian proprietors cannot be supposed to have deeper roots. Whether it be said that such an interest justifies the cutting down by statute without compensation, in the exercise of the police power of what otherwise would be private rights of property, or that apart from statute those rights do not go to the height of what the defendant seeks to do, the result is the same. But we agree with the New

Jersey courts, and think it quite beyond any rational view of riparian rights than an agreement, of no matter what private owners, could sanction the diversion of an important stream outside the boundaries of the state in which it flows. The private right to appropriate is subject not only to the rights of lower owners but to the initial limitation that it may not substantially diminish one of the great foundations of public welfare and health.

We are of opinion, further, that the constitutional power of the state to insist that its natural advantages shall remain unimpaired by its citizens is not dependent upon any nice estimate of the extent of present use or speculation as to future needs. The legal conception of the necessary is apt to be confined to somewhat rudimentary wants, and there are benefits from a great river that might escape a lawyer's view. *But the state is not required to submit even to an aesthetic analysis.* Any analysis may be inadequate. *It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will.''*

Of the defense under the Fourteenth Amendment, respecting the contractual rights between the riparian owners and New York parties, he said:

"The defense under the Fourteenth Amendment is disposed of by what we have said. That under Article 1, Sec. 10, needs but a few words more. One whose rights,

such as they are, are subject to state restriction, cannot remove them from the power of the state by making a contract about them. The contract will carry with it the infirmity of the subject matter. *Knoxville Water Co. v. Knoxville,* 189 U. S. 434, 438; *Manigault v. Springs,* 199 U. S. 473, 480. But the contract, the execution of which is sought to be prevented here, was illegal when it was made."

Hudson Water Co. v. McCarter, 209 U. S. 349, 354-7.

While in the above opinion Mr. Justice Holmes observes, "The problems of irrigation have no place here" it would seem that the decision, involving as it did the rights of riparian proprietors as against a sovereign state would apply with equal effect to the rights of individual appropriators as against the state, as stated by the late Mr. Kinney:

"It is stated by Mr. Justice Holmes in rendering the opinion of the Court that 'the problems of irrigation have no place here,' the principles laid down in the case apply as much to cases where the diversion and use is made for the purpose of irrigation as for culinary and domestic purposes of a great city, as was the fact in the case at bar. * * *

There is no principle of law, as far as we are able to distinguish, why the same principles as laid down in the above case should not equally apply to a case where the diversion and use of the water was made for the purpose of the irrigation of land as well

as to a case where they were for municipal purposes."

Kinney on Irrigation and Water Rights
2nd Ed. Vol. 3, Page 2224.

See also Walbridge vs. Robinson, 22 Idaho 240, (*infra*) where the Court arrives at the same conclusion expressed by Mr. Kinney.

The decisions of the New Jersey Courts, reviewed by this Court in the above case are of value, not only as regards the limitations of private riparian rights, but as well of the paramount right of the state to control for its own benefit the natural resources of its territority irrespective of the wishes or contracts of the particular class of citizens (riparian owners) whom it had permitted to acquire usufructuary rights in its streams. To these we shall next refer.

McCarter v. Hudson County Water Co. (1905), Court of Chancery of New Jersey, involved taking of waters of Passaic River, in New Jersey to New York for the use of citizens of the latter state under a prohibitory statute of New Jersey. Opinion by Vice-Chancellor Bergen.

After stating the facts of the case wherein certain contracts have been made with a New Jersey Company to enlarge its mains and conduct water to New York and wherein it is said "that some of these contracts were prior and others subsequent to the approval of the legislative act, which defendant insists makes unlawful the threatened acts of the defendant" and "that the defendant had incurred large expense in laying mains and doing other necessary work to enable it to take the water through to New York State previous to the adoption of the statute now under consideration," the Vice-Chancellor said:

"The question is thus presented, can the defendant * * * divert from the Passaic river, free from any control or regulation by the state, whatever quantity it may desire of the fresh water running therein and carry it to another state, the consent of parties in interest other than the state being assumed?

As absolution from control or regulation means the right to withdraw, against the protest of the state, every drop of water from the river, a right which can only be sustained upon the ground of ownership, * * * if the contention of the defendant expresses the law, persons and corporations may, by acquiring the private rights in any running stream, obtain such an ownership in the water passing down the stream as to permit its total withdrawl and transportation to a foreign jurisdiction, leaving the citizens of this state entirely destitute of a natural and necessary element of life, so far as the same may be derived from streams supplied from the running surplus or overflow of water from lakes, ponds, springs and other natural sources of potable water.

If the public have any common rights in or to the running waters of our rivers and streams at any point during its flow to the sea, such a right is manifestly held by the state in trust for the public * * * and the fact that it has not heretofore objected is no reason why it may not now protest against a further spoliation of public property. It may lawfully permit its own citizens the

benefit of property held in trust for them, and at the same time limit such permission to those who have a common right therein.

* * * * * * * * * * *

Whether this act be valid or not, under the view I take of this question the state may rest its case upon general principles, and does not need the support of the statute under review. The state has a duty to perform in that it must protect its citizens against the assumption by individuals or corporations of any of its soverign rights, or the conversion to private use of such common property and rights as the state is said to hold in trust for the public use, the loss of which may destroy the health and comfort of its subjects. * * * * *

It is admitted that the Passaic river is the most important of the available sources of water-supply for the people of New Jersey, and that their necessity therefor is constantly increasing. This river in its natural condition carries from its source to the ebb and flow of the tide a necessary element of life, the common property of the public, subject to usufructuary use, * * * and no one has a right to divert the water for commercial purposes without the grant of the state, in the absence of which such abstraction is the conversion of public property without legislative authority. The state may grant this right, but until it does it should be held beyond the reach of private appropriation.

My opinion is that, subject to the lawful transient rights of riparian owners along the banks of running streams the waters of which finally empty into a tidal stream, there is vested in the soverign power the right to insist upon the proper riparian user of the waters therein, in order that the common right to the use of the residue, which is not private property, may be preserved for the benefit of those to whom all common property belongs; nor would the grant of every owner of land along the stream, from its source to tidewater, affect the right of the public (for which the state is but another name), for that only can be granted which the grantor hath, which is the transitory usufructuary use, subject to which running water is *publicis juris*. As the threatened act is an invasion of a common right, in that it will result in the removal from the state of the common property, it has a right to protest against the proposed diversion, and should seek to protect the public estate."

McCarter v. Hudson County Water Co., 70 N. J. Eq. 525, 527-8, 529, 533-4, 534-5.

McCarter vs. Hudson County Water Co. (1906), Court of Errors and Appeals, New Jersey, reviewed the decision of the Chancery Court (70 N. J. Eq. 525). Opinion by Mr. Justice Pitney, now of this Court.

After stating the facts and setting forth the provisions of the act of 1905 prohibiting the transporta-

tion of water from New Jersey to other states Mr. Justice Pitney said:

> "It is important to keep it clearly in mind that if the defendant carries out the project that it has in contemplation a considerable part of the fresh and potable waters of the River Passaic will be diverted out of the river at Little Falls, and conducted thence in a continuous, artificial channel or channels to some point outside of the State of New Jersey, and will there be permitted (subject only to defendant's control) to escape and flow forth, to the benefit of the citizens of the State of New York, and to the incidental profit of the defendant.
>
> The questions are whether such an artificial and extra-territorial outlet can be prevented by the people of the State of New Jersey, with or without an act of the legislature, and if an act be needed for the purpose whether the act of 1905 is a constitutional piece of legislation.
>
> It must, we think, be sufficiently obvious that the government established in this state by and for the people thereof has complete dominion (subject only to constitutional limitations) over all things within the borders of the state, including all lands and waters, and the mode of acquiring and disposing of rights of property therein. The fresh-water lakes, ponds, brooks, and rivers, and the waters flowing therein, constitute an important part of the natural advantages of this territority, upon the faith of

which its population has multiplied in numbers and increased in material and moral welfare. The regulation of the use and disposal of such waters, therefore, if it be within the powers of the state, is among the most important objects of the government."

After clearly defining the right of riparian owners in the usufructuary title to the waters of the state and the paramount right of the state to control its own natural resources, he answers the argument that the people of New York have a natural right to the waters of New Jersey, if such use can be obtained without impairing riparian owners, in part as follows:

"Stripped of all circumlocution, what is asserted is the right of the people of New York to derive an artificial water-supply from the the territority of New Jersey without the consent of the people of this state. This argument, however, is at once overthrown by reference to the established principle that one state cannot expropriate for its public purposes property within the territory of another state. * * * *

To admit that the people of the State of New York have any inherent right to gain a water supply from the lakes or streams of New Jersey by means of an artificial aqueduct constructed for the purpose is to assert that the sovereignty of New York extends to some extent and for some purposes over the soil of New Jersey. To state the proposition is to refute it. Such interstate

rights can be acquired only by interstate compact."

In conclusion:

"In our opinion, therefore, the legislature may prohibit the abstraction from the lakes, ponds and streams of the state of waters to be used for any other purpose than to meet the lawful uses of riparian owners (saving, of course, other rights vested under grants already made), and when the legislature has forbidden its abstraction for a stated purpose not within such uses, abstraction for that purpose becomes unlawful, and may be restrained at the instance of the attorney general. * * *

The act of 1905 looks not only to the present, but to the future. It recognizes that the growth and prosperity of the state depends not alone upon the advantages that it presently affords, but upon the assurance that the like advantages, to the extent of our natural resources, properly conserved, will remain for posterity. This policy of foresight, and the desire to foreclose in advance any claim of a vested right to transport the waters of our lakes and streams beyond the borders of the state, doubtless entered into the motive of the legislature in imposing a present prohibition."

McCarter v. Hudson County Water Co., 70 N. J. Eq. 695, 700, 701, 717, 719.

The New Jersey Act is set forth in full on pages 698-9, 70, N. J. Eq. in the opinion by Mr. Justice Pit-

ney. It is of interest to here note that California adopted the same act, made to conform to California conditions, in 1911.

See Stat. of Cal. 1911, Chap. 104, p. 271.

Also that Colorado adopted an act modeled after the New Jersey Act in 1917.

Colo. Session Laws, 1917, Chapter 151, p. 539 (quoted *infra*).

In *Walbridge v. Robinson,* 22 Idaho 240, the same doctrine is declared to apply in Idaho, and Wyoming follows the same doctrine in accordance with the opinion of its attorney general. See Biennial Report, Atty. Gen'l Wyo., 1915-16, p. 75.

Boquillas Cattle Co. vs. Curtis (1909) affirms the former decisions of this Court to the effect that each state in the exercise of its sovereign rights has exclusive control over the waters within its borders and may regulate the use of the same irrespective of the common law rules. The suit was brought to prevent the defendants from withdrawing water from the San Pedro River in Arizona by means of a dam and ditch upon the plaintiff's land. Plaintiff claimed title under a Spanish land grant to the lands lying on both sides of the river. Defendants "set up no title except that they had been the first to appropriate the water" while the plaintiff "claims as a riparian owner, and argues that as such it has a right that cannot be taken from it by simple appropriation." The decision of the Supreme Court of the Territority of Arizona dismissing the bill was brought to this Court for review. Opinion by Mr. Justice Holmes, who after discussing and following the decision of the local Court in Arizona and the ef-

fect of the patent of the United States affirming the Mexican Land Grant, said:

> "But, perhaps, the main contention of the plaintiff is based on the legislation of the Territory, and especially on the Howell Code of 1864, Chap. 61, Sec. 7, as follows: 'The common law of England, so far as it is not repugnant to, or inconsistent with the Constitution and laws of the United States, or the bill of rights or laws of this territory, is hereby adopted, and shall be the rule of decision in all the Courts of this Territory.' We assume that this section, however it may affect the case at bar, was within the power of the legislature to enact. * * * But we agree with the territorial court that, construed with the rest of the code, it is far from meaning that patentees of a ranch on the San Pedro are to have the same rights as owners of an estate on the Thames. * * * If there were nothing more in the code, it would be going a great way to say that such a broad phrase forbade the courts to hold that the common law was adaptable and established the English rule of riparian rights only for English conditions. * * * It might be argued, with force, that an amendment, inserting the words 'So far only as is consisent with and adapted to the natural and physical condition of the Territory, and the necessities of the people thereof,' merely expressed what was implied before. * * But we are not left to rely upon reasonable implications and argument, for other parts of the original code are express upon the point. Therefore we need not consider

whether, in any event, the statute could be supposed to confer property rights not previously possessed and not subject to legislative change."

Mr. Justice Holmes then quotes from the laws of Arizona wherein "all streams capable of being used for the purpose of irrigation are declared to be public property, and no one shall have the right to appropriate them exclusively, except under such equitable regulations as the legislature shall provide"; that all streams of running water are public; that the owners of arid lands shall have the right to construct ditches, etc., and are given the right to condemn ways therefor; that preference is given to irrigation over other uses with exclusive right to water for agricultural purposes and that precedence is given in time of scarcity to the oldest titles, and concludes:

> "There are many more details, but we have recited enough to show that the interpretation given by the Court below to the general adoption of the common law by the Howell Code, and the qualifications imposed upon it, were correct. They simply follow what has been understood to be the law for many years. *Clough v. Wing*, 2 Arizona, 371.
>
> The right to use water is not confined to riparian proprietors. *Gutierres v. Albuquerque Land & Irrigation Co.*, 188 U. S. 545, 556; *Coffin v. Left Hand Ditch Co.*, 6 Colorado, 443, 449, 450; *Willey v. Decker*, 73 Pac. Rep. 210, 220. Such a limitation would substitute accident for a rule based upon economic considerations, and an effort,

adequate or not, to get the greatest use from all available land."

Boquillas Cattle Co. v. Curtis, 213 U. S. 339, 345-7.

McGilvra vs. Ross (1909) involved *riparian rights* of lands bordering on Lakes Washington and Union in the State of Washington. The principal question was whether rights below high water mark pass to the patentees as appurtenant to the uplands or whether they vested in the state upon its admission to the Union. By Article XVII of the state constitution of Washington the state asserts its ownership to the beds and shores of all navigable waters in the state up to and including the ordinary water line. Opinion by Mr. Justice McKenna.

After discussing the opinion of *Shively v. Bowlby*, supra, and navigability as a limitation of riparian rights, it is said:

> "It is enough to say that the test of navigability of waters insisted on has had no place in American jurisprudence since the decision in the case of The *Propeller Gennesee Chief vs. Fitzhugh*, 12 How. 443, and is therefore no test of riparian ownership. This is the effect of *Shivley vs. Bowlby*, 152 U. S. *supra*. * * * And the term 'navigable waters,' as there used, meant waters which were navigable in fact. The definition was not inadvertent or unnecessary. It was that to which the reasoning conduced and which became the test of the dominion of the national and state governments over shore lands and the rights which they had or could convey. Hence this conclusion by the Court: 'The title and

rights of riparian or littoral proprietors in the soil below high-water mark, therefore, are governed by the laws of the several States, subject to the rights granted to the United States by the Constitution.'

It was observed that the United States while it is held the country as a Territory, having all the powers of national and municipal government, might have granted for appropriate purposes rights and titles below high-water mark. See *United States v. Winans*, 198 U. S. 371; *Prosser v. Northern Pacific R. R.*, 152 U. S. 59.

But, it was said, that they had never done so by general laws, but had considered it 'as most in accordance with the interest of the people and with the object for which the Territories were acquired of leaving the administration and disposition of the soverign rights in navigable waters, and in the soil under them, to the control of the States respectively, when organized and admitted to the Union.' This policy, it was remarked, as 'to navigable waters and the soils under them, whether within or above the ebb and flow of the tide,' has been 'constantly acted upon.' And hence it was further said: 'Grants by Congress of portions of the public lands within a Territory to settlers thereon, though bordering on or bounded by navigable waters, convey, of their own force, no title or right below high-water mark, and do not impair the title and dominion of the future state created, but leave the question of the use of the shores by the owners of uplands to the sovereign control of each state,

subject only to the rights vested by the Constitution in the United States.' The conclusion necessarily follows, as expressed by the Court, that the state may dispose of its lands under navigable waters 'free from any easement of the upland proprietor.'

Joy vs. St. Louis, 201 U. S. 332, is to the same effect. See also *Scranton v. Wheeler*, 179 U. S. 141, 190; *United States v. Mission Rock Co.*, 189 U. S. 391; *Kansas v. Colorado*, 206 U. S. 46-93. In the latter case it was said, as a deduction from many previous cases, including *Shively v. Bowlby*, 'that each state has full jurisdiction over the lands within its borders, including the beds of streams and other waters.' * * 'It properly belongs to the States by their inherent sovereignty, and the United States has wisely abstained from extending (if it could extend) its survey and grants beyond the limits of high water.' "

McGilvra v. Ross, 215 U. S. 70, 78-80.

Snyder v. Colorado Gold Dredging Co. (1910), Circuit Court of Appeals, Eighth District, involved certain placer mining claims along the Swan river in Colorado, waters for the use of which were claimed under the theory of riparian rights.

Opinion by Mr. Justice Van Devanter (then Circuit Judge):

"The common-law doctrine in respect of the rights of riparian proprietors in the waters of natural streams never has obtained in Colorado. From the earliest times in that jurisdiction the local customs, laws, and

decisions of courts have united in rejecting the doctrine and in adopting a different one which regards the waters of all natural streams as subject to appropriation and diversion for beneficial uses and treats priority of appropriation and continued beneficial use as giving the prior and superior right. Yunker v. Nichols, 1 Colo. 551; Coffin v. Left Hand Ditch Co., 6 Colo. 443, 447; Platte Water Co. v. Northern Colo. Irrigation Co., 12 Colo. 525, 531, 21 Pac. 711; Crippen v. White, 28 Colo. 298, 64 Pac. 184. *In so choosing between these inconsistent doctrines, Colorado acted within the limits of her authority, first* as a territory and and then as a state, and her choice was recognized and sanctioned by Congress, so far far as the public lands of the United States were concerned. United States v. Rio Grande Irrigation Co., 174 U. S. 690, 702-706; Gutierres vs. Albuquerque Land & Irrigation Co., 188 U. S. 545, 552-554; Clark v. Nash, 198 U. S. 361, 370; Kansas vs. Colorado, 206 U. S. 46, 94. Boquillas Land & Cattle Co. v. Curtis, 213 U. S. 339."

Of the application of local law in appropriation states:

"It needs only to be added that, by the settled rule of decision in the Supreme Court of the United States, conveyances by the United States of public lands on non-navigable streams and lakes, when it is not provided otherwise, are to be construed and have effect according to the law of the state in which the lands are situate, in so far

as the rights and incidents of riparian proprietorship are concerned. Hardin vs. Jordan, 140 U. S. 370, 384, 402; Hardin vs. Shedd, 190 U. S. 508, 519; Whitaker vs. McBride, 197 U. S. 510; Harrison v. Fite, 78 C. C. A. 447, 449; 148 Fed. 781, 783. Here it is not provided otherwise, either by statute or by the patent, and, as has been seen, the local law does not recognize a conveyance of the land as carrying any right to the unappropriated waters of the stream."

Snyder v. Colorado Gold Dredging Co.
181 Fed. 62, 65, 69.

In *Walbridge v. Robinson* (1912), Supreme Court of Idaho, the exclusive jurisdiction over and sovereign title to the waters of Idaho was determined. A land owner in Montana was denied the right to divert Idaho waters for the irrigation of his lands to the same degree as the State of New Jersey denied the use of its waters to New York in Hudson County Water Co. vs. McCarter (*supra*), although there was no prohibitive statute in Idaho similar to that of New Jersey (also that now adopted in California and Colorado). Opinion by Mr. Justice Ailshie is in part as follows:

"The state engineer, acting under authority of the state, has prosecuted this appeal. He contends that under the constitution and laws of Idaho, *the waters of the state belong to and are owned by the state*, and that the state holds the title to all the public waters in common for the benefit of all its people. In support of this contention, counsel cite Sec. 1, of Art. 15 of the constitution, which provides that 'The use

of all waters now appropriated, or that may hereafter be appropriated for sale, rental or distribution; also of all water originally appropriated for private use, but which after such appropriation has heretofore been, or may hereafter be sold, rented, or distributed, is hereby declared to be a public use, and subject to the regulation and control of the state in the manner prescribed by law' and Sec. 3240 of the Rev. Codes, which provides that, 'All the waters of the state when flowing in their natural channels, including the waters of all natural springs and lakes within the boundaries of the state, are declared to be the property of the state.' It is further contended that this latter declaration of the statute is only a written expression of what the law has always been with reference to the public waters of a state.

Freund, in his work on the Police Power of the state, at Sec. 417, seems to entertain this view, and in discussing similar statutes in other states, says: 'Such declaration is expressive of what is believed to be the law, and does not intend to make new law.'

We think it is clear that the title to the public waters of the State is vested in the State for the use and benefit of all the citizens of the State under such rules and regulations as may be prescribed from time to time by the law-making power of the State. This is not, however, an interest or title in the proprietary sense, but rather in the sovereign capacity as representative of all the

people for the purpose of guaranteeing that the common rights of all shall be equally protected and that no one shall be denied his proper use and benefit of this common necessity. The interest which an individual or the State may have in such things as water and gas and wild animals has received special consideration from courts and text-writers on account of the tendency of these things to escape beyond the power of control or possession or management of any particular person and without the volition of the one who claims to be the owner. They have, nevertheless, been classed together by most of the authorities. * * *

It will be found that the authorities quite uniformly class wild animals, fish, water, gas, light and air as things of the 'negative community,' or the property of no one, and that they are consequently *res communes* and subject to the regulation and control of the state in its sovereign capacity. * * * * * * * *

There is no doubt in our minds but that *the state* in its sovereign capacity *is the owner of the waters* flowing in the streams thereof and may exercise its authority over the same. If the foregoing propositions be correct, the state has the right to prohibit the diversion of the waters of its streams for use outside of and beyond the boundaries of the state. In other words, as said by the supreme court in *Geer vs. Connecticut, supra,* 'The common ownership imports the right to keep the property, if the sovereign so chooses, always within its jurisdiction for every purpose.' "

The court then quotes with approval from Hudson County Water Co. vs. McCarter (*supra*) and of the right of the state to prohibit diversion of its waters for lands in other states in the absence of prohibitory statutes, said:

> "It is conceded in the outset that there is no express legislation to that effect. It is contended by the appellant that, in the absence of a positive statute authorizing such a thing or conferring such a right, the right does not exist, and that no presumption arises that the state by its silence intends to permit the diversion and use of its waters beyond its jurisdiction. * * *
>
> In the light of these authorities and the fundamental reason and principle of justice on which they rest, it would seem necessary for anyone, who claims a right under the laws of a state, which right is to be exercised beyond the jurisdiction thereof, to rest such right upon some specific legislative grant or authority. In the case at bar, a right is urged to enjoy the use of state property or a natural resource of the state beyond the jurisdictional borders of the state and within the confines of another state. A gift or grant of state property or a public franchise, or a right which must emanate from the sovereignty representing the whole people, ought not to arise by mere inference or failure of the sovereignty to speak on the subject. On the other hand, a failure to speak on the subject or to confer the right in specific terms ought to be construed in favor of the state and against those claiming the right. * * * We are

clear that there is no authority for the diversion and appropriation of the waters of this state for application to a beneficial use in another state."

Walbridge vs. Robinson, 22 Idaho 236, 241-4, 245-7.

Marshall Dental Mfg. Co. vs. State of Iowa (1913) involved title to a meandered lake in Iowa. The State of Iowa was granted an injunction restraining the draining of the lake. Opinion by Mr. Justice Holmes:

"The state courts found that Goose Lake was an unnavigable body of water proper to be meandered, and we see no sufficient reason for going behind these successive findings, if we had power to do so. *Cedar Rapids Gas Light Co. vs. Cedar Rapids*, 223 U. S. 655, 668. See *French vs. Fyan*, 93 U. S. 169; *McCormick vs. Hayes*, 159 U. S. 332.

* * * * * * * *

It is enough to say that by virtue of its sovereignty the State of Iowa has an interest in the condition of the lake sufficient to entitle it to maintain this suit against an intruder without title, whether the state owns the bed or not. This principle has been affirmed and acted on by the court so recently that it does not require further argument here. *Georgia vs. Tennessee Copper Co.*, 206 U. S. 230, 237; *Hudson Water Co. vs. McCarter*, 209 U. S. 349, 356. See also *Kansas vs. Colorado*, 206 U. S. 46, 93; *McGilvra vs. Ross*, 215 U. S. 70, 79."

Marshall Dental Co. vs. State of Iowa, 226 U. S. 460, 461-2.

Scott vs. Lattig (1913) involved the question of title to an island in Snake River, a *navigable* stream constituting the boundary between the states of Oregon and Idaho.

Mr. Justice Van Devanter in delivering the opinion of the court said:

> "It was settled long ago by this court, upon a consideration of the relative rights and powers of the Federal and state governments under the Constitution, that lands underlying navigable waters within the several states belong to the respective states in virtue of their sovereignty and may be used and disposed of as they may direct, subject always to the rights of the public in such waters and to the paramount power of Congress to control their navigation so far as may be necessary for the regulation of commerce among the states and with foreign nations, and that each new state, upon its admission to the Union, becomes endowed with the same rights and powers in this regard as the older ones. *County of St. Clair vs. Lovingston*, 23 Wall. 46, 68; *Barney vs. Keokuk*, 94 U. S. 324, 338; *Illinois Central Railroad Co. vs. Illinois*, 146 U. S. 387, 434-437; *Shively vs. Bowlby*, 152 U. S. 1, 48-50, 58; *McGilvra vs. Ross*, 215 U. S. 70."
>
> Scott vs. Lattig, 227 U. S. 229, 242.

The very recent case of *United States vs. Cress*, (1917) involved recovery of compensation for taking of lands and water rights by means of back-water resulting from construction of Government works

upon the Cumberland and Kentucky rivers, Kentucky, in aid of *navigation.*

The long established rule of the authority of the states over the waters within their borders is thus expressed by Mr. Justice Pitney:

> "*The states have authority to establish for themselves such rules of property as they may deem expedient with respect to the streams of water within their borders, both navigable and non-navigable,* and the ownership of the lands forming their beds and banks (Barney vs. Keokuk, 94 U. S. 324, 338; Packer vs. Bird, 137 U. S. 661, 671; Hardin vs. Jordan, 140 U. S. 371, 382; Shively vs. Bowlby, 152 U. S. 1, 40, 58; St. Anthony Falls Water Power Co. v. Water Comrs. 168 U. S. 349, 358); subject however, in the case of navigable streams, to the paramount authority of Congress to control the navigation so far as may be necessary for the regulation of commerce among the states and with foreign nations (Shively vs. Bowlby, 152 U. S. 1, 40; Gibson vs. United States, 166 U. S. 269, 272; Scott vs. Lattig, 227 U. S. 229, 243)."
>
> United States vs. Cress, — U. S. —, 37 Sup. Ct. Rep. 380, 381.

We believe sufficient appears to justify the conclusions set forth in the "General Statement" at the beginning of this portion of the brief, which we now re-affirm.

We shall now consider the Acts of Congress upon this subject and the cases construing the same.

(b) Acts of Congress and Judicial Construction.

In the foregoing review of the decisions of the Courts we find a unanimity of opinion, from the earliest decisions to those of the present year, upon the fundamental doctrine that each state of the United States has full sovereign jurisdiction over the waters within its borders, whether in arms of the sea, where the tide ebbs and flows, upon the great navigable rivers and lakes or upon the non-navigable streams and bodies of water, and further that this jurisdiction applies to all usufractuary titles (riparian or by appropriation) to uses for navigation (save for Congressional control), fisheries, power, domestic supply, irrigation, and other demands of the state and its citizens, according to local conditions and necessities.

We shall now review the various acts of Congress, particularly with regard to use of waters within the arid region and public land states, wherein it will be observed that the same rule of state jurisdiction over waters is recognized and affirmed both by the acts themselves and by the courts in construing the same. Of the many decisions available, we shall select but a few of those dealing particularly with the subject under consideration.

Act of July 26, 1866.

"Whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged *by the local customs, laws, and decisions of Courts*, the possessors and owners of such vested rights shall be maintained and protected in the

same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed; but whenever any person, in the construction of any ditch or canal, injures or damages the possession of any settler on the public domain, the party committing such injury shall be liable to the party injured for such injury or damage."

Act of July 9, 1870.

"All patents granted, or pre-emptions or homesteads allowed, shall be subject *to any vested and accrued water rights*, or rights to ditches and reservoirs used in connection with such water rights, as may have been acquired under or recognized by the preceding section."

Act of March 3, 1877.

The act of March 3, 1877, in relation to desert lands, contained in its first section this proviso:

"*Provided, however*, That the right to the use of water by the persons so conducting the same on or to any tract of desert land of six hundred and forty acres shall depend upon *bona fide* prior appropriation; and such right shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation; and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply upon the public lands, and not navigable, shall remain

and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights."

Act of March 3, 1891.

The act of March 3, 1891, provided:

"That the right of way through the public lands and reservations of the United States is hereby granted to any canal or ditch company formed for the purpose of irrigation and duly organized under the laws of any *State or Territory* which shall have filed, or may hereafter file, with the Secretary of the Interior a copy of its articles of incorporation, and due proofs of its organization under the same, to the extent of the ground occupied by the water of the reservoir and of the canal and its laterals, and fifty feet on each side of the marginal limits thereof; also the right to take, from the public lands adjacent to the line of the canal or ditch, material, earth and stone necessary for the construction of such canal or ditch: *Provided*, That no such right of way shall be so located as to interfere with the proper occupation by the Government of any such reservation, and all maps of location shall be subject to the approval of the department of the Government having jurisdiction of such reservation, and the privilege herein granted shall not be construed to interfere with the control of water for irrigation and other purposes under authority of the respective States or Territories."

26 Stat. L. 1095; U. S. Comp. St. 1901, p. 1570.

Act of August 18, 1894.

The act of August 18, 1894 (The Carey Act) grants to the public land states the desert lands therein situated or so much thereof, not exceeding 1,000,000 acres, as the *state may cause to be irrigated*, reclaimed and occupied.

28 Stat. L., P. 422.

Special Act of ~~Feb. 28~~ March 2, 1897.

~~February 26~~ March 2, 1897, Congress passed an act regarding the use of a reservoir theretofore reserved:

> "Provided, That nothing in this act shall be construed to deprive the *State of Colorado* of the control of the water in any reservoir which may be constructed on this site by any person, or corporation, or association *under the regulations provided by the state laws in such cases.*"

29 Stat. L. 603

Act of February 26, 1897.

The act of February 26, 1897 providing for the use and occupation or reservoir sites theretofore reserved by the United States, contained the following proviso:

> "*Provided,* That the charges for water coming in whole or in part from reservoir sites used or occupied under the provisions of the Act *shall always be subject to the control and regulation of the resepctive states and territories* in which such reservoirs are in whole or in part situated."

7 Fed. Stat. Ann., 1905, p. 1098.
29 Stat. L. 391.
2 U. S. Comp. Stat. 1901, p. 1556.

Act of ~~July~~ June 17, 1902, (National Reclamation Act).

~~July~~ June 17, 1902, the National Reclamation Act was passed providing for government assistance in construction or irrigation works within and under the laws of the respective public land states and territories from funds derived from the sale of public lands within the same, and in Section 8 of the act it is provided:

> "*That nothing in this act shall be construed as affecting or intending to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution, of water used in irrigation,* or any vested right acquired thereunder, and the *Secretary of the Interior*, in carrying out the provisions of this act, *shall proceed in conformity with such laws,* and nothing herein shall in any way affect any right of any state or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof; *Provided,* That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limitation of the right."
>
> 7 Fed. St. Ann., 1905. p. 1098;
> Supp. U. S. Comp. St. 1905, p. 349;
> 32 St. L. 388.

The act of February 21, 1911, (36 Stat., 925), authorizes the government, through the Secretary of the Interior, to contract and co-operate with irrigation districts, water users' associations, corporations,

entrymen, or water users for the construction or use of such reservoirs, canals, or ditches as may be advantageously used by the government and irrigation districts, water users' associations, corporations, entrymen, or water users for empounding, delivering, and carrying water for irrigation purposes and then contains the following proviso:

> "*Provided,* that nothing contained in this act shall be held or construed as enlarging or attempting to enlarge the right of the United States, *under existing law,* to control the waters of any stream in any state."

These acts have been repeatedly construed by this Court, and particular reference is made to them in the following cases:

Atchison vs. Peterson, 20 Wall. 507.

Basey vs. Gallagher, Id. 620.

Broder vs. Natoma Water Co., 101 U. S. 274.

Jennison vs. Kirk, 98 U. S. 453, 456.

United States vs. Rio Grande Irr. Co., 174 U. S. 690, 705-6.

Gutierres vs. Albuquerque Land & Irr. Co., 188 U. S. 545, 552-5.

Kansas vs. Colorado, 206 U. S. 46, 85, 94.

Boquillas Land & Cattle Co. vs. Curtis, 213 U. S. 339, 344-5.

Twin Falls Canal Co. vs. Foote, 192 Fed. 583.

Stanfield vs. Umatilla River Water Users Ass'n. 192 Fed. 596.

In *Atchison vs. Peterson* (1874) the use of water in the states and territories according to the local laws, customs and the decisions of their courts and the recognition thereof by Congress in the act of 1866 is thus stated by Mr. Justice Field:

> "As respects the use of water for mining purposes, the doctrines of the common law declaratory of the rights of riparian owners were, at an early day, after the discovery of gold, found to be inapplicable or applicable only in a very limited extent to the necessities of miners and inadequate to their protection. By the common law the riparian owner on a stream not navigable, takes the land to the centre of the stream, and such owner has the right to the use of the water flowing over the land as an incident to his estate. And as all such owners on the same stream have an equality of right to the use of the water, as it naturally flows, in quality, and without diminution in quantity, except so far as such diminution may be created by a reasonable use of the water for certain domestic, agricultural, or manufacturing purposes, there could not be, according to the law, any such diversion or use of the water by one owner as would work material detriment to any other owner below him. * * *
>
> This equality of right among all the propriators on the same stream would have been incompatible with any extended diversion of the water by one proprietor, and its conveyance for mining purposes to the points from which it could not be restored to the stream. But the government being

the sole proprietor of all the public lands, whether bordering on streams or otherwise, there was no occasion for the application of the common-law doctrine of riparian proprietorship with respect to the waters of those streams. The government, by its silent acquiescence, assented to the general occupation of the public lands for mining, and, to encourage their free and unlimited use for that purpose, reserved such lands as were mineral from sale and the acquisition of title by settlement. And he who first connects his own labor with property thus situated and open to general exploration, does, in natural justice, acquire a better right to its use and enjoyment than others who have not given such labor. So the miners on the public lands throughout the Pacific States and Territories by their customs, usages, and regulations everywhere recognized the inherent justice of this principle; and the principle itself was at an early period recognized by legislation and enforced by the courts in those States and Territories. * * *

This doctrine of right by prior appropriation, was recognized by the legislation of Congress in 1866."

Atchison vs. Peterson, 20 Wall. 507, 511-13.

In *Basey vs. Gallagher* (1874) the rights of the western states and territories to control waters within their borders, for irrigation as affirmed by the act of 1866, is thus stated by Mr. Justice Field:

"In the late case of *Atchison vs. Peterson,* we had occasion to consider the respective rights of miners to running waters. * * * No distinction is made in those States and Territories by the custom of miners or settlers, or by the courts, in the rights of the first appropriator from the use made of the water, if the use be a beneficial one. * * *

Ever since that decision it has been held generally throughout the Pacific States and Territories that the right to water by prior appropriation for any beneficial purpose is entitled to protection. Water is diverted to propel machinery in flour-mills and saw-mills, and to irrigate land for cultivation, as well as to enable miners to work their mining claims; and in all such cases the right of the first appropriator, exercised within reasonable limits, is respected and enforced. * * * The act of Congress of 1866 recognizes the right to water by prior appropriation for agricultural and manufacturing purposes, as well as for mining. * * *

It is very evident that Congress intended, although the language used is not happy, to recognize as valid the customary law with respect to the use of water which had grown up among the occupants of the public land under the peculiar necessities of their condition; and that *law may be shown by evidence* of the local customs, or *by the legislation of the State or Territory, or the decisions of the courts.*"

Basey vs. Gallagher, 20 Wall. 670, 681-4.

We pause to note that Colorado was admitted to the Union August 1, 1876, and that at that time only the acts of 1866 and 1870 had been enacted by Congress. These acts and the decisions of the courts construing the same, alone affected the lands in Colorado during its territorial period and all subsequent acts must necessarily refer to lands in Colorado as a state of the Union in all respects equal with the original thirteen states and not as a territory.

In *Jennison vs. Kirk* (1878) the effect of the act of 1866 is thus stated by Mr. Justice Field:

> "In other words, the United States by the section said, that whenever rights to the use of water by priority of possession had become vested, and *were recognized by the local customs, laws, and decisions of the courts*, the owners and possessors should be protected in them; and that the right of way for ditches and canals incident to such water-rights, being recognized in the same manner, should be 'acknowledged and confirmed;' but where ditches subsequently constructed injured by their construction the possessions of others on the public domain, the owners of such ditches should be liable for the injuries sustained."
>
> Jennison vs. Kirk, 98 U. S. 453, 460.

In *United States vs. Rio Grande Dam and Irrigation Co.* (1899) the acts of 1866, 1877 and 1891 are construed and the language in Broder vs. Natoma Water Co., 101 U. S. 274, quoted with approval. The case involved a conflict between the control by the United States (act of 1890, etc.) of the Rio Grande river for navigation and the use of the water thereof for irrigation by the Territory of New Mexico, through one of its corporations.

The case was remanded for further proceedings on the question of navigability. The opinion of Mr. Justice Brewer construing the rights of states and territories to control the waters within their borders, subject to the paramount rights of the United States, is in part as follows:

> "The unquestioned rule of the common law was that every riparian owner was entitled to the continued natural flow of the stream."

He then quotes from 3 Kent. Com., Sec. 439, and proceeds:

> "While this is undoubted, and the rule obtains in those states in the Union which have simply adopted the common law, it is also true *that as to every stream within its dominion a state may change this common law rule and permit the appropriation of the flowing waters for such purposes as it deems wise.* Whether this power to change the common law rule and permit any specific and separate appropriation of the waters of a stream belongs to the legislature of a territory, we do not deem it necessary for the purposes of this case to inquire. We concede *arguendo* that it does."

After speaking of the paramount rights of the United States, he continued:

> "Notwithstanding the unquestioned rule of the common law in reference to the right of a lower riparian proprietor to insist upon the continuous flow of the stream as it was, and although there has been in all the Western states an adoption or recognition of

the common law, it was early developed in their history that the mining industry in certain states, the reclamation of arid lands in others, compelled a departure from the common law rule, and justified an appropriation of flowing waters both for mining purposes and for the reclamation of arid lands, and there has come to be recognized in those states, by custom and by state legislation, a different rule—a rule which permits, under certain circumstances, the appropriation of the waters of a flowing stream for other than domestic purposes. So far as those rules have only a local significance, and affect only questions between citizens of the state, nothing is presented which calls for any consideration by the Federal courts."

Quoting the act of 1866 he said:

"The effect of this statute was to recognize, so far as the United States are concerned, the validity of the local customs, laws and decisions of courts in respect to the appropriation of water. In respect to this, in *Broder vs. Water Company*, 101 U. S. 274, 276, it was said:

'It is the established doctrine of this court that rights of miners, who had taken possession of mines and worked and developed them, and the rights of persons who had constructed canals and ditches to be used in mining operations and for the purposes of agricultural irrigation, in the region where such artificial use of the water was an absolute necessity, are rights which the Government had, by its conduct, recog-

nized and encouraged and was bound to protect before the passage of the act of 1866. We are of opinion that the section of the act which we have quoted was rather a voluntary recognition of a pre-existing right of possession, constituting a valid claim to its continued use, than the establishment of a new one.' "

After quoting the Acts of 1877 and 1891 he said:

"Obviously by these acts, so far as they extended, *Congress recognized and assented to the appropriation of water in contravention of the common law rule as to continuous flow.* * * * This legislation must be interpreted in the light of existing facts—that all through this mining region in the West were streams, not navigable, whose waters could safely be appropriated for mining and agricultural industries, without serious interference with the navigability of the rivers into which those waters flow. *And, in reference to all these cases of purely local interest the obvious purpose of Congress was to give its assent, so far as the public lands were concerned, to any system, although in contravention to the common law rule, which permitted the appropriation of those waters for legitimate industries.*" (Italics ours.)

Mr. Justice Brewer then observed that the state would have no right to appropriate all the waters of tributary streams to such a degree as to destroy the navigability of the upper stream and referred to the act of September 19, 1890 (26 Stat. 454, Sec. 10), regarding the government control of navigation and held that this later declaration of Congress would

control over prior statutes. After an interpretation of the power of Congress over navigable streams he concluded:

> "The question always is one of fact, whether such appropriation substantially interferes with the navigable capacity within the limits where navigation is a recognized fact. In the course of the argument this suggestion was made, and it seems to us not unworthy of note, as illustrating this thought. The Hudson River runs within the limits of the State of New York. It is a navigable stream and a part of the navigable waters of the United States, so far at least as from Albany southward. One of the streams which flow into it and contributes to the volume of its waters is the Croton River, a non-navigable stream. Its waters are taken by the State of New York for domestic uses in the city of New York. *Unquestionably the State of New York has a right to appropriate its waters, and the United States may not question such appropriation, unless thereby the navigability of the Hudson be disturbed.* On the other hand, if the State of New York should, even at a place above the limits of navigability, by appropriation for any domestic purposes, diminish the volume of waters, which, flowing into the Hudson, make it a navigable stream, to such an extent as to destroy its navigability, undoubtedly the jurisdiction of the National government would arise and its power to restrain such appropriation be unquestioned; and within the purview of this section it would become the right of the Attorney General to institute proceedings to restrain such appropriation."

The case was remanded for inquiry whether the intended acts of the defendants would substantially diminish the navigability of the Rio Grande.

> United States vs. Rio Grande Dam and Irrigation Co., 174 U. S. 690, 702-6, 709.

In *Gutierres vs. Albuquerque Land & Irrigation Co.* (1903) the rights of certain *territorial acts* of New Mexico respecting irrigation were assailed first, upon the ground that the acts assumed to dispose of property (water) of the United States, and second, because the territorial act was inconsistent with legislation of Congress (Acts of 1866, 1877, 1891 and 1902, *supra*). Mr. Justice White thus disposed of the contentions:

> "The argument in support of the first proposition proceeds upon the hypothesis that the waters affected by the statute are public waters, the property, not of the territory or of private individuals, but of the United States; that by the statute private individuals or corporations, for their mere pecuniary profit, are permitted to acquire the unappropriated portion of such public waters, in violation of the right of the United States to control and dispose of its own property wheresoever situated. Assuming that the appellants are entitled to urge the objection referred to, we think, in view of the legislation of Congress on the subject of the appropriation of water on the public domain, particularly referred to in the opinion of this court in *United States vs. Rio Grande Dam & Irrig. Co.*, 174 U. S. 704-706, the objection is devoid of merit. As

stated in the opinion just referred to, by the act of July 26, 1866 (14 Stat. at L. 253, Chap. 262, sec. 9, Rev. Stat. Sec. 2339, U. S. Comp. Stat. 1901, p. 1437), Congress recognized, as respects the public domain, 'so far as the United States are concerned, the validity of the local customs, laws, and decisions of courts in respect to the appropriation of water.' By the act of March 3, 1877, (19 Stat. at L. 377, chap. 107, U. S. Comp. Stat. 1901, p. 1549), the right to appropriate such an amount of water as might be necessarily used for the purpose of irrigation and reclamation of desert land, part of the public domain, was granted, and it was further provided that 'all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers, and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining, and manufacturing purposes, subject to existing rights.'

That the purpose of Congress was to recognize as well the legislation of a territory as of a state with respect to the regulation of the use of public waters, is evidenced by the act of March 3, 1891 (26 Stat. at L. 1095, Chap. 561; U. S. Comp. Stat. 1901, p. 1570)."

Section 18 of the act of 1891 is then quoted wherein "the right of way through all public lands and reservations of the United States is hereby granted to any ditch and canal being formed for the purpose of

irrigation and duly organized under the laws *of any state or territory*" and wherein it is provided that "the privilege herein granted shall not be construed to interfere with the control of water for irrigation and other purposes under authority of the respective *states or territories*" and of the National Reclamation Act, he said:

> "It may be observed that the *purport of the previous acts is reflexively illustrated* by the act of June 17, 1902 (32 Stat. at L. 388). That act appropriated the receipts from the sale and disposal of the public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands; (Quoting Sec. 8 of the National Reclamation Act.)
>
> It would necessarily seem to follow from the legislation referred to that the statute which we have been considering is not inconsistent with the legislation of Congress on the subject of the disposal of waters flowing over the public domain of the United States. Of course, as held in the *Rio Grande Case*, p. 703, even a state as respects streams within its borders, in the absence of specific authority from Congress, 'cannot, by its legislation, destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far, at least as may be necessary for the beneficial uses of the government property; and the power of a state over navigable streams and their tributaries is further limited by the superior power of the general government to secure the uninterrupted

navigability of all navigable streams within the limits of the United States. Necessarily, these limitations are equally applicable in restraint of the legislative branch of a territorial government, controlled, as is such body, by Congress. * * *

We perceive no merit in the contention that the proviso in the desert land act of March 3, 1877, declaring that surplus water on the public domain shall remain and be held free for the appropriation and use of the public for irrigation, mining, and manufacturing purposes, subject to existing rights, is an expression of the will of Congress that all public waters within its control or the control of a legislative body of its creation must be *directly* appropriated by the owners of land upon which a beneficial use of water is to be made, and that in consequence a territorial legislature cannot lawfully empower a corporation, such as the appellee, to become an intermediary for furnishing water to irrigate the lands of third parties. As all owners of land within the service capacity of appellee's canal will possess the right to use the water which may be diverted into such canal, the use is clearly public (*Fallbrook Irrig. Dist. vs. Bradley*, 164 U. S. 163), and appellee is therefore a public agency, whose right to divert water and whose continued existence is dependent upon the application by it within a reasonable time of such diverted water to a beneficial use. Irrigation corporations generally are recognized in the legislation of Congress, and the rights conferred are not limited to

such corporations as are mere combinations of owners of irrigable land."

Gutierres vs. Albuquerque Land & Irrigation Co., 188 U. S. 545, 553, 554, 556.

In Re Withdrawal of Public Lands for Irrigation Purposes (1903), 32 L. D. 254, involved the construction of National Reclamation Act (32 Stat. 388). The Director of the United States Geological Survey recommended that all lands within one half mile on each side of the center line of the Salmon River, State of Washington, *together with the water flowing theron,* be withdrawn from entry on the ground that the same was required for engineering works under the National Reclamation Act. The communication was referred to the Attorney General of the United States for opinion. September 5, 1903, Assistant Attorney General Campbell rendered opinion wherein he found that the United States had no authority or control over the waters of a stream exclusive jurisdiction of which, save for interstate navigation, was vested in the State of Washington. The opinion was adopted and thereafter followed by the U. S. Reclamation Service. (See Second Annual Report U. S. Reclamation Service, 1902-3, page 36.)

The opinion is especially pertinent in view of the fact that Assistant Attorney General Campbell appeared of counsel for the United States in the case of *Kansas vs. Colorado.* He in part said:

"The purpose to be accomplished by the withdrawal, as will be seen from the text of the letter, is to control the use of the water passing through the lands proposed to be withdrawn, so as to prevent its appropriation by others in any

manner that will impair the continuous flow of the water through said lands, in violation of the common law right of riparian proprietors. The practical question thus presented is, whether the United States, by the exercise of executive authority, has the right to control the use of unappropriated waters passing through the public lands in a state, so as to prevent their appropriation by others for any of the beneficial uses recognized and allowed by the statutes of the state.

The United States, as proprietor of the public lands through which a stream of water naturally flows, has the same property and right in the stream that any owner of land has, be it usufructuary or otherwise. The stream of water is part and parcel of the land, and the right to the use of it and to its continuous flow, without alteration or diminution, is, under the common law, a right incident to the ownership of the soil, enjoyed alike by every riparian proprietor. It is not a property in the water, but a simple usufruct as it pases along. 3 Kent's Com. Sec. 439; Unions M. & M. Co. vs. Ferris 2 Sawy. 176; Vansickle vs. Haines 7 Nev. 249; Lux vs. Haggin 69 Cal. 255.

Such is the cardinal rule that controls in every state of the Union which has simply adopted the common law. While this is true, 'it is also true that as to every stream within its dominion a state may change this common law rule and permit the appropriation

of the flowing waters for such purposes as it deems wise.' (United States v. Rio Grande Irrigation Co. 174 U. S. 690-702.) But, 'in the absence of specific authority from Congress, a state cannot by its legislation destroy the right of the United States, as the owner of lands bordering on a stream, to the continued flow of its waters; so far at least as may be necessary for the beneficial uses of the government property.' (Id. 703.)

In all the arid land states the common law rule as to the right of a riparian proprietor to the continued flow of a stream over his land has been changed, and rights to the use of water for manufacturing, mining, agricultural and other beneficial purposes have accrued and vested, under local customs, the laws of the states and the decisions of the Courts. The statutes of a state providing for the diversion and appropriation of the waters of a flowing stream for irrigation or other public uses is a valid exercise of the legislative power of a soverign state. (Fallbrook Irrigation District, v. Bradley, 164 U. S. 112.)

The constitution of the State of Washington declares that 'the use of the waters of this state for irrigation, mining, and manufacturing purposes shall be deemed a public use.' The laws of the state provide that the use of such water may be acquired by appropriation, and as between appropriations the first in time shall be first in right. The right thus acquired is a property right that may be transferred by deed. Although

in that state, as in all the other states of the arid west, the common law was adopted and recognized, their peculiar physical conditions soon 'compelled a departure from the the common law rule, and justified an appropriation of flowing waters for mining purposes and for the reclamation of arid lands, and there has come to be recognized in those states, by custom and by state legislation, a different rule—a rule which prevents, under certain circumstances, the appropriation of the waters of a flowing stream for other than domestic purposes.' United States v. Rio Grande Irrigation Co., *supra,* page 704.

Such legislation would, however, have had no effect upon the rights of the United States as to the public lands and the waters of the streams and lakes thereon, but for the act of July 26, 1866, (14 Stat., 253; Rev. Stat., Sec. 2339), and subsequent acts of the same character."

He then discussed the Acts of July 26, 1866 (14 Stat., 253), July 9, 1870, (16 Stat., 217), March 3, 1877 (19 Stat., 377), March 3, 1891, (26 Stat., 1095) and the local effect thereof as interpreted by this Court and continued:

> "These acts evince a clear and definite purpose to authorize and assent to the appropriation of water upon the public lands in contravention of the common law rule as to continuous flow * * * ."

He then quoted, with approval, the portions of the opinion of this Court in *United States v. Rio Grande Irrigation Co.* and *Gutierres v. Albuquerque*

Land Co., supra, and after quoting Section 8 of the National Reclamation Act, continued:

> "The absolute right to appropriate the waters flowing over the public lands has been so obviously sanctioned by the acts referred to, and so clearly determined by the decisions cited, as to be no longer an open question. The Director of the Geological Survey, however, bases his recommendation for a withdrawal of land and the riparian right incident thereto upon the theory that whatever recognition and assent may have heretofore been given to the appropriation of the waters on the public lands, the United States may at any time resume the control of all unappropriated waters on such lands, and that 'as the Secretary of the Interior has full power to withdraw from entry any unappropriated lands which, in his opinion, may be necessary for public uses, there appears to be no reason why the Secretary may not, at the same time, withdraw both the land and the water from further appropriation, when the same are required for public use.'
>
> Whether the United States, by the legislative branch of the government, may resume its common law right of riparian proprietorship as to the unappropriated waters flowing over and upon the public domain, by the repeal of the several statutes recognizing rights in contravention thereof, is a question that need not be discussed in determining the question submitted. * * * * Those acts are still in full force and effect, and their operation can not be limited or

suspended by executive authority. Section 8 of the reclamation act is an emphatic declaration that such laws are to continue in force. It expressly declares that in carrying out the provisions of the act it shall not 'interfere with the laws of any State or Territority relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder,' but that it 'shall proceed in conformity with such laws.' A withdrawal of waters from appropriation under the State and Territorial laws would be in direct conflict with the provisions of this section.

I have therefore to advise that there is no authority to make such executive withdrawal of public lands in a state as will reserve the waters of a stream flowing over the same from appropriation under the laws of the state, or will in any manner interfere with its laws relating to the control, appropriation, use or distribution of water."

In Re Withdrawal Public Lands for Irrigation Purposes, Act of June 17, 1902. 32 L. D. 254-8.

In *Kansas vs. Colorado* (1906) Mr. Justice Brewer, in answer to the claim of the National Reclamation Service, of control over all the streams of the Western States, in part said:

"As to those lands within the limits of the states, at least of the Western states, the national government is the most considerable owner and has power to dispose of and make all needful rules and regulations respecting its property. We do not mean

that its legislation can override state laws in respect to the general subject of reclamation. *While arid lands are to be found mainly, if not only, in the Western and newer states, yet the powers of the national government within the limits of those states are the same (no greater and no less) than those within the limits of the original thirteen*, and it would be strange if, in the absence of a definite grant of power, the national government could enter the territory of the states along the Atlantic and legislate in respect to improving, by irrigation or otherwise, the lands within their borders. Nor do we understand that hitherto Congress has acted in disregard to this limitation."

He then quoted, with approval, the language of Mr. Justice White in *Gutierres vs. Albuquerque Land & Irrig Co., supra*, page 554, construing Section 8 of the National Reclamation act (heretofore quoted), wherein he said "the purport of the previous acts" (1866, 1877 and 1891) "is reflexively illustrated by the act of June 17, 1902," and concluded:

> "But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that each state has full jurisdiction over the lands within its borders, including the beds of streams and other waters" (citing cases).
>
> Kansas vs. Colorado, 206 U. S. 46, 92.

Twin Falls Canal Co. vs. Foote (1911), U. S. Circuit Court of Idaho, was commenced before a state court of Idaho for adjudication of conflicting rights

of appropriators of water from Snake River, including appropriations made by the U. S. Reclamation Service by means of one of its irrigation systems diverting water from that stream. The representative in charge of the U. S. Reclamation structures filed petition to remove the case to the Circuit Court of the United States, which, having been granted, *ex parte*, the plaintiff moved to remand to the state court.

The representative in charge of the government project contended that the United States Court should take jurisdiction by reason of the fact that the Reclamation Act is a "revenue law of the United States." In the opinion remanding the action to the state court, United States District Judge Dietrich construed the reclamation act and determined that it was not a "revenue law." After a discussion of the authorities upon this question he said:

> "The storage of water for irrigation purposes or the reclamation of arid lands is not, accurately speaking, a governmental function, and is not 'a necessary part of civil government in the same sense in which the protection of life, liberty and property, the defense of the government against insurrection and foreign invasion, and the administration of public justice, are.' The government, being possessed of large tracts of arid land, which without irrigation are practically worthless, in pursuance of a wise policy, as we think, is, under the reclamation act, engaged in reclaiming them, to the end that they may become marketable and utlimately fruitful.

In prosecuting such an enterprise, however, it is not primarily performing a governmental, or, strictly speaking, even a public function, but is promoting its proprietary interests. Such advantage as arises therefrom to the people at large is material and not governmental, and is only such as might indirectly accrue to the public from the reclamation of an equal amount of land through private enterprise. Kansas vs. Colorado, 206 U. S. 46, 92; United States vs. Hanson, 167, Fed. 881, 93 C. C. A.371; United States vs. Burley (C. C.) 172 Fed. 615, Id., 179 Fed. 1, 102 C. C. A. 429.

It will further be borne in mind that the subject-matter of this action is not, directly, at least, the right to collect dues or enforce contracts, but to use the flow of a certain stream of water. *This right of the government,* such as it possesses, *is of the same quality, and is derived from the same sources and rests upon the same basis as that of the plaintiff or any other claimant.* Not in its sovereign, but in its proprietary capacity, as the owner of arid lands, *it acquired such right, by complying with the laws of the state governing the appropriation and use of water for beneficial purposes.* Congress was careful to make clear its intent in this respect." (Italics ours.)

Judge Dietrich then quotes Section 8 of the Reclamation Act wherein it is provided that all oppropriations of water made by the Reclamation Service shall be subject to the laws and regulations of the states or territories where made and continues:

"In acquiring the right, therefore, and using it, the Secretary of the Interior is not authorized to act independently of, but is directed to proceed in conformity with and subject to, *the laws of the state*, and there can be no implication that Congress intended that all controversies touching a right thus acquired and held under the state laws should be withdrawn from the state courts. The plaintiff is not seeking to restrain the defendant from collecting water rents or water dues, or from enforcing any contracts that have been made for the payment of money. The only substantive relief sought is the adjudication of conflicting claims to certain water, a judicial determination of the extent, and the dignity of the rights of the several parties to the flow of the Snake River. The *right* not having been conferred upon the Secretary of the Interior by the reclamation act, but *having been acquired by him through a compliance with the statutes of the state*, in adjudicating the controversy herein involved, the court exercising jurisdiction, whether it be a state or a federal tribunal, will be under the necessity of construing and applying the statutes, not of the national government, but of the state."

In the remainder of the opinion the Court determined that the reclamation act is not a measure for raising revenue in a constitutional sense and remanded the case to the state court.

Twin Falls Canal Co. vs. Foote, 192 Fed. 583, 594.

Stanfield vs. Umatilla River Water Users' Assn. (1911), U. S. Circuit Court, Oregon, involved a motion to remand the action to the state court from which it had been removed upon motion of Director Newell of the U. S. Reclamation Service under claim that the suit was being prosecuted against an officer appointed and acting under a revenue law of the United States, and also against an officer of the United States claiming to act under a law of Congress.

The action was commenced in the state court to enjoin the reclamation project from operating their canal above the city of Stanfield until so constructed as to prevent damage by loss of water therefrom. In remanding the case to the state court, District Judge Bean found against Director Newell, and, on the claim that he was acting under a revenue law of the United States, said:

> "This question has been recently considered and decided by Judge Deitrich in the District of Idaho. Twin Falls Canal Co., Ltd., vs. Foote, 192 Fed. 583. His conclusions are that the reclamation act is not a revenue law within the meaning of section 643, and that suit commenced in the state court against an officer of the reclamation service cannot be removed to a federal court under the provisions of that section. I had examined the question and reached a similar conclusion before being advised of Judge Deitrich's decision. I can, however, add nothing to his able and exhaustive opinion."

Of the claim that Director Newell was an officer acting under a law of the United States he said:

"It is suggested that, regardless of the method of removal, the Court should retain jurisdiction because the suit is against an officer of the United States claiming to act under a law of Congress. But this is not sufficient to give this court jurisdiction, under the judiciary act of 1887, either as an original action or by removal from a state court. Tennessee vs. Union & Planter's Bank, 152 U. S. 454; Chappell vs. Waterworth, 155 U. S. 102; Walker vs. Collins, 167 U. S. 57; People's U. S. Bank vs. Goodwin (C. C.) 160 Fed. 727. Although it would seem to have been enough under previous legislation. Feibelman vs. Packard, 109 U. S. 421; Bachrack vs. Norton, 132 U. S. 337."

Stanfield vs. Umatilla River Water Users' Assn. et al, 192 Fed. 596, 597.

These acts of Congress and decisions of the courts and the land department, clearly declare and affirm the jurisdiction of the states over the waters within their domain in so far as the United States is concerned.

We shall now refer to the laws and decisions of the courts of the litigant states, Colorado and Wyoming, without further reference upon this topic to the numerous decisions of the courts of other states.

(c) Colorado—Laws and Decisions.

The Colorado enabling act and the proclamation of the President admit the state to the Union "on an equal footing with the original states in all respects whatsoever."

18 U. S. Stat. L. 474.

President's Proclamation, Aug. 1, 1876.

Constitutional Provisions.

The Constitution, made in pursuance of the Enabling Act, and subsequently approved by the proclamation of President Grant, provides:

> "The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to use of the people of the state, subject to appropriation as hereinafter provided." (Art. 16, Sec. 5, Colorado Constitution.)

Then follow provisions giving preference to certain uses over others, and providing for rights of way and for state regulation of charges to water consumers, from canal systems.

> Art. 16, Sec. 6, 7 and 8, Colorado Constitution.

It thus appears that on her very admission and as a part of the solemn transaction, Colorado asserted her full sovereign dominion over the waters of her streams and that this assertion was then and there approved by the United States.

We shall hereafter cite statutes and decisions of her legislatures and courts wherein claim to full control of her waters is again and again asserted, finally culminating in a decision of her courts and an act of her legislature forever putting at rest any assumption of recognition of claims from without her boundaries on the principle of concurrence of laws or otherwise.

Colorado early provided for the careful policing of her streams in various divisions and water districts of her territory and provided procedure for adjudication of the rights of appropriation before her

courts upon the decrees of which the diversions of water are administered by her water officials.

Most of these statutes were enacted and the greater portion of the water of the state had been appropriated and adjudicated before Wyoming was admitted to the Union (July 10, 1890). Of these statutes it is said:

> "The statutes are in the nature of police regulations to secure the orderly distribution of water for irrigation purposes, and to this end they provide a system of procedure for determining the priorities of rights as between carriers."
>
> Combs vs. Farmer's H. L. C. & Co., 38 Colo. 420, 428.

Also:

> "This court has repeatedly upheld the irrigation laws of this state as being an exercise of the police power of the state."
>
> Robertson vs. People, 40 Colo. 119, 124.

Judicial Construction of Constitution.

The foregoing provisions of the Constitution of Colorado have been many times construed by her courts, we shall however confine ourselves to limited citation:

> "Our constitution dedicates all unappropriated water in the natural streams of the state 'to the use of the people,' the ownership thereof being vested in the 'public.' "
>
> Wheeler vs. Northern Colo. Irr. Co. 10 Colo. 582, 587.

Chief Justice Hayt said:

> "Under our constitution, the water of every natural stream in this state is deemed to be the property of the public. Private ownership of water in the natural streams is not recognized. The right to divert water therefrom and apply the same to beneficial uses, is, however, expressly guaranteed. By such diversion and use a priority of right to the use of the water may be acquired. This priority has been declared a property right, and as such subject to sale and transfer."
>
> Ft. Morgan L. & C. Co. vs. South Platte D. Co. 18 Colo. 1, 2.

In *Stockman vs. Leddy* (1912), construction of the above provision of the constitution came before the Supreme Court of Colorado on the question of the right of the legislature to make appropriation for protecting and defending the rights of the state and its citizens, in the waters of the natural streams of the state. The opinion by Chief Justice Campbell leaves no doubt of the meaning of the constitutional provisions and the extent of the claims of the state:

> "That the general assembly, which, under our constitution, is the representative of the people in making laws, has the power, and is charged with the duty, to protect the state's interest in the natural streams of this state, cannot be questioned. * * * From the very beginning of settlement in Colorado territory, and in other arid regions of the West, irrigation has been recognized by federal and state legislation, by the decisions of the federal and state courts, and by the people directly interested, as the declared

public policy. These decisions need not be cited. They are abundant. In Section 5 of Article 16 of our state constitution as originally adopted, this public policy is thus tersely expressed: 'The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided.' Other sections of the same article make such provision. This language is both emphatic and clear. It is the voice of the people who ratified the constitution, and declares for all time the public policy of this state which theretofore had been recognized by all the departments of the dual governments. The statutes which were enacted by the early sessions of our General Assembly to carry out the provisions of this section provide an elaborate and systematic scheme for the distribution of the waters of the state to those entitled to their use.

The state has never relinquished its right of ownership and claim to the waters of our natural streams, though it has granted to its citizens, upon prescribed conditions, the right to the use of such waters for beneficial purposes and within its own boundaries. The property right, however, in the natural streams, and the waters flowing therein, has never been renounced or relinquished by the state, and it has at all times asserted not only its right of ownership, but the unrestrained right, within its

own boundaries, to distribute its waters to those who have, under its authority, acquired, by perfected appropriations, the right to their use.

This constitution of ours was ratified and adopted by the legal voters of the state in accordance with the conditions prescribed by the enabling act of Congress, and the President of the United States in his proclamation admitting Colorado into the Union found the fact to be that the fundamental conditions imposed by Congress on the State of Colorado to entitle it to such admission had been complied with. Congress, in passing the enabling act, and the President, in issuing his proclamation, were aware of the existing physical conditions and of the topography and geography of the state. The federal government, by its lawmaking and executive bodies, knew that the natural streams of this state are, in fact, non-navigable within its territorial limits, and practically all of them have their sources within its own boundaries and that no stream of any importance whose source is without those boundaries, flows into or through this state. The entire volume of these streams is therefore made up of rains and snows that fall upon the surface of lands included within the exterior lines of this state and of springs which issue from the earth within the same area. Such being the peculiar conditions, the state was justified in asserting its ownership of all the natural streams within its boundaries. When Colorado was admitted into the Union with such a consti-

tution, the federal government, through its lawmaking and executive departments, thereby recognized and confirmed such right of ownership as belonging to the state in its sovereign capacity. We therefore find it to be not only that our state constitution and pertinent statutes, but the decisions of the courts and duly announced public policy, all are in accord on the proposition to which the federal government has, as we have just shown, given its consent that the waters of the natural streams of this state belong to the people, to the state, in its sovereign capacity, and that its right to their distribution and control within its borders is free from any interference by any other sovereignty. * * * The right of Congress to regulate and control navigable interstate streams and the jurisdiction of the Supreme Court of the United States to determine, in a controversy between two or more sovereign states over the waters of an interstate stream, whether they are reasonably exercising their inherent powers of sovereignty, are not overlooked or questioned by us; but these considerations do not, for the reasons above stated, affect or bear upon the right of ownership and control by Colorado of its own natural streams, and its power and authority to regulate the distribution of their waters, within its own territory, for beneficial purposes. We find nothing in *United States vs. Rio Grande Irrigation Co.*, 174 U. S. 690, 19 Sup. Ct. 770, 43 L. Ed. 1136; *Kansas vs. Colorado*, 206 U. S. 46, 27 Sup. Ct. 655, 51 L. Ed. 956; *Rickey L.*

& C. Co. vs. Miller & Lux, 218 U. S. 258, 31 Sup. Ct. 11, 54 L. Ed. 1032; *Bean vs. Morris,* 221 U. S. 485, 31 Sup Ct. 703, 55 L. Ed. 821, or in any other case that has been brought to our attention, which militates against our conclusion, when these cases are considered, as they should be, in connection with the facts on which they were determined. We therefore conclude that the general assembly, in order to protect the rights of the state in our natural streams and their waters, and the interests which its citizens have acquired thereunder, may make a valid appropriation of money for the purpose of protecting and defending them."

Stockman vs. Leddy, 55 Col. 24, 27-30.

Statutes to Protect Rights of State.

Reference must again be had to the several acts of the Colorado Legislature, looking particularly to the extent of the claims to full jurisdiction of the state over the waters within its borders and protection thereof from interference from without. In that portion of this brief devoted to a discussion of the cases cited by Wyoming in her "Supplemental Brief," wherein Wyoming relies upon precedents for settlement of mere private rights of citizens of different states (and not upon cases dealing with the rights of states), where it is "assumed, in the absence of legislation to the contrary, that the states were willing to ignore boundaries, and allowed the same rights to be acquired from outside the state that could be acquired within," we shall there observe that Colorado has legislated "to the contrary," and that aside from the fundamental weakness of establishing rules for settlement of mere private property

interests without regard to the rights of states, the cases cited by Wyoming do not apply because of the prohibitory action of Colorado (See p. 153-178 Sup. Brief, Wyo). Nevertheless, the position taken by Colorado should be clearly defined in this portion of the discussion and we shall now refer to several of the more recent of the numerous acts of the Colorado legislature so defining her position.

Act of April 10, 1903, provided for defense of case of Kansas vs. Colorado "and for the protection of the natural streams of Colorado for irrigation, wherever threatened," and appropriated $25,000 for such purpose.

S. L. 1903, Chap. 2, p. 23.

The carrying out of the provisions of the above act, and subsequent similar acts, terminated in 1907.

S. L. 1907, Chap. 57, p. 136.

Act of May 2, 1909, directed the Attorney General to institute and defend suits to defend the waters of the state and to determine whether or not the federal government "is encroaching upon or usurping the rights and powers of the state," etc., and appropriated $20,000 therefor.

S. L. 1909, Chap. 83, p. 199.

Act of May 11, 1911, appointed a joint legislative committee with full powers to investigate and

> "Ascertain whether or not the right of this state to control the distribution of the waters thereof within its borders is thereby in any way unlawfully limited or interfered with or infringed upon * * * and to investigate and determine what claims are made by or upon behalf of any state or corporation or individual thereof to the waters

> of any stream or streams originating or flowing in the State of Colorado to the detriment of the interests of this state and the citizens thereof or the appropriators and users of said waters; and to examine into all matters by which the state's right to control the waters thereof may be affected * * * said committee is hereby empowered to authorize prosecution or defense of such action or actions as it may deem proper to determine or to protect the rights of the state."

The sum of $50,000 was appropriated to carry out the provisions of the bill.

S. L. 1911, Ch. 227, p. 671.

Act of Feb. 25, 1913, after reciting the attacks then pending and threatened against the state and its waters appropriated $50,000 to pay the expenses of bringing or defending suits, etc., "for protection of the right to use the water of the natural streams of Colorado."

S. L. 1913, Ch. 100, p. 381.

Act of Feb. 24, 1915, was similar and made the same appropriation as that of 1913.

S. L. 1915, Ch. 21, p. 93.

Act of April 21, 1917, made and appropriation of $50,000 for defraying expenses of all suits "for the protection of the right to use the water of the natural streams of Colorado * * * wherever threatened," etc.

S. L. 1917, Ch. 33, p. 108.

Thus it appears that Colorado has constantly resisted all attempts to challenge or encroach upon her rights to the use, regulation and control of the

waters within her borders, constituting, as they do, her greatest natural resource, and has repeatedly appropriated her moneys, and without stint, for the protection of her sovereign rights.

By the Act of March 30, 1917, Colorado forever put at rest any possible question of the extent of her claims, if indeed any further act was required after her admission to the Union on an equality with the other states in 1876, and after the most positive declaration of state claim to the waters within her borders made in Art. XVI, Sec. 5, of her constitution above quoted. This last act of her legislature was modeled after the New Jersey Act construed in Hudson County Water Co. vs. McCarter, 209 U. S. 349. (See copy New Jersey Act in opinion by Mr. Justice Pitney, 70 N. J. Eq. 698), but adapted to the Colorado procedure. It reads:

An Act

To preserve and maintain the waters of the State of Colorado and to prevent the diversion, carriage and conveyance thereof into other states for use therein, and to authorize the District and Supreme Courts to enforce the provisions hereof.

Be it Enacted by the General Assembly of the State of Colorado:

Section 1. For the purpose of aiding and preserving unto the State of Colorado and all its citizens the use of all the waters of the springs, lakes, ponds, creeks, rivers, streams and water-courses of this state, which waters do not increase with the growth of population and which are neces-

sary for the health and prosperity of all the citizens of the State of Colorado, and for the growth, maintenance and general welfare of the state, it shall be unlawful for any person, corporation of association to divert, carry or transport by ditches, canals, pipes, conduits, natural streams, or water-courses, the waters of any springs, reservoir, lake, pond creek, river, stream or water-course of this state into any other state for use therein.

Section 2. It shall be the duty of the State Engineer, the Division Engineers and the Water Commissioners of this state, to see that the waters of the state are preserved for the use and benefit of the citizens and inhabitants of the state for its growth, prosperity and general welfare, and to prevent the waters thereof from being diverted, carried, conveyed or transported by ditches, canals, pipes, conduits, natural streams or water-courses, into other states for use therein, and upon its being brought to the knowledge of the State Engineer of Colorado that any person, corporation or association is carying or transporting any of such waters into any other state for use therein, or is intending so to do, it shall be his duty to immediately call the matter to the attention of the Attorney General, who shall, in behalf of and in the name of the state, apply to any District Court or to the Supreme Court of the State of Colorado, for such restraining orders or injunctions, both preliminary and final, as may be necessay to enforce the provision of this act and jurisdiction is conferred upon said courts for such purposes.

Section 3. In the opinion of the General Assembly this act is necessary for the immediate preservation of the public peace, health and safety.

Section 4. In the opinion of the General Assembly an emergency exists, therefore this act shall be in force and take effect from and after its passage.

Approved: March 30, 1917."

S. L. 1917, Ch. 151, p. 539.

In an act permitting the sale, by an irrigation district, of its water system, the following appears:

"The sale herein provided for may be made to any person or persons, to a corporation organized under the laws of the State of Colorado, or may be made to the United States, but no sale of water rights shall in any manner impair or be deemed to relinquish any of the sovereign rights of the State of Colorado in the waters of the state or to control and regulate the diversion, use and distribution thereof."

S. L. Colo., 1917, Ch. 86, Sec. 5. p. 324.

In an Act, introduced at the instance of the Reclamation Service to permit state and government co-operation in construction of irrigation projects in Colorado, the following proviso occurs:

"But, however, all water which has been or is acquired by the district by virtue of the laws of Colorado may be distributed and apportioned according to the terms of any contract entered into between the district and the United States, until the obligation due the United States is paid or the

obligation to pay is discharged in any manner; but nothing in this act contained shall be deemed or construed to grant or relinquish unto the United States any of the sovereign rights of the State of Colorado in and to the waters within its borders, or its exclusive authority over and jurisdiction and control of said waters, and the diversion, appropriation and use thereof, nor in any manner change the methods of appropriation thereof."

S. L. 1917, Ch. 83, Sec. 3, p. 296.

We believe sufficient appears to clearly define the claims of Colorado to the waters within her borders, free from any assumption of recognition of claims of private citizens in other states. As we shall next observe, the claims of Wyoming are, in all essentials similar.

(d) Wyoming—Laws and Decisions.

Wyoming was admitted into the Union July 10, 1890, "on an equal footing with the original states in all respects whatever."

Enabling Act Wyoming—26 Stat. 224, c 664.

Constitutional Provisions.

Her constitution, adopted before admission, made full claim to the waters within her borders in essential respects the same as had Colorado in 1876, with the addition therein of provisions for the policing of her streams by officials in manner theretofore adopted by statute in Colorado save for the creation of a Board of Control:

"Section 1. The water of all natural streams, springs, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state.

Section 2. There shall be constituted a board of control, to be composed of the state engineer and superintendent of the water divisions; which shall, under such regulations as may be prescribed by law, have the supervision of the waters of the state and of their appropriation, distribution and diversion, and of the various officers connected therewith. Its decisions to be subject to review by the courts of the state.

Section 3. Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests.

Section 4. The legislature shall by law divide the state into four (4) water divisions, and provide for the appointment of superintendents thereof.

Section 5. There shall be a state engineer who * * * shall be president of the board of control, and shall have general supervision of the waters of the state and of the officers connected with its distribution * * *."

Wyoming Constitution, Art. VIII, Secs. 1 to 5, inclusive.

(Note: It should be observed that by her constitution no appropriation shall be denied except

when such denial is "demanded by the public interests.")

The preference of uses one over the other is not provided in the constitution, as in Colorado, but is fixed by statute.

Statutes.

The statutes of Wyoming provide:

> "A water right is a right to use the *water of the state,* when such use has been acquired by the beneficial application of water under the laws of the state relating thereto, and in conformity with the rules and regulations dependent thereon. Beneficial use shall be the basis, the measure and limit of the right to use water at all times, not exceeding in any case, the statutory limit of volume. Water being always the property of the state, rights to its use shall attach to the land for irrigation, or to such other purpose or object for which acquired in accordance with the beneficial use made and for which the right receives public recognition, under the law and the administration provided thereby. Water rights cannot be detached from the lands, place or purpose for which they are acquired, without loss of priority."
>
> Wyo. Comp. Stat. (1910), Sec. 724, p. 247.

Then follow statutes defining the preference of various uses, by appropriation, one over the other; provisions requiring all persons intending to appropriate water to first obtain a permit so to do and

that no right shall attach before date of permit, and provisions generally for regulation of diversions and uses of water under state control, leaving adjudication of priorities to the Board of Control, rather than to the courts. While fundamentally the system of state control by dividing the state into divisions for purposes of administration is similar to that of Colorado, nevertheless, the manner of defining the extent of the right to use of water, and the various details of administration are radically different.

Judicial Construction of Constitution.

The above provisions of the Wyoming constitution have been construed and upheld by her courts. In *Farm Inv. Co. vs. Carpenter* (1900), Chief Justice Potter said:

> "At the outset, however, it is strenuously insisted that the declaration contained in the constitution that the waters of the natural streams, etc., are the property of the state, is meaningless and of no force or effect. It is argued that the state no more than an individual can acquire property by a mere assertion of ownership; and that the United States as the primary owner of the soil is also primarily possessed of title to the waters of the streams flowing across the public lands. * * *
>
> So far as any proprietary rights of the United States are concerned, the question would seem to be settled in favor of the effectiveness of the declaration, by the act of admission, which embraces the following provision: 'And that the constitution which the people of Wyoming have formed for

themselves, be, and the same is hereby, accepted, ratified, and confirmed.' McCornick vs. Western Union Tel. Co., 79 Fed. 499. In that case the circuit court of appeals for the 8th circuit of the United States, held that under a similar provision in the act of Congress, admitting Utah, all the provisions of the Utah constitution were invested with all authority conferred by any act of Congress.

But is there not a further and deeper reason for upholding the validity and force of the constitutional declaration? Under the doctrine of prior appropriation, it would seem essential that the property in waters affected by that doctrine should reside in the public, rather than constitute an incident to the ownership of the adjacent lands. Such waters are, we think, generally regarded as public in character.

By the civil law, the waters of all natural streams were *publici juris*, and according to Bracton that was the rule anciently in England. * * * At the modern common law public waters are generally confined to those which are navigable, and public rights therein to navigation and fishery, and privileges incident thereto. In the arid region of this country another public use has been recognized by custom and laws and sanctioned by the courts; a public use sufficient to support the exercise of the power of eminent domain. Fallbrook Irr. Dist. vs. Bradley, 164 U. S. 112, 160. This use, and the doctrine supporting it, is founded upon the necessities

growing out of natural conditions, and is absolutely essential to the development of the material resources of the country. Any other rule would offer an effectual obstacle to the settlement and growth of this region, and render the lands incapable of continued successful cultivation. The waters for the reclamation of the desert lands must be obtained, in a very large measure, from the natural streams and other natural bodies of water.

The common law doctrine of riparian rights relating to the use of the water of natural streams and other natural bodies of water not prevailing, but the opposite thereof, and one inconsistent therewith, having been affirmed and asserted by custom, laws, and decisions of courts, and the rule adopted permitting the acquisition of rights by appropriation, the waters affected thereby become perforce *publici juris*. It is therefore doubtful whether an express constitutional or statutory declaration is required in the first place to render them public.* * * We entertain no doubt of the power of the people in their organic law, when existing vested rights are not unconstitutionally interfered with, to declare the waters of all natural streams, and other natural bodies of water, to be the property of the public, or of the state. Nor do we doubt that the legislature may make a like declaration, when, in that particular, unrestrained by the constitution.

If any consent of the general government was primarily requisite to the incep-

tion of the rule of prior appropriation, that consent is to be found in several enactments by Congress, beginning with the Act of July 26, 1866, and including the Desert Land Act of March 3, 1877. Those acts have been too often quoted and are too well understood to require a restatement at this time at the expense of unduly extending this opinion.

It has been held that the Act of July 26, 1866, was rather a voluntary recognition by Congress of pre-existing rights, constituting valid claims to a continued use, than the establishment of new rights. Brodie v. Water Co., 101 U. S. 274.

By these various acts, 'the obvious purpose of Congress was to give its assent, so far as the public lands were concerned, to any system, although in contravention to the common law, which permitted the appropriation of these waters for legitimate industries,' and, 'a state may change the common law rule, and permit the appropriation of the flowing waters for such purposes as it deems best.' U. S. V. Rio Grande Irr. Co., 174 U. S. 690.

If, as has been said, the title of the general government to the public lands is that of proprietor rather than sovereign (Kinney on Irr., Sec. 145), it would seem that its rights as such are not greater to the waters of the streams flowing across the lands than those of an individual owner.

In Arizona and Nevada, the statutes declare the ownership of the public in the waters of the natural streams. * * *

> The effect of such a declaration has been determined by the Courts of Colorado, whose constitution declares that the unappropriated waters of the streams within the state are the property of the public."

He then cites with approval the quotations in the first two cases, *supra*, wherein the Supreme Court of Colorado construed the constitution of that state and continued:

> "There is to be observed no appreciable distinction, under the doctrine of prior appropriation, between a declaration that the water is the property of the public, and that it is the property of the state.
>
> It is said in McCready v. Virginia, 94 U. S. 391, in discussing the subject of tide waters: 'In like manner the states own the tide waters themselves. * * * For this purpose, the state represents its people, and the ownership is that of the people in their united sovereignty. See also Martin v. Waddell, 16 Pet. 410; Gould on Waters, Sec. 32; Bell vs. Gough, 23 N. J. L. 624. The sovereign is trustee for the public.' 3 Kent's Com. 427; Miller v. Mendenhall (Minn.), 8 L. R. A. 89.
>
> The ownership of the state is for the benefit of the public or the people. By either phrase, 'property of the public' or 'property of the state,' the state, as representative of the public or the people, is vested with jurisdiction and control in its sovereign capacity.
>
> * * * There can hardly be any controversy over the power of the state to regulate

prior, as well as subsequent, rights of appropriation. * * *

From any standpoint we think it is clear that the declaration that the waters subject to appropriation for beneficial purposes are the property of the state, is valid and effectual.

The other fundamental principles expressed in the constitution, are, that control of the public waters must be in the state, which in providing for their use shall equally guard all the various interests involved. Such control shall consist in a supervision of the waters, their *appropriation, distribution, and diversion,* by a Board of Control to be composed of certain designated officers, with an officer of technical and practical knowledge and experience at its head; and priority of appropriation shall give the better right."

In closing the opinion he upholds the system of adjudication of priorities by the Board of Control in Wyoming.

Farm Inv. Co. v. Carpenter, 9 Wyo. 110, 135-8, 138-41.

While in *Willey v. Decker,* 11 Wyo. 496, which we shall hereinafter consider, the Court held that as to certain water rights which vested on Young's Creek while Montana and Wyoming were both territories and before either had passed into soverign control of the streams within their respective borders, the Wyoming court might adjudicate rights for the irrigation of lands in Montana, that opinion was specifically limited to a construction of the particular rights there involved and Chief Justice Potter

took pains to there state that the opinion should not be authority as to rights vesting after the admission of either of the states, and by a later decision in *Grover Irr. Co. vs. Lovella Ditch Co.*, (1913) likewise by Chief Justice Potter, it will appear that Wyoming assumes the same attitude of exclusive control over the waters within her borders which has been taken by Colorado, California and other states.

While the latter case involved the question of the right of a Colorado corporation to condemn lands in Wyoming for the upper portion of its ditch diverting waters in Wyoming from Crow Creek, an interstate stream (rising in Wyoming and flowing into Colorado), and carrying the same across the line for use upon lands in Colorado immediately adjacent to the interstate line, the effect nevertheless of the decision which denied to the Colorado corporation the right to condemn lands for its ditch in Wyoming, was equivalent to forbidding the diversion of water in Wyoming for use on lands in another state, notwithstanding the fact that the *res* and parties were both in Wyoming and submitted to the jurisdiction of its courts.

In a very elaborate opinion Chief Justice Potter reviews the law relative to the exercise of eminent domain in one sovereignty for the benefit of property in another and said in part:

> "Eminent domain is generally defined as the right or power of a sovereign state to appropriate private property to particular uses, for the purpose of promoting the general welfare. * * * In this respect the several states are distinct and independent of each other, respectively possessing and exercising the power for their own purposes or their own public welfare. 'The

eminent domain in any sovereignty exists only for its own purposes.' * * *

"The principle above discussed, that the power of eminent domain will be exercised by a state for its own purposes, and not for the use of another state, seems, therefore, to be applicable. Clearly the State of Colorado cannot exercise the power in this state, and any authority conferred by its laws to do so would be void, for it is fundamental that the sovereignty of any government is limited to persons and property within the territority it controls. * * * *

While this state may be interested and even indirectly benefited in the manner above indicated by the reclamation and settlement of lands in another state, it would be difficult, we think, to uphold the exercise of eminent domain in this state on the ground that such reclamation and settlement in another state is a necessity of the government of this state, in view of the fact that within its own boundaries and in all parts of the state there are vast areas yet uncultivated capable of irrigation and reclamation. * * *

Since the purpose is solely to irrigate lands in another state, it is not material that the headgate is to be located but a short distance above the southern boundary line of this state, or that the lands to be irrigated are located just over the line in the adjoining state. It would make no difference in principle if it was proposed to divert the water from some stream in the in-

terior or elsewhere in our state much farther removed from the lands to be irrigated, or if it was proposed to irrigate lands in another state situated at a greater distance beyond our territorial limits."

He concludes by denying the right of eminent domain to the Colorado appropriator so as to make diversion in Wyoming.

Grover Irr. Co. v. Lovella Ditch Co., 21 Wyo. 204, 240, 256, 260.

The irrigation officials of Wyoming, under advice of the Attorney General, likewise refused to permit the diversion of waters in Wyoming for use in other jurisdiction.

In an opinion of January 31, 1916, to the State Engineer of Wyoming, involving an application for a permit to appropriate water in Wyoming to be conveyed across the line for use upon lands in Montana, Attorney General Preston concluded:

"On the assumption that there was no law in Wyoming granting any right, privilege or authority to the State Board of Control to be exercised beyond the jurisdiction of the state, this office has heretofore held that the State Board of Control is without jurisdiction to issue a certificate of appropriation of water for the irrigation of lands without the state.

Your request, like the question of the jurisdiction of the State Board of Control, involves a construction of the state laws relating to the application for a permit to divert and appropriate the waters of the state to be used beyond its borders; and as heretofore construed, I am of the opinion that

the State Engineer of the State of Wyoming has no jurisdiction over an application for a permit to divert and appropriate the water of the state of Wyoming, to be used on land beyond its borders, and that the approval by the State Engineer of the application above referred to would be in excess of his authority. See Walbridge vs. Robinson, 22 Idaho 236."

(e) Summary—Colorado and Wyoming.

It thus appears that each of the states of Colorado and Wyoming have adopted the following fundamental principles of state government:

That the state has full sovereign control and jurisdiction over the waters within its borders and that all such waters are the property of the state to be by it disposed of as it may elect in accordance with its natural conditions and the necessities of its people.

That in permitting usufructuary rights to the citizens of the state, the rule of priority of appropriation to the extent of beneficial use shall control as between such appropriators; and

That the use of the waters of the state, so under its control since its admission to the Union, are exclusively in the state and its citizens and are denied and prohibited to other states or the citizens thereof.

While it might be said that, when the United States admitted Colorado and Wyoming to the Union and recognized and approved the provisions in their constitutions declaring state and public ownership of the waters within their respective boundaries, the United States thereby consented to the said

provisions in their constitutions and the acts of admission amounted to grants from the United States to the states respectively (Farm Investment Co. v. Carpenter, 9 Wyo. 110, *supra*), nevertheless we believe that each of the states of the Union, including Colorado and Wyoming, standing as they do upon an equality one with another, and with all other states of the Union, do not derive their sovereign jurisdiction over the waters within their respective borders by grant from the United States, but rather that such jurisdiction was among the powers reserved by the states and not granted to the United States in the Constitution, either by express terms or necessary implication. (Stockman vs. Leddy, 55 Colo. 24; Kansas vs. Colorado, 206 U. S. 46; United States vs. Hanson, 167 Fed. 881).

The original thirteen states were in all respects independent nations at the time of the formation of the Union and none of them surrendered the waters within their borders or the jurisdiction and control thereof to the United States, save for regulation of navigation, and each of the new states thereafter coming into the Union upon an equality with the original thirteen, likewise reserved unto itself the same jurisdiction and control of the waters within its borders as that retained by the original states.

By either process of reasoning, however, we find in this case two sovereign states of the Union contending as such, over the waters of a stream rising in Colorado and flowing into Wyoming, where it unites with other tributaries of the Laramie River.

Although the controversy is between sovereign states and not between mere individuals claiming private property rights, the rights of the sovereign are the more clearly revealed by brief consideration of the rights of the individual, in order that the con-

trast between the two classes of right may be the better defined.

V. EITHER RIPARIAN OR APPROPRIATION DOCTRINES ARE BUT RULES OF PRIVATE PROPERTY.

We believe that sufficient already appears to justify the conclusion that either the doctrine of riparian rights or the doctrine of appropriation are, at most, rules of law for determining private property rights of citizens of the various states in their uses, under regulation of sovereign power, of the waters of the states according to the natural conditions prevailing in the various portions of the United States and according to the necessities of the various states and the citizens thereof.

As we shall hereafter more at length observe, either rule is one of equality or inequality before the *local* law, of the rights of one particular class of citizens to the utter exclusion of all other classes and that by either rule a certain favored portion of the people are given a right to enjoy the natural resource which is denied to the remainder of the people of the state, subject of course to various modifications of this general principle according to the will of the sovereign, the state, as expressed by its *local* laws, customs and decisions.

While the two rules are fundamentally to be contrasted and in absolute conflict one with the other, yet as the riparian doctrine has been modified and enlarged by the various states where it obtains, to meet local necessities, and the appropriation doctrine has in other states been restricted to meet the local conditions there obtaining, and in still others both rules have been adopted, enlarged and modified to meet local necessities (as in California, Kansas, Nebraska, Oregon, Etc.), we find that after all, they

define but *private property rights* of the citizen under control of the state, the former obtaining at best but a usufructuary right in the property of the latter and that, in the final analysis, the right of the individual must ever yield to the will of the state which if it so wills, may take away the usufructuary right of the citizen by eminent domain and establish an entirely new order of things.

In the light of the reasoning of this and other courts, which we have at length already quoted, it would appear unnecessary to further discuss this phase of the argument, but, out of ample caution, we shall give it limited attention condensing the presentation of authority by quoting from accredited authors to a considerable degree in order to avoid prolonged citation from the numerous decisions of the courts of both England and the United States.

(1) Riparian Rights.

Chancellor Kent thus defines the usufructuary private right of the riparian land owner under the common law:

> "Every proprietor of lands on the banks of a river has naturally an equal right to the use of the water which flows in the stream adjacent to his lands, as it was wont to run (*curre solebat*) without diminution or alteration. No proprietor has a right to use the water, to the prejudice of other proprietors, above or below him, unless he has a prior right to divert it, or a title to some exclusive enjoyment. He has no property in the water itself, but a simple usufruct while it passes along. *Aqua currit et debet currere ut currere solebat* is the language of the law. Though he may use the water while it runs

over his land as an incident to the land, he cannot unreasonably detain it, or give it another direction, and he must return it to its ordinary channel when it leaves his estate."

3 Kent Com., Sec. 439.

It will be noted that Chancellor Kent's definition limits the "equal" right to "every proprietor of lands on the *banks* of a river". Thus while the usufructuary right was "equal" as to the particular class "proprietors of lands on the banks" it was necessarily exclusive as to the remaining lands not so situate by nature. Hence, while the right is frequently termed an "equal" right, it is so only to a limited class of citizens and, as regards all the lands of the state, is an *exclusive* rather than equal right. This distinction will be found throughout the interpretation of the common law.

Blackstone said:

"For water is a movable, wandering thing, and must of necessity continue common by the law of nature; so that I can only have a temporary, transient *usufructuary* property therein."

2 Blackstone Com., p. 18.

Again:

"But, after all, there are some few things, which, notwithstanding the general introduction and continuance of property, must still unavoidably remain in common; being such wherein nothing but an *usufuctuary* property is capable of being had; and, therefore, they belong to the first occupant, during the time he holds possession of them,

and no longer. Such (among others) are the elements of light, air and water; which a man may occupy by means of his windows, his gardens, his mills, and other conveniences; such also, are the generality of those animals which are said to be *ferae naturae*, or of a wild untamable disposition, which any man may seize upon and keep for his own use or pleasure. All these things, so long as they remain in possession, every man has a right to enjoy without disturbance; but if once they escape from his custody, or he voluntarily abandons the use of them, they return to the common stock, and any man else has an equal right to seize and enjoy them afterward."

2 Blackstone Com., p. 14.

Vice Chancellor Bergen in McCarter v. Hudson County Water Co., *supra*, analyzed the law of private property rights under the riparian doctrine and in part said:

"Thus it appears from immemorial times *running water*, as one of the elements of life, health and comfort, has been esteemed common property, subject to *usufructuary* use by the owners of land over which it passed, a use which, by legal construction based upon public needs, has been from time to time enlarged to meet the demands of civilization and preserve the peace of society, but it has never been extended to the point of absolute ownership, to the detriment of a lower landowner. If diverted, it must be returned undiminished, except as to the incidental waste made necessary by the personal private use, for domestic and other

recognized lawful purposes appertaining to the land and its occupant."

While he based his decision upon the grounds, primarily, that New Jersey had the right to insist that the waters of the river should flow to the tide waters, over which she had undoubted control, nevertheless the following language is indicative of the character of the rights of the riparian owners:

> "My opinion is that, subect to the lawful transient rights of riparian owners along the banks of running streams the waters of which finally empty into a tidal stream, there is vested in the sovereign power the right to insist upon the proper riparian user of the waters therein, in order that the common right to the use of the residue, which is not private property, may be preserved for the benefit of those to whom all common property belongs; nor would the grant of every owner of land along the stream, from its source to tidewater, affect the right of the public (for which the state is but another name), for that only can be granted which the grantor hath, which is the transitory *usufructuary use*, subject to which running water is *publicis juris*. As the threatened act is an invasion of a common right, in that it will result in the removal from the state of the common property, it has a right to protest against the proposed increased diversion, and should seek to protect the public estate."

McCarter v. Hudson County Water Co.
70 N. J. Eq. 525, 531, 534.

In the same case on review, Mr. Justice Pitney discussed the nature of right of the riparian owner and found it to be but a private usufructuary estate inferior and in all respects subordinate to the paramount right and title of the state.

McCarter v. Hudson Co. Water Co., 70 N. J. Eq. 695.

Mr. Justice Holmes on review of the case before this Court, likewise treated the rights of riparian owners as mere private usufructuary estates subject to State control, in which he said in part:

> "It sometimes is difficult to fix boundary stones between the private right of property and the police power when, as in the case at bar, we know of few decisions that are very much in point. But it is recognized that the state as *quasi*-sovereign and representative of the interests of the public has a standing in court to protect the atmosphere, the water and the forests within its territority, irrespective of the assent or dissent of the private owners of the land most immediately concerned. *Kansas vs. Colorado*, 185 U. S. 125, 141, 142; S. C., 206 U. S. 46, 99; *Georgia v. Tennessee Copper Co.* 206 U. S. 230, 238. * * It appears to us that few public interests are more obvious, indisputable and independent of particular theory than the interest of the public of a state to maintain the rivers that are wholly within it substantially undiminished, *except by such drafts upon them as the guardian of the public welfare may permit* for the purpose of turning them to a more perfect use. This public interest is omnipresent wherever there is a state, and grows more

pressing as population grows. It is fundamental, and we are of opinion that the *private property* of riparian proprietors cannot be supposed to have deeper roots. Whether it be said that such an interest justifies the cutting down by statute, without compensation, in the exercise of the police power, of what otherwise would be private rights of property, or that apart from statute those rights do not go to the height of what the defendant seeks to do, the result is the same. But we agree with the New Jersey Courts, and think it quite beyond any rational view of riparian rights that an agreement, of no matter what private owners, could sanction the diversion of an important stream outside the boundaries of the state in which it flows. The *private right to appropriate* is subject not only to the rights of lower owners but to the initial limitation that it may not substantially diminish one of the great foundations of *public* welfare and health."

Hudson Co. Water Co. vs. McCarter, 209 U. S. 349, 355.

The mere private, usufructuary property rights of the riparian owner as compared with the paramount and superior right of the state, are learnedly discussed and distinguished by Mr. Justice Peckham in an earlier case, wherein he affirms the rule that the extent of the exercise of the private right is a matter of local law with the several states of the Union.

St. Anthony Falls Water-Power Co. vs. St. Paul Water Comm. 168 U. S. 349.

Mr. Justice Brewer said:

> "It is the settled rule that the question of the title of a riparian owner is one of local law."
>
> Whitaker vs. McBride, 197 U. S. 510, 511.

The late Mr. Kinney in the 2nd Edition on "Irrigation and Water Rights," Part VI, Chapters 21 to 28 incl. Vol. 1, elaborately discussed the common law rule of riparian rights (1) as it prevailed in England, (2) as enlarged under control of the several states of the United States, where adopted, to suit local conditions and necessities, and in some of which it has been so enlarged as to permit use thereof for irrigation, even to the extent of largely consuming the waters of the stream, contrary to the original limited usufructuary right.

Throughout the treatise run the fundamental principles (1) that it is a mere rule of private property and (2) a usufructuary right, applying equally to all owners of lands touching the stream to the exclusion of all others not so situate.

We briefly quote from the two hundred pages of text:

> "The common law rights of riparian proprietors are such as grow out of, or are connected with, their ownership of the banks of the streams and rivers, or other bodies of water. (p. 760.)
>
> In general riparian rights are incident to the ownership of the banks of a stream, or the shores of some other body of water, which the riparian owner possesses exclusively, distinct from the rest of the public, by reason of the fact that his land is so sit-

uated that it touches the waters. All the facilities which the location of his land, with reference to the body of water, affords he has the right to enjoy for the purpose of gain or pleasure, and these oftentimes give property thus situated its chief value. It is evident from the nature of the case that these rights of user and of exclusion are connected with the land itself, grow out of the location, and can not be materially abridged or destroyed without inflicting an injury upon the owner which the law should redress. It seems unnecessary to add the remark that these *riparian rights are not common to the citizens at large*, but exist as incidents to the right of the soil itself adjacent to the water. In other words, according to the uniform doctrine of the best authorities, the foundation of riparian rights, *ex vi termini*, is the ownership of the bank or shore. In such ownership they have their origin. (p. 762.)

'Riparian rights,' according to the strict meaning of the phrase, are such as follow or are connected with the banks of streams or rivers. These rights are a species of property, which belong to the owner of the bank or banks of a stream, and do not depend upon the fact as to whether or not he is the owner of the bed; neither do they depend at all upon the fact as to whether the owner actually uses any of his rights or not, provided he has not lost any of them through grant or prescription.

* * * * * * * *

Unlike the rights acquired to the use of water under the Arid Region doctrine of appropriation, riparian rights require no act upon the part of the owner, with the exception of the acquisition of the land adjoining such waters. These rights, in those jurisdictions where the common law is followed in this respect, are attached to the land itself and are a part and parcel of it. As an incident to such estate they pass by a deed to the land, unless specifically reserved by the grantor. (p. 765.)

One of the most important rights which a landowner has by virtue of his riparian ownership is the right to the *use* of the water as it flows by his land. Although this is a property right, accorded to him by virtue of the natural position of his land upon the stream, as in the case of public waters, this property right is in its nature usufructuary. A riparian owner has no absolute title to the water itself of a stream as it flows by his land. He may, however, have the right to apply it to certain uses.

* * * * * * * * *

All the riparian owners, through or by the side of whose land a stream naturally flows, may enjoy the privilege of using it. * * * The rights of all riparian proprietors upon a stream are equal. * * *

In fact, the water must be so used by any one that no injury will result to the other owners or to any one of the other owners. This is the necessary result of the perfect equality of right among all of the proprietors. (p. 769.)

> The riparian owners also have some duty to the public. While the rights of the riparian owners can not be destroyed by the public without just compensation, *they are always subordinate to the public rights*, and the state has the power to regulate their exercise in the interest of the public." (p. 771)

Of modification and enlargement of riparian rights to meet local necessities, especially in the Pacifi Coast States (not the states of the Rocky Mountain Region), he said:

> "In some of the States and Territories of the Western portion of this country, riparian rights as defined by the common law have been entirely abolished; we will add that in others they have been modified to a great extent, and in still others they exist with but few modifications as they are interpreted by the Courts of England and the Eastern States. We have also shown in previous sections, that although irrigation of the soil under certain circumstances was perhaps allowed under the strict application of the common law theories, it was so restricted by certain rules and restraints placed upon its practicable workings that these theories unmodified were found to be wholly inapplicable to irrigation as it is known and applied in the "Great Arid West." In that part of the country, in order to make the soil productive, there must be an application of the waters of the streams upon it. In order to apply it to the soil there must be an actual diversion from the natural stream; and, owing to the porous soil, the hot sun, and dry atmosphere,

a certain loss or diminution in quantity must necessarily follow as a result of its application and use for irrigation. Hence, in all of the states and territories in the arid West, even in those where the common law theories are most strongly applied to riparian rights, there has been a modification of these theories to this extent, that a riparian proprietor may take water from the stream and may make a reasonable use of it for purposes of irrigation. It is considered in the Pacific states that irrigation must be held in that climate to be a proper mode of using water by a riparian proprietor and the lawful extent of the use depends upon the circumstances of each particular case. In other words, the right of a riparian proprietor to irrigate his lands, to the extent that it is permitted under the Western American doctrine of riparian rights, is a great modification and extension of that doctrine as defined by the later English and Eastern American authorities." (p. 873.)

Of the exclusion of one class of land owner (non-riparian) for the benefit of the preferred class (riparian) he in part said:

"As we have seen, riparian rights of all kinds depend upon the ownership of the banks of the streams or other bodies of water. The lands for which they are claimed must touch upon the water. Hence it follows that one who is not a riparian owner can not use the water of a stream for irrigation as a riparian right. His claim would lack the essential element—ownership

of the bank of the stream. No person can take water from a stream, under the common law right, for the purpose of irrigating his tract of land which is separated from the stream by intervening lands belonging to other riparian proprietors. * * *

A riparian proprietor has no right to irrigate non-riparian land, by virtue of his title to other lands which touch upon the water of a stream and therefore are themselves riparian. Whatever may be his right to a reasonable use of the water of the stream to irrigate his riparian land, he has no right to conduct any of the water to irrigate other lands not riparian. In this respect the common law as it is enforced in England and in the Eastern States is in accord with the Western American Doctrine.

* * * * * * * * * *

As we have seen in previous sections, it is by a strained construction of the common law upon the subject that irrigation is permitted to the extent that it is practised in the Western states, as a riparian right." (p. 898.)

Kinney on Irrigation and Water Rights, (2nd Ed.) Ch. 21 to 28 incl.

Mr. Wiel, in the 3rd Edition of his "Water Rights in the Western States," devotes Part IV, as well as previous portions, to an elaborate discussion of riparian rights. Such rights are there defined as merely usufructuary and private property for the benefit of one class of land owners (equal among themselves) to the exclusion of all other landowners. He in part says:

"While the law does not regard the liquid itself as property while flowing naturally, any more than the air, it recognizes nevertheless, a very substantial right in its flow and use; the rights to have the liquid flow and to use and take of it; which the law calls *usufructuary right*, or 'the water-right.' * * * And says Story: 'But, strictly speaking, he has no property in the water itself, but a simple use of it while it passes along.' And Kent: 'He has no property in the water itself but a simple usufruct as it passes along.' In a Nebraska case it is said: 'The law does not recognize a riparian property right in the *corpus* of the water. The riparian proprietor does not own the water. He has the right only to enjoy the advantage of a reasonable use of the stream as it flows by his land, subject to a like right belonging to all other riparian proprietors.'" (p. 754.)

Of the exclusion of non-riparian owners for the benefit of the limited class (riparian owners):

"Having alone the accecss, the riparian proprietors alone have the right to take of the water. * * * All but riparian proprietors were thus shut out from the stream, * * * The law of riparian rights grows out of this exclusion of non-riparian owners because they have no access to the water.

Lawful access was given by the ownership of riparian land, and being so given, was equally afforded to all the riparian owners. Since all have an equal right to access. They all consequently have the same and

equal right to take and use the water." (p. 759.)

And further:

"Unlike an appropriation, riparian rights need no act of the owner to acquire them, they attach to the land bordering on the stream of their own accord. The riparian right is a privilege that is part and parcel of the riparian land that gives the access to the water; the right of access and all that follows from it being an inseparable result from ownership of the land like the right of support for the land. The riparian right is inherent in the riparian land and part and parcel of it; an inherent result of the relative position of the land to the stream as a natural resource. * * * The right is 'an *incorporeal* hereditament appertaining to the free hold.'

* * * *The riparian right, like the right by appropriation, is solely usufructuary,* * * * The right is to a flow and use merely, * * *

This usufruct is perpetually annexed to the riparian land whether availed of by irrigation or other works or not at all; just as the right of the landowner to build a house on the land remains though no house is ever actually built." (p. 777-81.)

After devoting Chapters 31 and 32 to the application of the rule according to the local necessities of various states, he devotes Chap. 33 to limitation of use between riparian owners, saying:

"Speaking generally, non-riparian owners are *excluded entirely* from rights in

> the stream, and riparian owners are given rights only for use on their own riparian land; they also cannot take the water to non-riparian land, whether it be their own or someone else's. * * * The limitation to riparian land arises, first, by the *exclusion* of non-riparian owners because their lands have no access to the water; second, because he who has access (the riparian proprietor) can excuse the damage (which any taking may cause to the land of other riparian proprietors) only on the ground of reasonable use of his own land." (p. 832.)

Without further citation, we trust sufficient appears to justify the conclusion that the riparian doctrine is but a rule of private usufructuary right to the use by the citizen of waters of a sovereign state, subject at all times, as all other property of individuals, to the regulation and control of the state and varying in the states of the Union where adopted, according to local law as local conditions and necessities require in order that the state may obtain the greatest good from her natural resources.

(2) Rights by Appropriation.

Rights by appropriation in the order of priority are directly antagonistic to riparian rights. The one is based on the title to the banks with incidental uses of the water, and the other on use of the water upon any lands (riparian or non-riparian) irrespective of location and the claims of other appropriators junior in point of time. Yet, as we shall observe priority by appropriation is, like the riparian doctrine, but a rule of private property of individuals under like control of the sovereign state, and such

are likewise but usufructuary rights in the public property (the water).

To cite authorities would appear needless for *the very basis of all rights by appropriation is beneficial use.* The rule is well expressed in Sec. 8 of the National Reclamation Act:

> "Beneficial use shall be the basis, the measure and the limit of the right"

and *all rights* by appropriation must, therefore, of necessity be *usufructuary.*

But, inasmuch as the character of such a right is, after all, largely the question here involved, we pause to briefly consider the source and character of this property right, and to first determine its fundamental principles and its place among the mere private property rights of individuals, before proceeding to a discussion of whether or not this rule of the law of private property may be applied to a determination of the sovereign rights of states.

Rights by priority of appropriation are as exclusive in their nature (but in a different manner) as are rights under the riparian doctrine. Under the latter, we have observed, the waters are limited to the one class of land owners (the bank owners) to the exclusion of the rest of the citizens of the state (owners of non-riparian lands) while under the rule of appropriation, the right of the first taker to the use of the water of the stream, to the extent of his beneficial use and upon lands whereever situate, is exclusive of the rights of all others who may wish the water, with the limitation that the first taker must apply the water within a reasonable time, must not divert more than his necessities actually require and must not enlarge his demands on

the stream to the depletion of the supply of his juniors. But, if the first appropriator's necessities actually so require he may take all the water of the stream to the exclusion of all others.

(See Sup. Brief Wyoming, pp. 134-140. The right of the prior appropriator is exclusive).

Both these general rules of exclusive use (riparian and appropriation) are after all but usufructuary in their nature, are but rules of private property of the citizen and are regulated, controlled, modified, abolished or re-established by the state according to the local conditions and necessities and at the will of the sovereign power. As stated by Mr. Justice Brewer in *United States vs. Rio Grande Irr. Co.*, (174 U. S. 690, 702):

> "While this is undoubted, and the rule obtains in those states in the Union which have simply adopted the common law, it is also true that as to every stream within its dominion a state may change this common law rule and permit the appropriation of the flowing waters for such purposes as it deems wise."

And by the same learned Justice in *Kansas vs. Colorado* (206 U. S. 46, 94):

> "It may determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid region of the West of the appropriation of waters for the purposes of irrigation shall control. Congress cannot enforce either rule upon any state."

Mr. Wiel, in the 3rd edition of "Water Rights in the Western States" classes rights to the use of

water under either doctrine as mere rules of private property, usufructuary in character, and under state control:

> "The law of watercourses is a law of streams as natural resources. The water running therein unrestrained is the property of no one, but a portion of it taken out of the stream and confined in the possession of an individual becomes the taker's private property, belonging to him while under his posession and control; and the law of watercourses is a development of the rules under which one may thus take of the water and make it his own. There is a large body of law specifying *who* may avail themselves of this privilege and to what limitations they are subject, forming in the common law, 'the law of riparian rights,' and in the West, 'the law of prior appropriation.' (p. 1).
>
> The result of these authorities is that the *corpus* of naturally *running water*—the water in the natural resource—was classed in the Institutes and civil-law writers with the air, and those things which cannot be owned while in their natural state and condition, or as they have been called, the 'negative community.' * * * However, as an outgrowth of this variation of the idea of the 'negative community'—the change from 'common' to 'public'—there is quite generally today a tendency to substitute the positive expression that running water belongs to the state in trust for the people or the public, in analogy to a similar change in the way of stating the law regarding wild game, and the law of the beds of navigable waters.
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> * * * * * * * * *

In nearly all now of the Western states this change of expression is, by statute, introduced regarding running water. All waters within the state are declared to be 'the property of the public' (or to 'belong to the public'). * * * there are also declarations that waters are 'the property of the state.' * * * however, there is no substantial difference in the two forms of expression (that is, whether common or public; *res communes* or *publici juris*; the property of no one or the property of the state in trust for the people). *So far as they concern the private rights of individuals, whether under the law of appropriation or the common law of riparian rights,* both are founded on the ancient view taken by the law that running water unrestrained in its natural course belongs to the 'negative community.' (p. 4-13).

While the *corpus* of naturally running water is thus in the negative community and not the subject of private ownership (or 'belongs to the public'), the law recognizes nevertheless a very substantial right in its flow and use,—the right to have the liquid flow and to use it, which the law calls usufructuary right,' or the 'water right.' The law of watercourses consists of the rules governing this right of flow and use of the natural resource." (p. 14).

After discussing the authorities on the usufructuary character of riparian rights he continues:

"*The right of an appropriator under the western law of prior appropriation is*

governed by the same principle. Nothing is more firmly settled in the West than the rule that an appropriator can have no ownership in the water, as such, in the natural stream above head of canal or ditch, and that his right is solely one to have the stream water flow to his ditch so that it may be used.

This principle of a *private* right in the *use* of the natural resource as distinguished from the substance itself is taken from the law of 'usufruct' in the Institutes, and is well recognized today. This usufructuary right, or 'water-right' is the substantial right with regard to flowing waters; is the right which is almost invariably the subject matter over which irrigation or water power or similar contracts are made and litigation arises; and is real property. *It is as fundamental under the law of riparian rights as under the law of appropriation.* Under the latter the right of use lasts only while in actual application. Under the former the *right* of use is perpetual whether actually excercised or not; it is perpetualy annexed as a privilege to the riparian freehold, to be put into actual exercise whenever its owner will, or not at all, but none the less a mere right of use, present or future, including no ownership of any drop of the water while it continues flowing naturally. * * *

The law of watercourses under whatever system (whether appropriation or riparian rights), borrowing from the civil law, is but a development of the exercise of the *usufructuary* right, and of the severance in pursuance of it, of a portion of the water from the natural stream. (p. 19).

A *water-right is a usufruct in the stream*, the natural resource, consisting in the right to have the water flow so that some portion of it (which portion the law limits in various ways under the system of prior appropriation or the system of riparian rights) may be reduced to possession and made the private property of an individual.

* * * * * * * * * *

The nature of the right of ownership existing in naturally running water is that of having it flow, of using it, and of taking it into possession by diverting it into artificial structures, ditches, reservoirs, cisterns, barrels, canals, pipes, and the like, thereby making private property of a part of it, during the time it is held in possession and control." (p. 22).

After discussing the temporary character of property in water severed from the stream:

"The value of the foregoing lies in showing that the *corpus* of water in the stream itself, as a substance, is not the subject of property (is in the 'negative community' or 'belongs to the public'), and that one may have only the strictly usufructuary right to the flow and use of the stream. * * controversies must, as a rule, be decided with regard to the flow and use of the natural water supply, and not its *corpus*; for the usufruct of the natural resource (and not the water itself) is alone of practical importance.

This is having much influence in the West under the law of appropriation, *which*

forcefully denies that a water user has any ownership in the water of the stream, from which he diverts (that 'belongs to the public'), but only a right to continuance of supply from the natural resource during the beneficial use. Under the common law of riparian rights the principle is as true—a riparian owner also has no ownership of the water of the stream to which his land is riparian. He also has only a right of continuance of supply, though this right of a riparian owner differs from the law of appropriation, in that it is confined to periods of use, but is perpetually reserved to his land,—a perpetual right to have the supply from the natural resource continued for future possible use whether now used or not." (p. 45.)

Of the elements of law of prior appropriation by way of introduction:

"In the law of watercourses the rules governing the usufruct in natural streams form the bulk of the law. The law of watercourses is a law of natural resources. We shall deal with this body of law under two systems prevailing in the Western states; first, the system of prior appropriation (the system of priorities), which gives unequal rights in streams according to the relative times of beginning use; second, the common law of riparian rights (the system of correlative rights), which gives equal rights to all riparian proprietors without regard to the relative times of beginning use." (p. 287).

He then quotes Blackstone B. II, Ch. 25, on the rule of common law, and says:

> "The right of an appropriator is likewise only usufructuary. Although for shortness' sake, the appropriator is spoken of as the owner of the water, yet there is no property in the water itself nor in the channel of the stream conferred by the appropriation; the appropriator owns only a right to have the *flow and use* of the stream, which is called his 'water-right.' The stream water itself is in the 'negative community,' the property of no one; or, by the recent Water Code form of expression, 'belongs to the public' or to the 'state in trust for the people.' " (p. 289.)

And further:

> "As opposed to the correlative rights of the common law, whereby all riparian owners on the stream have equal rights, under the law of appropriation the rights of the claimants are unequal. Each has an exclusive right to the extent of his prior appropriation, and appropriations vary greatly in the extent of right appropriated. 'A party appropriating water has the *sole and exclusive* right to use the same for the purpose for which it was appropriated.' So long as the water is put to a beneficial use, priority alone governs. Full protection is given to the prior appropriator against all later comers. * * *
>
> The right to exclusive use carries with it such right to exclusive flow as is necessary to preserve the appropriator's use

without damage to his use; but is not violated by any act that does not interfere with his use of the water. The right to the flow is subordinate to the right of use, and cannot exceed it." (p. 291.)

Of the extent to which an appropriator may divert the stream:

"If for a beneficial purpose, one may hence appropriate a *whole* stream. An appropriation is limited to beneficial use, but may absorb a whole stream to that end. 'Under such doctrine the first appropriator may appropriate the entire flow of a stream, if used in proper irrigation. Also, *a non-riparian owner may appropriate and get an exclusive right to the whole water of a stream for non-riparian lands.*' Another says: 'Beyond question, under our laws (Idaho), a party may be protected in the use of all the water he actually appropriates and uses, even if it be every drop that flows in as great a river as the Snake.'

In times of natural or other deficiency, also, unless otherwise provided by statute, the prior appropriator may still claim his full amount; the loss must fall on the later appropriators." (p. 311).

The late Mr. Kinney in Vol. 1 of the 2nd edition of his work on "Irrigation and Water Rights" treats the title of the appropriator as a usufructuary right of private property under the sovereign control of the state:

"We have seen in previous sections that, in this country it is within the power of

a state to declare whether the ownership of the soil under its waters shall remain in the state, or shall vest in the riparian owners.

* * * * * * * * *

In this chapter we shall attempt to show that the common law in many of the Western states has been modified by a declaration either in their respective constitutions or by legislative enactment, to the effect that the waters within such respective jurisdictions are 'the property of the state' or 'the property of the public.' Respecting the declaration that the waters are 'the property of the state' or 'the property of the public,' the Courts hold that these two terms are synonymous. As was said by the Court: 'There is to be derived no appreciable distinction, under the doctrine of prior appropriation, between a declaration that the water is the property of the public and that it is the property of the state.' What is really meant by the above expressions is that the running water is *publici juris*, or open to the people of the respective states for appropriation for beneficial uses or purposes. As was said in a Wyoming case: 'Under the rule permitting the acquisition of rights by appropriation the waters become, perforce, '*publici juris.*' " (p. 632.)

Of causes leading to dedication of water to the state with usufructuary titles (beneficial uses) in the individual, he said:

"Owing to the climatic conditions, the search for gold, and the exceeding fertility of the soil, settlers were attracted to these

arid regions, and the use of the water by diverting it from its natural channels and applying it to some beneficial purpose continued. When the population of certain sections had increased to such an extent as to make it practicable, territorial governments were formed, including certain portions of this region, and these were followed by state governments. * * * In a number of these states, in the constitutions themselves, there was a provision made dedicating all the waters within the state to the public, or to the state. * * * By this doctrine it is seen that the title to the use of the water is in the public, or the state, *which in turn, under its regulative or police powers, may prescribe by legislative enactment the details as to how an individual or corporation may acquire the right to the use of a portion of the water.*

* * * Coming down to the rights of the appropriator, in a jurisdiction where there has been an absolute dedication of its waters either to the public, as is the case in Colorado, or to the state, as is the case in Wyoming, it is held that the appropriator secures a right of use, which has been held, with good reason, to amount to a property right, and not a title to the running water itself, except, it may be, to such quantity as shall from time to time be lawfully diverted into his own ditches. *The title to the water of the appropriator fastens, not upon the water while flowing along its natural channel, but upon the use of a limited amount thereof for beneficial purposes* in pursuance

to an appropriation lawfully made and continued. The appropriation is made upon the basis that the public or *state is the owner* of the waters, and is protected, instead of impaired, by the constitutional dedication." (p. 635).

Of the effect of state regulation of private usufructuary rights to water and variation of the laws among the states:

"It will be noticed that in the dedication to the state, or public, the constitutions and statutes of the respective states, quoted in the preceding sections, vary greatly in the terms used. * * * some follow in certain features the California dedication, and others Colorado and Wyoming, while still others take positions somewhere between, depending largely as to whether or not it was the object to abolish the common law or riparian rights.

As we have seen, *it is left to each state to adopt whatever rule it sees fit relative to the use and control of the waters within its jurisdiction*, so long as the rights of the government are in no way impaired. And, as there was no general rule or guide upon the subject which a state was bound to follow, each state has adopted a rule of its own. In fact, *there are no two states where the laws are the same.* Some states may follow California in their main features, others may follow Colorado, but it will be discovered that each state has independent features of its own; and hence it follows that no state has a rule which in all of its features

will apply to any other state. The different grants in the dedications of the waters, of course, give different rights to the use of those waters, either by the public or by individuals. And these dedications, either being in the constitutions or by positive legislative enactment, are the fundamental laws upon the subject, and they themselves being different, have led to the enactment of different laws and different systems in various states. There are, however, many features in common, which will be discussed in the subsequent portions of this work. But to speak of the California rule or doctrine, or the Colorado rule or doctrine, is incorrect, unless the expression is used in the popular sense, except as the same may apply to the particular states of California or Colorado themselves, as each state has a rule or doctrine of its own. There is, however, the doctrine of state control or the state administration of waters, which is based upon the dedication of the waters within a state, either to the state itself or to the public, and has been adopted by many of the Western states. *But even the laws of state control differ greatly in the different states. Different rights are granted, different methods of the appropriation of water provided for, and entirely different powers given to the state officers who administer the law upon the subject.*" (p. 654).

He thus defined the doctrine of appropriation:

"The Arid Region Doctrine of appropriation may be defined as that doctrine or

> rule of law which has grown up in this Western portion of our country, governing the use of the water of the natural streams and other bodies, by its appropriation for any *uesful or beneficial purpose*, based upon the physical necessities of the case; and, whereby for the purpose of applying the water to some *beneficial use*, the water must be diverted from its natural channels, and, in contradistinction to the strict construction of the common law of riparian rights, the place of use may be on either riparian or non-riparian lands, and the right based upon priority." (p. 1009.)

After discussing the reason for the rule to be the "imperative necessities" of the western states, and the variations in the rule as adopted or only partially adopted in each thereof, he continued:

> "The control as a sovereign, of the waters within the boundaries of a state is left entirely to the state itself. Each state has the power either by legislative enactment, or by court decision, to adopt such a rule governing the waters flowing or standing therein, as it sees fit. A state may adopt the common law of riparian rights only, as has been done in the Eastern states. And, in this connection it may limit and define the rights of riparian owners in and to the waters of such streams and to the soil lying under the same. A state may also adopt a modified form of riparian rights allowing a more extensive use of the waters of streams, especially for irrigation, than was allowed under the strict rule of the common law. This has been done in California,

and some of the other Western common law states.

Again, a state may entirely abrogate the common law of riparian rights, and adopt in lieu thereof the Arid Region Doctrine of Appropriation, as defined in this chapter, and as enforced, as set forth in the following chapters of this part.

And, still again, a state may retain the common law of riparian rights, and at the same time adopt the Arid Region Doctrine of Appropriation, and thus have the dual systems of laws governing waters, within its jurisdiction.

As far as the United States Government is concerned by those various Acts of Congress, fully discussed in future portions of this work, it has waived its rights as sovereign in and to the government and control of the waters flowing or standing within the boundaries of any state, and has conferred the jurisdiction of such waters upon such state. * * *

It has also become the settled rule of law of the Federal courts that such courts will adhere to the rule that *each state has the right to adopt such law or laws,* as it sees fit governing and controlling the waters and the use thereof within its boundaries, and that the Federal courts will follow in their decisions the rule or rules so adopted by such jurisdiction. This is true whether that rule of law is adopted by such state by statutory enactment, or by decisions of its highest court. In other words, such state may

decide for itself, as to the applicability or inapplicability of the common law rule as applied to the physical conditions of such State; and, if such rule is determined to be inapplicable, the state, in lieu thereof, may adopt such other rule as it sees fit governing the entire subject of waters and their uses within its boundaries." (p. 1025).

A "water right" is thus defined:

"A water right, acquired under the Arid Region Doctrine of appropriation, may be defined as the *exclusive*, independent property right to the *use* of water appropriated according to law from any natural stream, based upon possession and the right continued only so long as the water is actually applied to some beneficial use or purpose; it is an incorporeal hereditament, so far as it includes the right to have the water flow over the lands of others down to the head of the appropriator's ditch; but the water is a corporeal hereditament after it has been once taken into the ditch or reservoir of the appropriator and is in his actual possession for the purpose of application to his uses." (p. 1313).

The water right is exclusive:

"In our definition of the term "water right" under the doctrine of appropriation, we said that it was an exclusive right. This is one of the most important distinctions between the right to the use of the water of natural streams under the common law of riparian rights and under the doctrine of appropriation. Under the common law the

right to the use of the water by one individual depends upon the equal or correlative rights to its use by all of the riparian owners upon the same stream." (but of course is exclusive to one class as against another class of citizens). "In this dry and arid country, where the water is exceedingly scarce and there is not enough for all, instead of following the common-law rule as to its use, or 'parceling it out generally and making it practically valueless to any,' in the early days of the settlement of this portion of the country, there was adopted the only rule founded in equity that could be rightfully adopted in the premises, based upon priority of the appropriation. He who first appropriated a certain amount of water from a natural stream should be rewarded for his industry and enterprise by the right to the use of the water to the full amount of his appropriation as long as he applied the same to some beneficial use or purpose, and to the exclusion of all others where they interferred with his right. * * * an appropriator has the several and exclusive right to the use of the water included within the extent of his appropriation." (p. 1314.)

The usufructuary right is governed by state laws:

"One of the essential elements of a water right is that the water upon which it is based must have been appropriated *according to the law of the states where the* appropriation is made. * * * If there is a statute or a water code in the state

where the appropriation is attempted, its provisions must be strictly complied with in order to secure the benefits allowed under it." (p. 1316).

The right is a mere possessory right:

"a water right in early times was considered and was merely a possessory right. And today a water right is but a possessory right. Upon the other hand, statutes have been enacted whereby the owner of a mining claim having but a possessory right thereto can secure an absolute title in fee to the same. There is no law whereby a possessory owner of a water right can secure an absolute title in fee to his right. The title to a water right has never been 'elevated to the dignity of a fee.' And, furthermore, the right is but a conditional possessory right; the possessory right depending upon the condition that all of the water claimed under the right is continually applied to some beneficial use or purpose. With the failure to comply with the condition of use for a certain time the right terminates, and it is either deemed abandoned, or forfeited under a statute, as the case may be. This is as it should be. If the law were otherwise, and if a person could secure the absolute title in fee to a water right, calling for a definite amount of water flowing in a certain stream, and then continue to own and hold the same, and that, too, whether he applied the water to any beneficial use or purpose or not, and thereby prevent others from using the water, it

> would subvert and overturn the whole system of the doctrine of appropriation as it is in force today. It is true that a water right has acquired the dignity of real property, but real property is owned and held by many kinds of title, the one highest in degree being an absoulte title in fee simple. If the law remains as it is no one can hope to secure an absolute title in fee simple to a water right, but he may, as long as he complies with the condition of applying the water claimed to some beneficial use or purpose, acquire an exclusive possessory right." (p. 1317).

and is conditional on *continuous use*:

> "Not only must there be an actual application of the water to some beneficial use or purpose * * * before the possessory title to the water right is acquired, but the continuation of the right is also conditioned upon the continuous use of the water. In other words, *the right is merely usufructuary*, and the right to the water lasts so long as it is in actual use and occupation, but no longer. The property in the water escapes and is out of his possession, and another man may appropriate it to his own use. The same is true also as to the water right itself * * * if the water claimed under the right is not used for a period of time sufficient to work an abandonment or forfeiture, the right ceases in the original appropriator, and the water claimed by him under it may be appropriated by others. But as long as the first appropriator holds possession of the right by the use

of the water claimed under it his possessory title is good, and exclusive in himself, as against all later comers, and the water right arises to the dignity of a distinct, exclusive usufructuary estate." (p. 1319).

May irrigate lands irrespective of location:

"Contrary to the rule of riparian rights at common law, where the right to the use of the water is dependent upon the ownership of the land adjoining which or through which the stream flows, *a water right based upon the doctrine of appropriation in the Western states does not depend upon the legal title, nor, in fact, upon any title to or the possession of lands* on the streams or other bodies of water, or elsewhere. But a water right is simply an exclusive possessory right, acquired by the diversion of the waters of a stream in a lawful manner, and the application to some beneficial use or purpose. * * * A valid appropriation may be made for the irrigation of lands, or for any other beneficial use, not situated upon or near the stream from which the water is taken. The very object of the appropriation may be to conduct the water from the stream through a ditch or canal, across the intervening lands, to irrigate a tract of land which the appropriator possesses far from the natural stream. * * * In other words, the *universal rule* is that a water right, or the right to the use of the water, under the doctrine of appropriation, is not in any way dependent upon the *locus* of its application to the beneficial use designed." (p. 1323).

It is a property right:

> "The distinct, exclusive, usufructuary estate acquired by an appropriator to the use of water, by its lawful appropriation, is property of the highest order, and oftentimes of the highest value." (p. 1326).

It is an incorporeal hereditament:

> "A water right is descendible by inheritance; and, being neither tangible nor visible, it is an incorporeal hereditament." (p. 1333).

And the first appropriator may take all the water of the stream:

> "the first appropriator on a certain stream is entitled, by virtue of his prior right, to the use and enjoyment of the water to the full extent of his original appropriation, even when this includes all of the water of the stream, and this right continues so long as he applies all of the water appropriated to some beneficial use or purpose. * * *
>
> The appropriator can not exceed the amount of water covered by his appropriation and thus cut out the rights of others." (p. 1357 and many cases cited).

And the usufructuary property right may be taken under eminent domain for other and preferred public uses.

> (Chapter 55, pp. 1900-1976 incl.)
>
> Kinney on Irrigation & Water Rights, 2nd Ed. Vols. I and II at pages above cited.

We have quoted copiously from the above authors to avoid elaborate citation to the numerous decisions of the courts, which will be found in the foot notes to the various portions of the text quoted, and all of which announce and affirm the principles above set forth.

Both Colorado and Wyoming recognize the usufructuary right of the appropriator as a private property right in the waters held by the state in its sovereign capacity.

The late Justice King thus tersely defined a water right under the Colorado law:

> "In determining this question we have to consider the peculiar nature of the property designated a 'water-right,' and the title thereto, as distinguished from land. This 'right is said to be intangible and incorporeal.' The ultimate title or ownership of the water of the natural streams of this state is, by the constitution, vested in the public, but dedicated to the use of the people, subject to appropriation. * * * The right is usufructuary. There is no property in the corpus of the water so long as flowing naturally. There is no property in the channel of the stream, and the water-right is distinct from the right to the ditch, canal or other structure in which the water is conveyed. The original right and title is secured by apropriation."
>
> Monte Vista Canal Co. vs. Centennial Irr. D. Co., 22 Colo. App. 364, 368.
>
> See Art. XVI, Sec 5, Colorado Constitution (*supra*).

Wyoming, by statute, thus defines the usufructuary private property right of the appropriator and its relation to the sovereign right of the state:

> "A water right is *a right to use the water of the state*, when such use has been acquired by the beneficial application of water under the laws of the state relating thereto, and in conformity with the rules and regulations dependent thereon. Beneficial use shall be the basis, the measure and limit of the right to use water at all times, not exceeding in any case, the staututory limit of volume. *Water being always the property of the state*, rights to its use shall attach to the land for irigation, or to such purpose or object for which acquired in accordance with the beneficial use made and for which the right receives public recognition, under the law and administration provided thereby."
>
> Wyo. Comp. Stat. (1910) Ch. 58, Sec. 724, p. 247.
>
> See Wyo. Const. Art. VIII, Sec. 1 to 5 incl. *supra*.
>
> Farm Inv. Co. vs. Carpenter, 9 Wyo. 110.

Without further citation of authorities, we think sufficient appears to define the character of the property rights of the water user under both the riparian and appropriation doctrines.

Rights acquired under either system are usufructuary private property interests of the individual citizens (the land owner or appropriator) under the control of the state and at all times inferior and subordinate to the greater, the sovereign right of

the state. Such rights being mere private propetry, the law thereof is law of private property and cannot be taken as defining the greater rights of the states within which such private usufructuary rights of citizens are acquired, enjoyed, regulated and controlled, or by which such private rights may be taken away at any time under the power of eminent domain. Their interpretation involves consideration of their relations to one another or to the sovereign state under which they are acquired and enjoyed, or by which they may be taken away, and rules which the state may fix for regulation of these private property rights of its citizens cannot have extra-territorial force, either in behalf of or against the state but are purely local law and subject to change or repeal.

Story Confl. Laws, Ch. 2, pp. 19-34;
Pennoyer vs. Neff, 95 U. S. 714, 720-22.

And this local private law is recognized and applied *within* the respective states by the Federal as well as the local courts.

Hardin vs. Jordan, 140, U. S. 371.
Whittaker vs. McBride, 197 U. S. 510.
Boquillas Cattle Co. vs. Curtis, 213 U. S. 339.

Of the effect of attempting to apply this local law to controversies between sovereign states, in no two of which the rules and laws are identical, we shall treat at length in the next portion of this brief.

VI. PRINCIPLES OF PRIOR APPROPRIATION CANNOT APPLY WITHOUT REGARD TO STATE BOUNDARIES.

We now come to a discussion of the vital question involved and thus stated in the order for reargument:

> "Whether the rights asserted are to be tested and determined solely by the application of the principles of prior appropriation, without regard to state boundaries, or whether, on the contrary, the general principles of prior appropriation are subject to be restricted or their operation limited in this case by state lines."

All that has been previously stated herein, is, after all, but preliminary and a premise to the discussion to follow.

In the foregoing portion of the brief we have, under separate subdivisions, treated of the fundamental rules of law involved in the following manner.

At the outset we observed that this case is not one between property owners in different states, each claiming under the law of his respective commonwealth, but rather a controversy between two sovereign states, each asserting and standing upon its extreme rights, and necessarily inclusive not alone of the property owners but as well of all the citizens of each state thereof, and involving states of equal magnitude in the Union and their future as well as their present welfare. (Pages 11 to 16.)

We next considered the law of independent nations, as regards their jurisdiction over the citizens and also the waters and all natural resources thereof, and observed that each independent nation has full, absolute and exclusive jurisdiction over all such within her boundaries. (Pages 16 to 21.)

We then observed that each of the original thirteen states was, at the time of the formation of the Union, a free and independent nation; that upon the adoption of the Constitution and thereafter,

each of such original states continued to retain all of the attributes, powers and jurisdiction of independent nations, save for those powers voluntarily surrendered to the United States by the Constitution, and that as such continuing free and independent states (in so far as here to be considered), each retained all its original powers and jurisdiction over all the waters within its boundaries, save as voluntarily surrendered to the United States for regulation of navigation. (Pages 21 to 25.)

Each new state admitted into the Union is possessed of all the powers and jurisdiction over the waters within its borders "no greater and no less" than possessed by the original thirteen states. (Pages 26 to 30.)

We then devoted many pages of this brief to a discussion and review principally of the decisions of this court, from the earliest times in our national history down to the present year, wherein we found that, with one accord, the same independent and exclusive jurisdiction over waters was recognized in the new states as had always obtained, even before the Constitution, in the original thirteen states(save for federal control of navigation); that exclusive jurisdiction extended over all such waters for navigation (with paramount control in Congress when asserted), fisheries (those that swim or those which grow upon the beds of waters), power, municipal supply, rights of and use by bank owners, irrigation (both for riparian and non-riparian lands), and for all other uses and purposes beneficial alike to the state and its citizens; that in the exercise of this power and jurisdiction, the local laws and regulations, varying necessarily in every state, have been controlled by and founded upon local conditions and necessities; and that in construing or applying the

laws governing any controversy, the United States and its courts have always followed and applied the local law of the state within which the controversy arose. Also that no powers were delegated to Congress to establish or determine laws or rules for control of waters within either the old or the new states and that even when legislating with reference to the public lands Congress has refrained from attempting to establish any laws which might embarrass the new states or infringe upon their powers and has specifically left all jurisdiction and control over waters to the states and territories. (Pages 30 to 118.)

We quoted the Acts of Congress relative to waters on public lands, and the decisions construing the same, all recognizing the inherent sovereign jurisdiction of the states. (Pages 119 to 148.)

The Constitutions, laws and decisions of both Colorado and Wyoming were cited and reviewed and we there found that each state had not only made full claim of state title, power and jurisdiction to all the waters within its boundaries (which claim had been ratified, approved and enacted as law by Congress in the Enabling acts), but, also, that each state had forbidden the use and benefit of its waters to neighboring states or the citizens thereof. (Pages 148 to 175.)

And lastly we fully discussed the doctrine of riparian rights as well as that of prior appropriation and the application and construction thereof in the several states and in Colorado and Wyoming, and there observed that both are but rules of local, private law obtaining in different degrees, either alone or in combination, in different states of the Union (in no two of which is the application of either doctrine

identical), for determining the property rights, interests and titles of citizens of the respective states, to a mere *usufructuary* property in water, in their relations with one another on the one hand and with the state on the other. Also that each of the rules is one of exclusion of one class of citizens of the state for the benefit of another limited class thereof and that both are, in truth, rules of inequality from the standpoint of the state as a whole and are but private, usufructuary property law and not in any sense rules of public, interstate or international law. (Pages 175 to 215.)

We have considered at length these various phases of the law of waters and the jurisdiction of the states in order that we may the more intelligently express our views upon the question now presented, believing that by so doing we may make plain the reason for the rules for which we contend, which otherwise might stand as mere conclusions without adequate reason or premise.

(1) RULES OF PRIVATE PROPERTY INAPPLICABLE TO CONTROVERSIES BETWEEN STATES.

With all due respect to the learned presentation of rules of the law of private usufructuary property, by counsel for Wyoming, which they contend should govern in controversies between states (not individuals), we cannot concur in their conclusions either in the ultimate rule to be applied between states or that the authorities which they cite are applicable to controversies between states, where the individual citizen and his property becomes merged into and disappears from view within the greater rights of the sovereign, the state, including not alone him and his private property interests, but as well all the people and all the property and natural re-

sources (private and public), within the boundaries of the commonwealth; and concerning not so much the past and the present, as the future of the state and its people; beside which greater rights the citizen and his limited usufructuary property sink into insignificance. And we contend that rules which, for the present, might apply between one water user and his neighbor, or even him and his state, are wholly inadequate to procure for his state and a neighboring state, a just settlement and adjustment of the rights of each to the enjoyment unimpaired of their natural resources not alone for the present but as well for all future time.

We respectfully contend that the rule of priority of appropriation (a mere rule of private usufructuary right) cannot apply in the settlement of controversies between sovereign states over the waters of rivers common to both.

States have rights irrespective of and greater than the usufructuary rights of private owners, in their natural resources of which, all agree, water is one of the most and, in the arid states, the most valuable. A controversy of this nature rises therefore above a controversy between private property owners in neighboring states and must be treated upon those broader principles which apply between nations regardless, in large measure, of the private property rights of the citizens of either. As well sail by this court in the opinion by Mr. Justice Holmes in *Georgia vs. Tennessee Copper Co.*, notwithstanding vigorous dissent:

> "The case has been argued largely as if it were one between two private parties; but it is not. The very elements that would be relied upon in a suit between fellow-citi-

zens as a ground for equitable relief are wanting here. The state owns very little of the territory alleged to be affected, and the damage to it capable of estimate in money, possibly at least, is small. This is a suit by a state for an injury to it in its capacity of quasi-sovereign. In that capacity the state has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air. It might have to pay individuals before it could utter that word, but with it remains the final power. The alleged damage to the state as a private owner is merely a makeweight, and we may lay on one side the dispute as to whether the destruction of forests has led to the gullying of its roads. * * *

Some peculiarities necessarily mark a suit of this kind. If the state has a case at all, it is somewhat more certainly entitled to specific relief than a private party might be. It is not lightly to be required to give up quisi-sovereign rights for pay; and, apart from the difficulty of valuing such rights in money, if that be its choice it may insist that an infraction of them shall be stopped.

The states, by entering the Union, did not sink to the position of private owners, subject to one system of private law. This court has not quite the same freedom to balance the harm that will be done by an injunction against that of which the plaintiff

complains, that it would have in deciding between two subjects of a single political power. * * *

It is a fair and reasonable demand on the part of a sovereign that the air over its territory should not be polluted on a great scale by sulphurous acid gas, that the forests on its mountains, be they better or worse, and whatever domestic destruction they have suffered, should not be further destroyed or threatened by the act of persons beyond its control, that the crops and orchards on its hills should not be endangered from the same source. If any such demand is to be enforced this must be notwithstanding the hesitation that we might feel if the suit were between private parties, and the doubt whether, for the injuries which they might be suffering to their property, they should not be left to an action at law.* * *

Whether Georgia, by insisting upon this claim, is doing more harm than good to her own citizens, is for her to determine. The possible disaster to those outside the state must be accepted as a consequence of her standing upon her extreme rights."

Georgia vs. Tennessee Copper Co., 206 U. S. 230, 237.

This is a case even stronger than the foregoing. Here not only is one state (Wyoming), "Standing upon her extreme rights," but Colorado likewise asserts "it is the right of the defendant commonwealth to dispose of the waters of that portion of said stream" (the Laramie River), "lying within

the State of Colorado, without let or hinderance by the complainant or its citizens; and defendant avers that the *defendant commonwealth can so dispose of the waters of said stream regardless of the prejudice that it may work to the complainant or its citizens within the State of Wyoming, and need give no reason for its will.*"

Answer of State of Colo. Par. 1, Vol. 1, p. 31 of Record.

As well observed by Mr. Justice Brewer in *Kansas vs. Colorado,* where, as here, there were several defendant Colorado corporations:

> "While several of the defendant corporations have answered, it is unnecessary to specially consider their defenses, for, if the action against Colorado fails, it fails also as against them."
>
> Kansas vs. Colorado, 206 U. S. 46, 85.

Here the rights of the private citizens (or local corporations) of the plaintiff state on the one hand or those of citizens of Colorado on the other hand, sink into comparative insignificance and are included within the greater right of the states, and likewise, rules of local law in either Wyoming or Colorado, whereby the relative rights of the citizens of either (priority of appropriation with differing methods of acquisition, administration and enforcement) are determined, degulated and protected, have no place in determining the rights of the states for "the state has an interest independent of and behind the title of its its citizens, in *all* the earth and air within its damain" (Georgia vs. Tennessee Copper Co., *supra*).

In *Kansas vs. Colorado,* Mr. Justice Brewer further points out the essential difference between the private property rights of the citizen (in that case riparian rights), and the greater rights of the state in the following language:

> "It is the State of Kansas which involves the action of this court, charging that through the action of Colorado a large portion of its territory is threatened with disaster. In this respect it is in no manner evading the provisions of the Eleventh Amendment to the Federal Constitution. *It is not acting directly and solely for the benefit of any individual citizen to protect his riparian rights. Beyond its property rights it has an interest as a state in this large tract of land bordering on the Arkansas River.* Its prosperity affects the general welfare of the state. *The controversy rises, therfore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint.*" (Georgia vs. Tennessee Copper Co. 206 U. S. 230).
>
> Kansas vs. Colorado, 206 U. S. 46, 99.

We have previously observed that riparian rights (likewise rights by appropriation), are but private property rights of individuals within the greater right of the sovereign—the state. We further observed that Colorado, by her constitution and the decisions of her courts and statutes, had always stood upon her extreme rights to the fullest degree and had denied the right of the use of her waters to citizens of other states under rules of appropriation or otherwise (S. L. 1917, p. 539; Stockman vs. Leddy, 55 Colo. 24, 28).

New Jersey took the same position in 1905 (P. L. 1905, p. 461; 70 N. J. Eq. 698), and denied the right of her citizens or others to withdraw the waters from her domain, under theory of private property therein by riparian rights or otherwise. Her assertion of her full power was questioned by those who assumed to act under authority of contracts with riparian owners, some of which were executed before and some after the enactment of the prohibitory statute (see 70 N. J. Eq. 526), but her right to preserve her natural resources, irrespective of the assent or dissent of the private rights of her citizens was upheld by her courts (70 N. J. Eq. 525; Id. 695). Her action and decree having been brought before this court for review, her action was upheld and in the opinion by Mr. Justice Holmes it is said:

> "The courts below assumed or decided and we shall assume that the defendant represents the rights of a riparian proprietor, and on the other hand, that it represents no special chartered powers that give it greater rights than those. * * * But we prefer to put the authority which cannot be denied to the state upon a broader ground than that which was emphasized below, since in our opinion it is independent of the more or less attenuated residuum of title that the state may be said to possess.
>
> All rights tend to declare themselves absolute to their logical extreme. Yet all in fact are limited by the neighborhood of principles of policy which are other than those on which the particular right is founded, and which become strong enough to hold their own when a certain point is reached.

The limits set to property by other public interests present themselves as a branch of what is called the police power of the state. The boundary at which the conflicting interests balance cannot be determined by any general formula in advance, but points in the line, or helping to establish it, are fixed by decisions that this or that concrete case falls on the nearer or farther side. * * *

It sometimes is difficult to fix boundary stones between the private right of property and the police power when, as in the case at bar, we know of few decisions that are very much in point. But it is recognized that the state as quaisi-sovereign and representative of the interests of the public has a standing in court to protect the atmosphere, the water and the forests within its territory, irrespective of the assent or dissent of the private owners of the land most immediately concerned. *Kansas vs. Colorado*, 185 U. S. 125, 141, 142; S. C., 206 U. S. 46, 99; *Georgia vs. Tennessee Copper Co.*, 206 U. S. 230, 238. What it may protect by suit in this court from interference in the name of property outside of the state's jurisdiction, one would think that it could protect by statute from interference in the same name within. On this principle of public interest and the police power, and not merely as the inheritor of a royal prerogative, the state may make laws for the preservation of game, which seems a stronger case. (*Geer vs. Connecticut*, 161 U. S. 519, 534).

* * * But we agree with the New Jersey courts, and think it quite beyond any rational view of riparian rights that an agreement, of no matter what private owners, could sanction the diversion of an important stream outside the boundaries of the state in which it flows. The private right to appropriate is subject not only to the rights of lower owners, but to the initial limitation that it may not substantially diminish one of the great foundations of public welfare and health.

We are of opinion, further, that the constitutional power of the state to insist that its natural advantages shall remain unimpaired by its citizens is not dependent upon any nice estimate of the extent of present use or speculation as to future needs. The legal conception of the necessary is apt to be confined to somewhat rudimentary wants, and there are benefits from a great river that might escape a lawyer's view. But the state is not required to submit even to an aesthetic analysis. Any analysis may be inadequate. *It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will.*"

Hudson Water Co. vs. McCarter, 209 U. S. 349, 354-7.

While, as observed in a previous portion of this brief, Mr. Justice Holmes premised his remarks with "The problems of irrigation have no place here" (p. 356), nevertheless the sovereign jurisdiction of New Jersey over the waters within her borders would appear to be no greater and no less than that

of any other state of the Union admitted on an equality "in all respects whatever," and the rights there affected (riparian rights), were after all mere usufructuary titles of the same and no greater or less dignity than are the usufructuary rights of the prior appropriator (See previous discussion this brief, pages 175 to 214.)

Kinney on Irrigation and Water Rights (2nd Ed), p. 2225.

Walbridge vs. Robinson, 22 Idaho, 240.

Biennial Rep. Atty. Genl. Wyo. (1915-16), p. 75.

That private property rights of individuals in waters of interstate streams (by appropriation or common law) cannot determine the rights of the states in controversies one with another is clearly discussed by Mr. Justice Holmes in *Richey Land & Cattle Co. vs. Miller & Lux*, involving private rights of water users in Nevada (where the appropriation doctrine obtains) and users in California (where both the common law of riparian rights and rights by appropriation are recognized). He there likened the usufructuary rights of water users to parcels of land:

> "When a right is asserted in favor of land in one jurisdiction over land in another, different principles are involved from those that suffice when both parcels are subject to the same law. When such rights have been recognized it has been on the ground of an assumed 'concurrence between the two states, the one, so to speak, offering the right, the other permitting it to be accepted. *Manville Co. vs. Worcester*, 138 Massachusetts, 89.' *Missouri vs. Illi-*

nois, 200 U. S. 496, 521. But still there are two parcels of land subject to different systems of law; and although the rights and liabilities in respect of each may require a consideration of the other if they are to be dealt with completely, the fact remains that each may be regulated by the state where the land lies according to its sovereign will. *Kansas vs. Colorado*, 206 U. S. 46, 93. If then the courts of one state are about to deal with one parcel they should not be indirectly interfered with by a foreign court that has no power to control the use of the *res*. It is said to be a general principle that apart from some privity, such as is created by contract, trust, or fraud, courts of equity recognize the impropriety of using their power over the person to achieve such a result. *Northern Indiana R. R. Co. vs. Michigan Central R. R. Co.*, 15 How. 233, 242-244; *Carpenter vs. Strange*, 141 U. S. 87; *Norris vs. Chambers*, 29 Beav. 246, 253, 254; S. C., 3 De G., F. & J., 583, 584. It is conceivable, to be sure, that the decisions of this court may determine that the states have rights as against each other *in invitum* in streams that flow through the land of both. *Kansas vs. Colorado*, 206 U. S. 46, 84; *Missouri vs. Illinois*, 200 U. S. 496, 519, 520. These rights may vary according to the system of law required by natural conditions. * * * But whatever this court may decide, *if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his state, and*

those rights, the petitioner insists, can, or at least should, be determined only in a suit *brought by the state itself.*"

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, 260, 261.

The above decision was announced Nov. 7, 1910. Evidently having in mind, *inter alia*, this decision and the rule there discussed of "concurrence between the two states, the one, so to speak, offering the right, the other permitting it to be accepted," and that the relation of the right within the two jurisdictions "depends as well upon the permission of the laws of Nevada as upon the compulsion of the laws of California" and "the acts necessary to enforce it must be done in California and require the assent of that state" etc., and further the language "if California recognizes *private rights* that cross the border line"—the California legislature in the next session, and immediately following this decision, passed an act almost identical in its terms with the New Jersey act construed by this court in Hudson Water Co. vs. McCarter, *supra*, absolutely prohibiting the diversion of its waters for use in other states, denying the recognition of rights that cross the border line of the states and negativing the presumption of one state offering and the other accepting the right.

L. Cal. 1911, Chap. 104, p. 271 (Approved March 3, 1911).

That rights of appropriators are but private rights and cannot prevail in a suit such as this (between states) is further recognized by this court in *Bean vs. Morris*, wherein Mr. Justice Holmes said:

"We pass at once to the question of private water rights as between users in different states.

We know no reason to doubt, and we assume, that, subject to such rights as the lower state might be decided by this court to have, and to vested private rights, if any, protected by the Constitution, the State of Montana has full legislative power over Sage Creek while it flows within that state. Kansas vs. Colorado, 206 U. S. 46, 93-95. Therefore, subject to the same qualifications, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. Missouri vs. Illinois, 200 U. S. 496, 521; Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, 260. But with regard to such rights as came into question in the older states, we believe that it always was assumed, in the absence of legislation to the contrary, that the states were willing to ignore boundaries, and allowed the same rights to be acquired from outside the state that could be acquired from within."

Manville Co. vs. Worcester, 13 Mass. 89, and several other cases are then cited and after observing that the doctrine of appropriation prevailed in both Montana and Wyoming before either were admitted to the Union and that the presumption is that the same system still pervailed, "save as necessarily implied or expressed" he closes the discussion of private rights of individuals in different states, as follows:

"It follows from what we have said that it is unnecessary to consider what limits there may be to the powers of an upper state, if it should seek to do all that it could. The grounds upon which such limits would stand are referred to in Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, 261. So it is unnecessary to consider whether Morris is not protected by the Constitution; for it seems superfluous to fall back upon the citadel until some attack drives him to that retreat."

Bean vs. Morris, 221 U. S. 485, 486, 488.

We pause to observe, that in this case (one between states and not private property owners) each state seeks "to do all that it could." One state asserts its full claims, these the other denies and in turn sets up full claim and says "it need give no reason for its will." It accordingly appears that any advantage to be gained by Wyoming from the language of this decision is swept aside by the character of this suit, where the rights must be determined under rules above announced as prevailing between states, not individuals.

And here again we note that Colorado since admission to the Union, by her constitution, the decisions of her courts and her statutes has steadfastly refused to recognize any rights, of individuals or states, without her borders.

Colo. Const. Art. XVI, Sec. 5.
Lamson vs. Vailes, 27 Colo. 201.
Stockman vs. Leddy, 55 Colo. 24.
S. L. Colo. 1917, Chap. 151, p. 539.
Kansas vs. Colo. 206 U. S. 46.

In the foregoing decision this court observes:

"So it is unnecessary to consider whether Morris is not protected by the Constitution" (p. 488) referring, as we are advised, to the claim that this right had vested before admission of Montana to the Union with full sovereign powers of a state. We wish to note that in the pending case Wyoming does not and canot make any such claim by reason of the fact that according to her evidence, with exception of one small appropriation, *no use whatever* had been made of the waters of the Laramie River *prior to the admission of Colorado to the Union, Aug. 1, 1876.* Substantially all of the Wyoming development has occurred subsequent to that date, and a large part subsequent to the Coloardo project here complained of. (See Def. Orig. Brief, Vol. II, p. 228).

Decree Dist. Ct. Laramie Co., Pl. Ex. N; also, Supp. Brief of Wyoming, p. 24.

It is therefore unnecessary to consider what difference, if any, would exist if Wyoming could claim constitutional protection of rights which had vested before Aug. 1, 1876, and the field is cleared of any claim of private rights under the Constitution and simplified to an issue of rights between sovereign states.

Even were we to assume, for argument's sake, that Colorado had not (since 1876) expressly denied recognition of all extra-territorial claims upon the streams rising and flowing within her borders, the fact still remains that there is no concurrence of laws upon which to base a claim of presumption of interstate servitudes between individual citizens of the two states, for, while both Wyoming and Colorado have fundamentally adopted the doctrine of ap-

propriation for determination of private usufructuary rights *within their respective borders,* yet even by constitutional provisions, as well as by statutes and court decisions, there is irreconcilable conflict, both in the preference of uses one over another, the extent to which a right attaches at all, the limit or lack of limit of the use within any one class, the means and method of initiating the right as well as the subsequent fixing and determination of the same, to omit from discussion the many conflicting rules and methods of distribution. The most that can be said is that both assert full state ownership and control over the waters within their borders and abolish riparian rights as a rule or basis of usufructuary private rights. Beyond this point the systems diverge. But we need not further consider this topic for no concurrence of laws is recognized by either state, even as to private property rights. (See *supra,* pages 149 to 175.)

We shall treat further of this subject in the pages to follow but for the moment shall consider the authorities cited by counsel for Wyoming dealing with this phase of the question.

(a) Plaintiff's Authorities—Not in Point.

Plaintiff in its supplemental brief, pp. 153-156, cites a number of authorities upon the "Effect of state lines upon right of Appropriators," and state: "The question of the effect of state lines upon the rights of appropriators in different states has been before the courts of the arid region in a number of states and so far as we have been able to find has always been decided in the same way. The universal holding is that priority of appropriation gives priority of right on interstate streams the same as on

streams wholly within one state." (Pltff. Supp. Brief p. 153).

The statement of plaintiff's position reveals its fundamental weakness. This action is one *between the sovereign states* of Wyoming and Colorado, each asserting its fullest sovereign claims to the waters of the Laramie river, and *not between mere individual citizens* of the respective states who claim appropriations under the laws of their states. Here we cannot presume a recognition of interstate servitudes because they are expressly denied by both states.

Plaintiff cites the cases of *Hoge vs. Eaton,* 135 Fed. 411, 414; *Taylor vs. Hulett,* 15 Ida. 265; *Conant vs. Deep Creek & Co.,* 23 Utah, 627; *Willey v. Decker,* 11 Wyo. 496, 533; *Howell vs. Johnson,* 89 Fed. 556; *Anderson vs. Bassman,* 140 Fed. 14; *Morris vs. Bean,* 123 Fed. 618; Id. 146 Fed. 423; *Bean vs. Morris,* 159 Fed. 651, 655; *Rickey Land & Cattle Co. vs. Miller & Lux,* 152 Fed. 11, 17; Id. 218 U. S. 258; *Bean vs. Morris,* 221 U. S. 485; and 3 Kinney on Irrigation (2nd Ed.) p. 2216 and relies upon these cases as authority for the statement above quoted and evidently intends that they shall be considered as authority for the rule that priority irrespective of state lines shall control sovereign states, and as determining the rights of the states in their sovereign capacity to the jurisdiction of the waters within their borders.

None of these cases are in point in this suit. Whatever the rights of the individual appropriators within each of the states may be, undoubtedly the states themselves have certain sovereign rights and powers irrespective of the private property rights of the citizens of either and in this suit, which is brought by Wyoming in her sovereign capacity against Colorado in its sovereign capacity, it is apparent that decisions dealing with the private prop-

erty rights of the citizens of each of the respective states can have no bearing in the settlement of this controversy which involves the greater rights of the states themselves. Whatever rights the citizens may possess are undoubtedly included within the greater right of the state and must stand or fall, not upon the private property right, but upon the greater right of the state.

Georgia vs. Tennessee Copper Co., 209 U. S. 230, 237;
Kansas v. Colorado, 206 U. S. 46, 99;
Hudson Water Co. v. McCarter, 209 U. S. 349, 356.

Brief comment upon these cases cited by counsel is sufficient.

Hoge v. Eaton, (135 Fed. 411) involved a controversy between two private appropriators from Sand Creek, an interstate stream of Colorado and Wyoming. Neither of the states were parties to the suit. Whatever language Judge Hallett used therein is therefore at best a *dictum.* The case was decided before the decision in Kansas v. Colorado, *supra,* which overrules the language quoted in plaintiff's brief. In *Kansas vs. Colorado,* the government of the United States cited the case of *Hoge vs. Eaton,* and quoted the language here quoted by plaintiff in their brief, in support of the contention that Colorado does not exercise soverign jurisdiction over the waters within its borders (Brief of U. S. on Final Hearing, page 191-3). It was in reply to the government's contention for national control of streams under the rule of prior appropriation irrespective of state lines that this Court, by Mr. Justice Brewer, made answer:

> "But it is useless to pursue this inquiry further in this direction. It is enough for the purposes of this case that each state has full jurisdiction over the lands within its borders, including the beds of streams and their waters * * * It may determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid regions of the West of the appropriation of waters for purposes of irrigation shall control."
>
> Kansas v. Colorado, 206 U. S. 46, 93-4.

Taylor vs. Hulett, (15 Ida. 265); *Conant vs. Deep Creek & Co.* (23 Utah 627); and *Willey vs. Decker*, (11 Wyo. 496); were decisions of state Courts involving the determination of appropriations in one state for use in another where the court had jurisdiction of both the person and property and where neither state had then denied interstate servitudes. The Idaho and Utah cases proceeded upon the theory of comity between states as defined in Carpenter v. Strange, 141 U. S. 105. The Idaho Court pointed out however that it must act upon the person and not the property which might be situated in a different jurisdiction. In neither of these cases were the rights of the state in any way involved.

In the case of *Willey vs. Decker* (*supra*) it is specifically pointed out that the rights of individuals there in question had vested before either state was admitted to the Union and the Court was careful to say "We are not called upon in the case at bar to decide whether such an apropriation as the plaintiff's * * * rely on can be lawfully made in this state under our constitution and present statutes; and we shall express no opinion on that matter", and the

doctrines were applied upon the particular facts of the case:

> "In the absence of contrary constitutional or statutory provisions".
>
> Willey v. Decker, 11 Wyo. 496, 511, 531.

We have already noted that the Wyoming Court in a recent case has practically reversed its decision in *Willey vs. Decker,* by denying, even where it had jurisdiction of both the property and the person, the right of eminent domain for construction of a ditch to head in Wyoming and irrigate lands in Colorado, thereby preventing the diversion in Wyoming for use in Colorado, upon a stream common to both.

> Grover Irr. Co. v. Lovella Ditch Co., 21 Wyo. 204, 240, 256;
>
> See also Biennial Rep. Atty. Gen'l., Wyoming (1915-16), p. 75.

The cases of *Howell vs. Johnson* (89 Fed. 556.) and *Anderson vs. Bassman,* (140 Fed. 14) were *between private parties* and the *states* wherein the various appropriations obtained under local law *were in no manner involved.* Both these cases were cited and urged as authority for the doctrine of priority irrespective of state lines by the United States in its brief in the case of *Kansas vs. Colorado* (Brief of U. S. on Final Hearing, 153, 178, 191) and the ruling of this Court, above quoted, was the answer to the contention here made.

It is interesting to note however, that in *Anderson vs. Bassman* the waters were not apportioned on the rule of appropriation irrespective of state laws:

> "The right of each is to have a reasonable apportionment of the water of the stream during the season of the year when

> it is scarce * * * the only method that appears to provide a just and equitable division is some fair and appropriate division in time by which the complainants and defendants shall have the use of the water alternately during the dry season."
>
> Anderson v. Bassman, 140 Fed. 14, 29.

Morris vs. Bean, (123 Fed. 618); Id. (146 Fed. 423); and *Bean vs. Morris* (159 Fed. 651) have been considered by this Court in *Bean vs. Morris,* 221 U. S. 485, wherein Mr. Justice Holmes said:

> "We know no reason to doubt, and we assume, that, subject to such rights as the lower state may be decided by this Court to have and to vested private rights, if any, protected by the constitution, the state of Montana has full legislative power over Sage Creek while it flows within that state."
>
> Bean v. Morris, 221 U. S. 485, 486.

In the above cases the private property rights of individuals were alone involved and in neither thereof were the states made parties. There was no showing of express denial by Constitution, laws or Court decisions (as is here the case) of refusal to recognize extra-territorial rights.

Rickey Land & Cattle Co. vs. Miller & Lux (152 Fed. 11) was reviewed by this Court in 218 U. S. 258. In as much as counsel quotes the language of this Court pointing out that in such a suit as was there presented, the rights of the state, as such, were not involved, and what such rights would be if properly asserted, we shall make no further quotation, and the same might have been said of the decision in the case of *Bean vs. Morris,* 221 U. S. 485, quoted on Page 162-3 of the brief of counsel.

Counsel also cites *Farm Investment Co. vs. Carpenter,* (9 Wyo. 110) but we are unable to concur with the conclusion that the decision in that case is authority for their contention. On the contrary that decision is authority against plaintiff:

> "we entertain no doubt of the power of the people in their organic law, when existing vested rights are not unconstitutionally interferred with, to declare the waters of all natural streams, and other natural bodies of water, to be the property of the public, or of the state. Nor do we doubt that the legislature may make a like declaration, when, in that particular, unrestrained by the constitution.
>
> If any consent of the general government was primarily requisite to the inception of the rule of prior appropriation, that consent is to be found in several enactments by Congress.
>
> The title of the appropriator fastens, not upon the water while flowing along its natural channel, but to the use of a limited amount thereof for beneficial purposes, in pursuance of an appropriation lawfully made and continued. The appropriation is made, in the first place, upon the basis of public ownership of the water, and is protected instead of impaired by the constitutional declaration."
>
> Farm Investment Co. v. Carpenter, 9 Wyo. 110, 137, 139.

The citation from Kinney on Irrigation, Vol. 3, Sec. 1225, is of little avail for the reason that it is but a summary of the law announced in the decisions

cited by counsel,—all of which, as already noted, do not relate to the rights of the states themselves. A reference to the author's foot note, however, calls attention to two cases holding contrary to the language quoted.

In *Lamson v. Vailes*, Chief Justice Campbell announced a doctrine in direct contrast to that announced in the cases cited by counsel for plaintiff. He denied to New Mexico the benefit of the laws of Colorado relative to adjudication of priorities. He said, in part:

> "We cannot presume that the general assembly intended to enact a law to operate beyond the territorial limits of the state. The distinction sought to be made by appellants, that the point of diversion of the ditch is the sole factor determining the jurisdiction of the Court, is not good. * * * It is not to be supposed that the state was legislating for the reclamation, or irrigation, of lands beyond its boundaries, or making provisions by the way of police regulations (which we have held these statutes, in some measure, to be) over a territory beyond its jurisdiction."
>
> Lamson v. Vailes, 27 Colo. 201, 203.

In *Turley v. Furnam*, (N. M.) Justice McFie adopted the doctrine announced by Chief Justice Campbell in *Lamson v. Vailes*, holding that New Mexico had no jurisdiction to determine the rights of an appropriator whose diversion occurred in Colorado for irrigation of lands in New Mexico.

> Turley v. Furnam, 16 N. M. 253, 262.

(b) Conclusion.

Stripped to the fundamental, it is the natural resource, the river and its waters, which we must here consider, irrespective of such usufructuary rights as the state may from time to time permit to its citizens. When the state entered the union, the river and its waters were a part of the domain set apart for its future growth and development. The few years that have since elapsed are but an instant as compared with the perpetuity of the commonwealth. The state now requires the use of its natural resources and it is to be presumed that the need will increase in the future and must be satisfied in so far as geographical conditions and physical obstacles shall permit. The waters of its streams are the most valued resources of the state. To them even more than to its lands, it must look for its future development, prosperity and general welfare. Any rights to the use of the waters which the state may have granted its citizens in the past, or may in the future permit them to acquire, are at best but temporary. Whatever rules it may have announced for the regulation, control and limitation of these rights are but of present not future importance. The possessory right in the stream had its origin in use and the right terminates whenever the individual ceases to make the use. The usufructuary right of the citizen is ever subject to the uncertainties and vicissitudes of human affairs while the title of the state is the same in the end as it was when it was admitted to the union. Whatever usufructuary rights the state may have permitted in its waters may be by it resumed, by exercise of its sovereign power of eminent domain, whenever it may so decree and it may resume to itself its first and former estate for disposal

and use according to its sovereign will and in such manner as shall best be adapted to its growing necessities, irrespective of the wishes or claims of the individual appropriator. Whatever right the state may now grant to the citizen it may at any time take away but the natural resource it may keep and "give no one a reason for its will." The individual and his usufructuary rights may vest today only to be abandoned or condemned tomorrow to give way to other uses demanded by new necessities. For while individuals may come and go the state and its jurisdiction are as enduring as the stream itself and to paraphrase the thought of the poet:—"Men may come and men may go, but the state goes on forever."

> "But the words of the Constitution would be a narrow ground upon which to construct and apply to the relation between states the same system of municipal law in all its details that would be applied by the individuals".
>
> Missouri v. Illinois, 206 U. S. 496, 520.

It would thus appear that laws of the usufruct in waters of the stream, by the individual in his relations to other users or his state, under whatever doctrine recognized (riparian or appropriation) have no place in the interpretation of laws which determine the rights of the state to not only use but keep its natural resource, the waters of its streams. The temporary claims of the individual do not rise above those of his state, and, it would appear, should not control the destiny of his commonwealth in its relation with other states.

(2) APPROPRIATION DOCTRINE VIOLATES EQUAL RIGHTS OF STATES.

In our previous discussion of the doctrine of priority of appropriations we observed that, like the rule of riparian rights, it is exclusive in its character, and the appropriator, if his needs so require, may take the entire flow of the stream.

(See pp. 190 to 214.)

In this conclusion counsel for Wyoming concur.

Sup. Brief of Plaintiff, pp. 134-140.

We observed that, under the doctrine of riparian rights, while the usufructuary rights of the riparian owners were in all respects equal, i. e., that each had an equal right to use the waters of the stream touched by his lands, nevertheless, as regards the property of all the citizens of the state, the doctrine is exclusive in that it grants to one class the sole use of the waters of the stream, by reason of accident of physical location of the riparian or bank lands, to the utter exclusion and denial of benefits to all other lands (nonriparian). In fact, a more wasteful monopoly in waters could hardly be conceived than that granted this favored class, who are thus privileged to utterly deny the greater body of the lands of the state all use of the waters of the stream while the favored few, whose lands happen to touch the stream, use the same as it flows along to finally waste into the sea. Hence, while the rights of riparian owners are equal one with another in their common use of the stream, they are, as a class, unequal and exclusive as regards the remainder of the lands of the state.

So, too, are private usufructuary rights by ap-

propriation exclusive and unequal. The first appropriator may take the waters of the stream to the extent of his necesary uses, with the qualifications that he must not enlarge his demands on the stream after the rights of juniors have attached, who are entitled to have the conditions remain as they were when they went upon the stream (Vogel v. Minnesota Canal Co. 47 Colo. 534, 541). If his actual, established needs so require, the first appropriator may take the entire flow of the stream to the exclusion of all juniors as well as all riparian and non-riparian owners. But the rule, though most exclusive, has the saving feature that no water goes wasting to the sea, and, as the rights of the first appropriator are limited fundamentally to beneficial use, none may be needlessly wasted, for if he has no actual need for the water he has no right to divert it and it must pass to juniors requiring its use.

While these characteristics of the two doctrines for acquisition and regulation of private usufructuary rights, are the established rules, with local modifications, in the various states of the union, it is apparent that either of them is fundamentally inapplicable to the regulation of rights between states, each of which stands upon an equality with each of the others "in all respects whatever", to the same degree as independent nations are to be regarded as equal in dignity and sovereign power.

Each state depends for its existence primarily upon its natural resources and that too irrespective of the rights or property interests of its citizens.

Missouri v. Illinois, 180 U. S. 208, Id. 200 U. S. 258.
Kansas v. Colorado, 206 U. S. 46.
Georgia v. Tennessee Copper Co., 206 U. S. 230.
Hudson County Water Co. v. McCarter 209 U. S. 341.

Water is one of the great natural resources of every state and in the arid states is frequently the most valuable. Upon the water, the state and her people must depend for all time for life, health and prosperity, and, if deprived of this natural resource, must ultimately perish. Self defense compels the state to withhold its resources for the benefit of future as well as present generations and for the welfare and perpetuity of the state.

> "It finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will".
>
> Hudson County Water Co. v. McCarter (*supra*).

With independent nations, these natural resources, if need require, must be defended by the sword. But with states of the union this Court must determine the controversy.

> Kansas v. Colorado, 185 U. S. 125; 206 U. S. 46.
> Missouri v. Illinois, 180 U. S. 208; 200 U. S. 258.

Turning now to an application of either of these rules of private local law to settlement of state con-

troversies over interstate streams we find that either exclusive rule cannot apply, and in particular is this true of the doctrine of appropriation, the more exclusive.

(a) Laramie River—Illustration

By way of illustration we shall first apply the rules to the river here involved:

The Laramie river rises in part in Colorado and in part in Wyoming. The branch in Colorado rises in high mountains and flows down through a narrow valley into Wyoming. Soon after reaching that state it enters a wide plains area, the Laramie Plains. The riparian or "bank" lands in Colorado are limited to the narrow mountain valley, while in Wyoming they extend from the river for miles upon either side. Out on the eastern plains of Colorado however are great areas of arid but fertile lands needing but the benefit of her mountain waters to bring them into the same high state of productivity already attained upon adjacent irrigated areas.

If the rule of riparian rights were to control the settlement of this controversy, Colorado would be forever deprived of but the most insignificant use of her own waters, her greatest natural resource, and her fertile but arid lands would remain forever unproductive, by reason of the fact that only the lands of the narrow mountain valleys in Colorado are riparian, and these waters, imperative to her present and future development and welfare, would pass forever into Wyoming there to be used, enjoyed or wasted or to pass to the sea. The exclusive rule, forbidding use on non-riparian lands, for the benefit of the favored class (riparian lands), would prevent the use by Colorado of her most valuable resource while at the same time would give it to her neighbor upon

which to fatten at the expense of the former. If such were the situation between independent nations, Colorado would seize such portion of water as she could and, if forced to that extreme, would defend her right so to do by the sword. Further argument would seem unnecessary to demonstrate that the riparian doctrine of private (and equal yet exclusive) usufructuary rights cannot apply between states or nations however ancient its origin may be.

With equal force, the doctrine of prior appropriation cannot apply between these states, with equal rights and powers to enjoy and control their own natural resources throughout all future time.

While in this case the forces of nature have so shaped the Laramie river valley that, do what she may, Colorado can never take more than a 91-250 portion of the water rising within her own borders and must permit the remainder, for all time, to pass to her neighbor, Wyoming, to use, waste or pass to the sea; yet, for the purpose of this illustration, we shall assume that the physical conditions were such that both the waters of the Colorado Laramie and those rising in Wyoming could be diverted within the latter state at the mouth of the Little Laramie and carried thence into Colorado. Further, that long prior to any development in Wyoming, this interstate canal had been constructed and all the waters so diverted in Wyoming, but rising in both states, had been conveyed into Colorado and there used upon her lands. Under the rule of priority of appropriation such right would have been exclusive and Colorado could forever prevent Wyoming from the use not only of the Colorado waters but as well of the waters rising and flowing in Wyoming (her valuable natural resource) and thereby Wyoming would be doomed, as to this

river, to total aridity while Colorado would wax rich at the expense of her neighbor. We venture to say that, were the states independent nations, the exclusive claim of the first appropriator in such a case would be refused recognition in any court for the settlement of international controversies and that Colorado would be limited to the use of her own waters and forbidden those of Wyoming. Colorado could not thus impose an extra-territorial servitude upon Wyoming without her consent, and the right of Wyoming to deny any such claims, had not surrender been made in the Constitution, might well be enforced by her armies in defense of herself and her natural resource.

The exclusive rule of appropriation is open to other similar objections.

(b) Destiny of State Left to Accident.

Location and construction of canals and diversion works are frequently the result of natural conditions. Such works are usually first constructed where no natural obstacles interfere.

On the other hand it requires the accumulated force of years and the massing of wealth, sometimes of generations, to overcome the great natural barriers which frequently obstruct the progress of development but whose ultimate removal is imperative in order that the desert places may be converted into fields and gardens, and the people of the state and the nation may obtain sustenance.

Infant nations or states can little afford to undertake projects which, in their later history, their accumulated energies often accomplish with apparent ease. For example, the United States could little

have undertaken and much less have accomplished, the construction of great irrigation works in the early years of our history. So, too, in the instant case, while natural conditions offered no obstacle and, on the contrary, invited construction on the plains of Wyoming, and canals were there built with ease and little expense, yet it took the accumulated energy of nearly half a century for Colorado to accumulate sufficient vital force to drive the tunnel through the mountain range wherewith to make beneficial use of the smaller part of the waters of her own stream.

Thus, it is that prior appropriation is very frequently the accident of physical location, and were the rule to apply between states their destiny would be determined, not by their present or future necessities for use of their natural resources, but rather by accident of local physical conditions inviting construction on the one hand or delaying it upon the other, thereby to leave the fate of states to accidental ease of first construction. While to be sure, the same rule applies with individuals in their usufructuary rights and within the state and the junior is utterly denied for benefit of the first taker, nevertheless such a preference is within the governmental powers of the states, and, in the disposition of their resources to the most ultimate good, inasmuch as there is but water for the few (which, if parceled among the many would benefit no one), the state may determine to whom the exclusive use may be given in order to ultimately bring to the state and its people the greatest benefit with the least waste, and furthermore, the state, whenever it may so desire, by the power of eminent domain, may take away all vested usufructuary rights and establish some new plan adapted to future conditions, only perhaps in the future to again condemn and establish still a different order of things.

But although such may be the local regulation among the private rights of citizens within the state, the very statement of the rule is its own denial, when asserted as law between states with equal rights and powers and which, save for the powers surrendered in the Constitution, are for all purposes of this case, to be considered as independent nations. To apply the exclusive rule of first appropriator would be to utterly deny to the one the use of its natural resources for total benefit of another.

The same objection may be pointed out in a different manner. In the case of Montana, as we read the record and briefs in *Bean v. Morris, supra*, it appears that Sage Creek, rising in that state and flowing into Wyoming, had its source in a portion of Montana set apart and withheld from development by the United States as an Indian Reservation during all the years when lands of Wyoming, along that stream, were open to settlement and reclamation. The reservation was later thrown open and Montana citizens were given their first opportunity to use either the lands or waters within their borders while, in the meantime, the waters of the Montana stream had been used in Wyoming by settlers who took with full knowledge that the stream had its rise in Montana and that the lands of that state are just as arid as those in Wyoming. If in that case the controversy had been between states, when Montana had her first opportunity to develop her domain and make use of her own, she would have been confronted by prior claims of citizens of Wyoming and, assuming that such claims were for the entire flow of the stream, her right to use her own resources would have been challenged by the neighboring state under claim of exclusive right by priority of appropriation.

To ask whether Montana, as a state, could thus be denied the use of her own greatest natural resource against her will, would seem its own denial. Yet such undoubtedly would be the effect of application of the private exclusive property rule of prior appropriation to settlement of controversies involving not only the present prosperity but as well the future destinies of states. Montana (if an independent nation) would without doubt, under all rules of international law, be entitled to make use of her own waters within her own domain in such manner as her sovereign will might prescribe and her neighbor, failing to settle the controversy by treaty or arbitration, must either suffer the consequences or challenge the right, which the neighbor would then defend. Undoubtedly no harsh, exclusive rule of first taker by private citizens could thus control the destinies of nations or of states of the Union.

The same conditions would obtain wherever natural, legal or artificial obstacles (forest or Indian reservations, etc.) have prevented the upper state from earlier making full use of her own. And, in the instant case, if in fact Wyoming had (which she has not) already appropriated all the waters of the Laramie river before any interwatershed diversions were undertaken by Colorado (owing to the enormity of the physical obstacles presented), it would be a new rule of international or interstate law which, on claim of first taker by a citizen of a neighboring state, would utterly deny to the state of origin the use of even a portion of her own waters, imperative for her own prosperity and the growth and sustenance of her own people. This would be especially true in view of the fact that the water had been used by Wyoming citizens after Colorado had been admitted as a state of the Union, with all the reserved

powers of the original thirteen, and with full knowledge upon their part of the natural conditions prevailing within Colorado and the necessities of the state and her people. Again we suggest that, under the law of nations, Colorado might take her own and do with it as she would and defend her right so to do by force.

Kansas v. Colorado, 206 U. S. 46, 98.

(c) **Servitude—Extra-territorial.**

But we cannot agree that among nations or states with equal powers and sovereign rights, the one may claim, through her citizens by mere first use, a preferred and exclusive right to perpetually use for her benefit waters rising within and flowing from out the domain of her neighbor, thereby to deny forever to the nation or state of origin a part or all of the benefit of her own stream, be her necessities ever so great.

In the opening pages of this brief we made note of the dignity and powers of independent nations and the equality thereof one with the other, also their exclusive jurisdiction over and right to use and enjoy their natural resources in such manner and at such times as best suited their development and their necessities and that the rivers of a nation are classed as among the most valuable of its natural resources.

Vattel Law of Nations, (1872 Ed. Chitty) pp. 53, 148-9, 163-4, also pp. 120, 123, 125.

Schooner Exchange v. McFadden, 7 Cranch, 116, 136.

Rhode Island v. Massachusetts, 12 Pet. 657, 633.

Further, that the original states, before the union, were free and independent states or nations and that each state of the Union, new or old, is, save for the powers surrendered to the United States by the Constitution, to be here considered as a free and independent nation with all its original rights to the benefit of and jurisdiction over the streams within its domain, and that each of the states of the Union, new and old alike, stand upon an equality one with the other and the powers of one are no greater and no less than those of every other.

New York v. Miln, 11 Pet. 102, 139.
Chisholm v. Georgia, 2 Dall. 419, 435.
Texas v. White, 7 Wall. 700, 725.
Kansas v. Colorado, 206 U. S. 46.

Each state may make such laws, rules and regulations for the control of streams within its domain as its local necessities may require, and the United States, by its legislation and its courts, recognizes and enforces these local laws.

Martin v. Waddell, 16 Pet. 367, 409-10;
Hardin v. Jordan, 140 U. S. 371, 380-2, 382, 402;
Shively v. Bowlby, 152 U. S. 1;
United States v. Rio Grande Irr. Co., 174 U. S. 690, 702-6;
Bacon v. Walker, 204 U. S. 311, 315;
Kansas v. Colorado, 206 U. S. 46;
Snyder v. Colorado Gold Dr. Co., 181 Fed. 62;
United States v. Cress,——U. S.——, 37 Sup. Ct. Rep. 380.

One state may grant rights to its citizens in its natural resources and its waters, which it may deny to citizens of another state.

McCready v. Virginia, 94 U. S. 391;
Manchester v. Massachusetts, 139 U. S. 240;
Geer v. Connecticut, 161 U. S. 519.

and the rights between states are to be decided irrespective of the rights or claims of private citizens.

Georgia v. Tennessee Copper Co., 206 U. S. 230;
Kansas v. Colorado, 206, U. S. 46;
Hudson Co. Water Co. v. McCarter, 209 U. S. 349;
Richey Land & Cattle Co. v. Miller & Lux, 218 U. S. 258;
Bean vs. Morris, 221 U. S. 485.

To carry the reasoning to its conclusion, it would seem, therefore, that whenever any rule of private property law is suggested as a proper rule for settlement of interstate disputes, it cannot obtain for such purpose if it violates any of the fundamental principles above announced. We contend the private property rule of priority of appropriation cannot obtain as a rule of interstate law. Neither for that matter can the private property rule of riparian rights apply. Both are rules of exclusion, where the usufruct in the natural resource, the water, is taken from the many and given to the few, and in turn the few exclude the many from its enjoyment.

In disputes over rivers common to two states, any rule, which permits the lower state to deprive the state of origin of the use and benefit of the waters that rise and flow within her borders, would be contrary to the fundamental doctrine that each state, as with an independent nation, has the right to, and must of necessity, enjoy and rely upon her natural resources within her domain, and cannot be deprived

thereof by her neighbor without her consent, to her own destruction. Waters that rise and flow from one state into another are forever lost to the former unless there used, and any rule which forbids this use denies to the state or nation of origin the benefit of her inherent sovereign right to enjoy her own and maintain herself with her domain.

This, the rule of appropriation does. It takes, if need be, the whole of the stream and gives it to the first user as against all others.

Here Wyoming claims that she is entitled to all the waters of the Laramie river which rise and flow in Colorado because, she says (and in the proof whereof she failed), her citizens appropriated and used all the waters of this river prior to the time Colorado and her citizens, delayed as they were, by a theretofore insurmountable obstacle (mountain range), had gathered sufficient vital force to build her "skyline" ditches over the mountain passes and to drive her great tunnel through the mountain range, by the combined ability of which she now and for all time can divert but 91/250 of the water of her own river. In other words, if, in fact, (though such is not the case) all the waters had actually been so applied to beneficial use in Wyoming, prior to the Colorado development, Wyoming contends that under the rule of priority she may lay claim to an exclusive use of the Colorado as well as the Wyoming river, notwithstanding the fact that the Wyoming diversions were all made with full knowledge of the necessities of Colorado, the aridity of her fertile lands and her right as a state to ultimately use her own great resource, her waters, to make her arid lands productive and to sustain herself and her people.

The assertion of such a rule is to deny its application to the settlement of interstate controversies over rivers. Its fundamental principles forbid its use. It would deny to the state of origin all the waters of the streams and give their entire benefit to a state foreign to the source, thereby, in effect, to invade and take the domain of one state and to give it to another, without consent, compensation or even regret. It would be the assertion by a foreign state of full, complete and exclusive jurisdiction over a portion of the domain of another state; a claim contrary to the law of nations and ultimately leading to disregard of all rules of international law and respect for the rights of other states of equal dignity. The taking of the property of one country and giving it to another, under rules of international or interstate law, has the same effect upon her domain as though it were invaded by armies. In the end the domain of one state is laid hold of for the benefit of another and the property of the former is taken away that she may perish, and given to the other that she may prosper. Any such a rule would violate the rights of independent nations of equal dignity and sovereign powers, and, we believe, would not be applied as a rule of settlement by a court of international arbitration. With equal force, it cannot apply between states of the Union of equal dignity, powers and jurisdiction, and with equal rights to use and receive the benefits of their own resources according to their present or future necessities, free from claims of foreign servitude.

The usufructuary rights of the individual citizen of Wyoming are defined by the Constitution, laws and decisions of the courts of that state. The rights of the private citizen are there permitted to attach under the fundamental doctrine of priority by appro-

priation with such modifications and limitations as the state has seen fit to assert, according to its peculiar local conditions and necessities, and with the reserved power of the state to take them away from the citizen, by eminent domain, whenever necessity may require. But the local law of Wyoming can have no extra-territorial effect, and especially when prejudicial to the rights of other states.

> "It is difficult to conceive upon what ground a claim can be rested, to give to any municipal laws an extra-territorial effect, when those laws are prejudicial to the rights of other nations, or to those of their subjects. It would at once annihilate the sovereignty and equality of every nation which should be called upon to recognize and enforce them; or compel it to desert its own proper interest and duty to its own subjects in favor of strangers, who were regardless of both. A claim, so naked of any principle or just authority to support it, is wholly inadmissible."
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> Story on Conflict of Laws, Sec. 32, p. 29.

> "Now, the general rule certainly is, that every legislative act ought to receive a reasonable construction; and it cannot be presumed that a legislature authorizes any act to be done in a foreign territory, when that act is beyond the reach of its proper jurisdiction or sovereignty. Every legislature, however broad may be its enactments, is supposed to confine them to cases or persons within the reach of its sovereignty."

Farnum vs. Blackstone Canal Co., 1 Sumner 46, 62.

See also:

Schooner Exchange vs. McFaddon, 7 Cranch 116, 136.

Cooley Const. Limitations (7th Ed.), p. 176.

Hilton vs. Guyot, 159 U. S. 113.

One state cannot expropriate for its public purposes property within the territory of another state.

"Every sovereign state may exercise the power of eminent domain—no state can exercise the power by taking or injuring property outside its territorial limits."

10 An. & Eng. Enc. Law, p. 1051.

"No sovereign, according to modern international law, can exercise the prerogative of sovereignty in any domain but his own. * * * By the law of nations one government cannot enter upon the territories of another, or claim any right whatever therein."

Wharton Int. Law Digest, Vol. I, p. 38-9.

Crosby vs. Hanover (N. H.) involved the right of officers of New Hampshire to expropriate territory of Vermont for abutments of an interstate bridge:

"Our courts and the officers of our laws have no jurisdiction as such to do any act or take any property in that State. Our official powers are confined to the limits of our own State, and the court in this case cannot require or authorize the town to go into Vermont to take the property of the corporation there, and the commissioners had no power to condemn property situated in that State.

They could take the franchise of the corporation, because that exists in this State, and by its laws; and they could take all the property in this State necessary for the purposes of building the bridge; but they had no jurisdiction or power beyond the limits of the State."

Crosby vs. Hanover, 36 N. H. 404, 423.

"The question has arisen whether, by virtue of the right of eminent domain, one state can take, or subject to public use, land in another state, and the decisions have naturally been against such a power. (Citing cases.)

The rule which has been referred to is based upon the principle that the improvement of the navigation of navigable rivers within a state is part of the state's governmental duties, and that the work which is done towards such improvement is done in the discharge of the governmental powers of the state, and that the land of the riparian proprietor within the state is subject to the just exercise of this power; and that when the state undertakes to exercise its governmental power, the public good is paramount to the consequential injury of land which is incidentally and necessarily affected by the improvement. The land is under the jurisdiction of the state and the state derives the power to inflict remote and consequential injuries upon it by virtue of such jurisdiction. The owner of land abutting upon a navigable river owns it subject to the right of the state to improve the navigation of the river, because the land is with-

in the governmental control of the state; but it seems to me *that the state obtains by virtue of its governmental powers no control over or right to injure land without its jurisdiction.* Jurisdiction confers the power and the right to inflict consequential injury, but when no jurisdiction exists the right ceases to exist. It is a recognized principle that the statutes of one state in regard to real estate cannot act extra-territorially. As Connecticut has no direct jurisdiction or control over real estate situate in another state, it cannot indirectly, by virtue of its attempted improvement of its own navigable waters, control or subject to injury foreign real estate."

Holyoke Water Power Co. vs. Connecticut River Co., 52 Conn., 570, 575-6.

In *McCarter vs. Hudson County Water Co.* citizens of New York were prohibited from taking away from New Jersey a part of the waters of its stream without its consent and contrary to its express statutory prohibition. In the opinion by the Court of Errors and Appeals, Mr. Justice Pitney thus answers the assertion that the people of the neighboring state of New York had a natural right to the use of the waters of New Jersey, if such a use could be granted without impairing the rights of individual riparian owners upon the New Jersey stream:

"Stripped of all circumlocution, what is asserted is the right of the people of New York to derive an artificial water supply from the territory of New Jersey without the consent of the people of this state. This argument, however, is at once overthrown

by reference to the established principle that one state cannot expropriate for its public purposes property within the territory of another state." (Citing cases.)

"To admit that the people of the State of New York have any inherent right to gain a water supply from the lakes or streams of New Jersey by means of an artificial aqueduct constructed for the purpose is to assert that the sovereignty of New York extends to some extent and for some purposes over the soil of New Jersey. To state the proposition is to refute it. Such interstate rights can be acquired only by interstate compact.

We have been privileged to see in print an opinion recently submitted to the Merchants' Association of New York by Mr. Randolph, author of the well-known work on eminent domain, upon the question of an interstate water supply for that city. Referring to 'that interest in water which each state possesses as the guardian of its community,' he says:

'I think it is clear that the right of an individual or corporation to divert water, whether gained by public grant *or by prior appropriation*, is presumed to be utilized within the state, which may forbid the carriage of the water beyond its bounds.'

And he uses this language:

'And when we point out that each state holds all the property in its territory free from the eminent domain of another, and cannot be compelled to surrender its prop-

erty to another in any way, I think we approximate the irreducible measure of sovereignty in this relation.' "

McCarter vs. Hudson County Water Co., 70 N. J. Eq. 695, 717.

While immediately following the above languafe, Mr. Justice Pitney observed that the case there presented is not parallel with a case which might arise on an interstate stream, it will be observed that his opinion was largely limited by the decision on demurrer in *Kansas vs. Colorado* (185 U. S. 125), and that he did not have the benefit of the final decision in that case (206 U. S. 46).

The fundamental rule that one nation cannot exercise its sovereign power and jurisdiction over the waters or domain of another nation without her consent and cannot expropriate the waters of an upper nation for the use of the lower nation by claim of *prior appropriation* even on an international river, has been recognized and followed by the United States in its relations with Mexico. Mexico made complaint of injury by diminution of the Rio Grande River by citizens of the United States in Colorado and New Mexico, and asserted a preferred right to the use of the stream by prior appropriation by certain of the citizens of Mexico. It was held that Mexico could not, under any rule of international law, lay claim to the waters that had their source within the United States, and that to claim the waters by prior appropriation would be to assert a *servitude* upon the domain of the upper nation. The facts there presented are so nearly parallel with the contention here made by Wyoming that we quote at length from the opinion of Attorney General Judson Harmon:

"There have been disputes about rights of navigation of international rivers, but they have been settled by treaty. (For a list of such treaties see Heffter Droit Int., Appendix VIII.) The subject is fully discussed by Hall (Int. Law, sec. 39), who denied that the people on the upper part of a navigable river have a natural right to pass over it through foreign territory to its mouth. But if such right be conceded, no aid is afforded for the present inquiry, because use for navigation, being common, would not curtail use by the proprietary country, while in the case now presented, there not being enough water for irrigation in both countries, the question is, which shall yield to the other.

It is stated by some authors that an obligation rests upon every country to receive streams which naturally flow into it from other countries, and they refer to this as a natural international servitude. Heffter Droit Int., sec. 43; 1 Philemore Int. Law, p. 303.) Others deny the existence of all international servitudes, apart from agreement in some form. (Letters of Grotius quoted, 2 Hert., p. 106; Kluber Droit des Gens Moderne, sec. 139; Bluntschli Droit Int. Cod.; Woolsey's Int. Law, sec. 58; 1 Calvo Droit Int., sec. 556.)

Such a servitude, however, if its existence be conceded, would not cover the present case or afford any real analogy to it. The servient country may not obstruct the stream so as to cause the water to back up and overflow the territories of the other.

The dominant country may not divert the course of the stream so as to throw it upon the territory of the other at a different place. (See authorities *supra.*) In either of such cases there would be a direct invasion and injury by one of the nations of the territory of the other. But when the use of water by the inhabitants of the upper country results in reducing the volume which enters the other, it is a diminution of the servitude. The injury now complained of is a remote and indirect consequence of acts which operate as a deprivation by prior enjoyment. *So it is evident that what is really contended for is a servitude which makes the lower country dominant and subjects the upper country to the burden of arresting its development and denying to its inhabitants the use of a provision which nature has supplied entirely within its own territory.*

Such a consequence of the doctrine of international servitude is not within the language used by any writer with whose works I am familiar, and could not have been within the range of his thought without finding expression.

Both the common and the civil law undertake to regulate the use of the water of navigable streams by the different persons entitled to it. Neither has fixed any absolute rule, but both leave each case to be decided upon its own circumstances. But I need not enter upon a discussion of the rules and principles of either system in this regard, because both are municipal and,

especially as they relate to real property, can have no operation beyond national boundaries. (Creasy Int. Law, p. 164.) So they can only settle rights of citizens of the same country *inter sese. The question must, therefore, be determined by considerations different from those which would apply between individual citizens of either country.* Even if such a question could arise as a private one between citizens of one country and those of another, it is not so presented here. The mere assertion of the claim by Mexico would make it a national one even if it were of a private nature. (Gray vs. United States, 1 C. Cls. R., 391-392.) But the use of water complained of and the resulting injuries are general throughout extended regions, so that effects upon individual rights can not be traced to individual causes, and the claim is by one nation against the other in fact as well as form.

The fundamental principle of international law is the absolute sovereignty of every nation, as against all others, within its own territory. Of the nature and scope of sovereignty with respect to judicial jurisdiction, which is one of its elements, Chief Justice Marshall said (*Schooner Exchange vs. McFaddon*, 7 Cranch, p. 136):

'The jurisdiction of the nation within its own territory is necessarily exclusive and absolute. It is susceptible of no limitation not imposed by itself. *Any restriction upon it, deriving validity from an external source, would imply a diminution of its sovereignty to the extent of the restriction.*

All exceptions, therefore, to the full and complete power of a nation within it own territories must be traced up to the consent of the nation itself. They can flow from no other legitimate source.'

It would be entirely useless to multiply authorities. So strongly is the principle of general and absolute sovereignty maintained that it has even been asserted by high authority that admitted international servitudes cease when they conflict with the necessites of the servient state. (Bluntschli, p. 212; see criticism by Creasy, p. 258.) Whether this be true or not, its assertion serves to emphasize the truth that *self-preservation is one of the first laws of nations. No believer in the doctrine of natural servitudes has ever suggested one which would interefere with the enjoyment by a nation within its own territory of whatever was necessary to the development of its resources or the comfort of its people.*

The immediate as well as the possible consequences of the right asserted by Mexico shows that its recognition is *entirely inconsistent* with the sovereignty of the United States over its national domain. Apart from the sum demanded by way of indemnity for the past, the claim involves not only the arrest of further settlement and development of large regions of country, but the abandonment, in great measure at least, of what has already been accomplished.

* * * * * * *

It is not suggested that the injuries complained of are or have been in any measure due to wantonness or wastefulness in the use of water or to any design or intention to injure. The water is simply insufficient to supply the needs of the great stretch of arid country through which the river, never large in the dry season, flows, giving much and receiving little.

The case presented is a novel one. Whether the circumstances make it possible or proper to take any action from considerations of comity is a question which does not pertain to this Department; *but that question should be decided as one of policy only, because, in my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States.*" (Italics ours.)

Opinions of Attorneys General, Vol. XXI, p. 280-3.

The complainant on pages 174-6 of the supplemental brief quotes the last paragraph in the foregoing opinion of Judge Harmon and places an erroneous construction upon the word "novel" as there used. The conclusions which counsel draw are however, not in full accord with the recommendations made by Judge Harmon, that "The question should be decided as one of policy only, because, in my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States". The United States did settle the controversy upon the grounds of international policy and by treaty, as all such matters are usually

adjusted between friendly nations, a power still reserved to the states of the United States, the consent of Congress first having been obtained.

When the United States, as a matter of international policy but not of international law, settled the differences over the Rio Grande with Mexico it took the precaution to so word the treaty that the adjustment could never be taken as a recognition of any lawful claims by Mexico and in Article 5 provided:

> "The United States, in entering into this treaty does not thereby concede, expressly or by implication, any legal basis for any claims heretofore asserted, or which may be hereafter asserted, by reason of any losses incurred by the owners of land in Mexico, due, or alleged to be due, to the diversion of the waters of the Rio Grande within the United States; nor does the United States in any way concede the establishment of any general principle or precedent by the concluding of this treaty."
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> Art. V, Treaty of May 1, 1906.

The same observation may be made with regard to the letter of Secretary of State Evarts of Jun 12. 1880 (cited on page 175) which was likewise considered a matter of international policy rather than international law and by express provisions, the letter referred primarily to private property interests of citizens.

Denial of right of international servitude by claims of prior appropriation for citizens of a lower nation upon an international stream, as defined in the opinion of Judge Harmon, has never been questioned so far as we are able to ascertain. Denial of such international servitudes seems to have been ac-

cepted as a proper interpretation of the principles governing such claims. The position taken by Judge Harmon is in large measure approved by this Court, as regards interstate streams. In Kansas vs. Colorado it was admitted that certain ditches in Kansas had prior claims to those in Colorado and that the Colorado diversions had diminished the water supply of these Kansas canals, but this court refused to enjoin the state of Colorado on account of such diminution of the supply of the stream. Mr. Justice Brewer said:

> "At one time there were some irrigating ditches in these western counties, which promised to be valuable in supplying water and thus increasing the productiveness of the lands in the vicinity of the stream, and it is true that those ditches have ceased to be of much value, the flow in them having largely diminished.
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> It cannot be denied in view of all the testimony * * * that the diminution of the flow of the water in the river by the irrigation of Colorado has worked some detriment to the southwestern part of Kansas, and yet when we compare the amount of this detriment with the great benefit which has obviously resulted to the counties in Colorado, it would seem that equality of right and equity between the two states forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation. * * *
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> Summing up our conclusions, we are of the opinion * * * that the appropriation of the waters of the Arkansas by Colo-

rado, for purposes of irrigation, has diminished the flow of water into the State of Kansas; that the result of that appropriation has been the reclamation of large areas in Colorado, transforming thousands of acres into fertile fields and rendering possible their occupation and cultivation when otherwise they would have continued barren and unoccupied; that while the influence of such diminution has been of perceptible injury to portions of the Arkansas valley in Kansas, particularly those portions closest to the Colorado line, yet to the great body of the valley it has worked little, if any, detriment, and regarding the interests of both states and the right of each to receive benefit through irrigation and in any other manner from the waters of this stream, we are not satisfied that Kansas has made out a case entitling it to a decree. At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes."

Kansas vs. Colorado, 206 U. S. 46, 113, 117.

That the application of the doctrine of priority without regard to state lines would be a recognition of extra-territorial servitudes is recognized in Bean vs. Morris, involving an interstate stream:

"We assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such *private* rights and obligations as are in dispute, across their common boundary line. Missouri vs. Illinois, 200 U. S. 496, 521; Rickey Land & Cattle Co. vs. Miller & Lux. 218 U. S. 258, 260. But with regard to such rights as came into question in the other states, we believe that it always was assumed, in the absence of legislation to the contrary, that the states were willing to ignore boundaries, and allowed the same rights to be acquired from outside the state that could be acquired from within."

Bean vs. Morris, 221 U. S. 485, 486.

But here there is no "absence of legislation to the contrary" and neither state is "willing to ignore boundaries and allow the same rights to be acquired from outside the state that could be acquired within." *On the contrary, both states by their constitution, laws and the decisions of their courts reserve their waters for themselves and deny and declare against any servitudes for the benefit of neighboring states.*

See Constitutions, Statutes and Decisions, (*Supra*) (pp. 148 to 174.)

Lamson vs. Vailes, 27 Colo. 201, 203.

Stockman vs. Leddy, 55 Colo. 24, 27.

S. L. Colo. 1917, Chap. 151, p. 539.

Farm Inv. Co. vs. Carpenter, 9 Wyo. 110, 135.

Grover Irr. Co. vs. Lovella D. Co. 21 Wyo. 204.

Of the decisions and statutes of Colorado we have heretofore commented at length.

The decisions of the Supreme Court of Wyoming deny her assertions of right to expropriate the waters of Colorado for the use of Wyoming. Subsequent to the filing of the bill of complaint herein (and on April 7, 1913) the Supreme Court of Wyoming denied the right of Colorado citizens to expropriate lands and water in Wyoming for use in Colorado notwithstanding the fact that the stream was interstate and common to the two states in the same degree as is that portion of the Laramie river here involved, save for the fact that with the stream there involved, Crow Creek, the conditions are reversed, the stream having its source in Wyoming and flowing into Colorado. While Wyoming here asserts a right (by prior appropriation) to all the waters of that portion of the Laramie river in Colorado and would impose a perpetual servitude upon Colorado domain and natural resources for the *exclusive* use and benefit of Wyoming, and asks that Colorado be perpetually enjoined from using her great tunnel enterprise; yet, when the conditions were reversed and Colorado citizens made claim to the right to use but a portion of the waters of a stream having its source in Wyoming and flowing into Colorado, Wyoming declared against any such servitudes and denied the right of Colorado to impress any such dominant estate upon Wyoming territory, irrespective of the fact that the district court had found that the use of water of the stream in Colorado would bring immediate returns to adjacent Wyoming territory. Chief Justice Potter in a most exhaustive opinion, denies the right of one state to expropriate property of another and in a most learned manner reviews the decisions. Owing to the immediate im-

portance of the decision and its unqualified approval of the authorities we have already cited we quote at some length from the sixty page opinion:

> "Eminent domain is generally defined as the right or power of a sovereign state to appropriate private property to particular uses, for the purpose of promoting the general welfare. * * * *In this respect the several states are distinct and independent of each other*, respectively possessing and exercising the power for their own purposes of their public welfare. 'The eminent domain in any sovereignty exists only for its own purposes.'"

He then discusses the essential elements of the power of eminent domain and its use for the purposes of state or public welfare and says:

> "It is also well settled that a state cannot take or authorize the taking of property or rights in property situated in another state. (Citing cases.) 'One state cannot expropriate for its public purposes property within the territory of another state.' (McCarter vs. Hudson W. Co., 70 N. J. Eq. 695).
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> 'The question has arisen whether, by virtue of the right of eminent domain, one state can take, or subject to public use, land in another state, and the decisions have naturally been against such a power.' (Holyoke W. P. Co. vs. Conn. R. Co., 52 Conn. 570, 575; s. c. (C. C.) 20 Fed. 71, 79).
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> The principles above stated seem to have been recognized by the trial court in this case, if we may refer to a quotation

from the opinion of the learned judge found in the brief of counsel for defendant in error, for the ground of the decisions seems to have been that the proposed irrigation of the lands, which lie just over the line of this state in the State of Colorado, will be of material benefit to a considerable part of the inhabiants of a section of this state, since it may lead to the growth of towns and the creation of new channels for the employment of capital and labor. * * * This line of argument is not without some force, but we think it disregards or misconceives the theory or public interest supporting the exercise of eminent domain for irrigation works or the irrigation of land, and would, in effect, if sustained, permit the exercise of eminent domain in this state by the State of Colorado, or any other state, for its own uses and purposes."

Then follows a review of authorities on public character of private enterprises, founded on the rules of local necessity, and continues:

"*The irrigation of land in a neighboring state,* and so also the building of a railroad in that state, or the development of its mines or other natural resources, may no doubt result in some benefit to the people of this state, but only in the general way that one state is benefited by the growth in industrial activities, population and wealth of an adjoining state, or even of a more distant state or the nation at large. To accept that, however, as a sufficient reason for taking land in this state under the power

of eminent domain, if for the *purpose of irrigation,* would not tend to advance the interest of this state in the reclamation and cultivation of its lands, or the development of its natural resources, but the effect might be entirely the reverse, and it would abandon the principle upon which the right to exercise the power for irrigation and other analogous purposes has been asserted and maintained. The headgate and ditch by which water for agricultural purposes is diverted and distributed is not the use for which land required for a right of way is taken; *the use authorizing such a taking is the application of the water to the land.* The use, whether public or private, therefore, occurs where the water is applied; that is, where the land to be irrigated is located. If located in another state the use is there, and that use must support the exercise of eminent domain for a right of way for the ditch, if it is to be supported. *Since in this case it appears that no land in this state will receive for its reclamation or cultivation any of the water to be diverted or distributed by means of the ditch, but the water is to be entirely devoted to the irrigation of land in another state, the use will be in and for that state*—for its uses and purposes, and not in this state or for any of its purposes. The principle above discussed, that the power of eminent domain will be exercised by a state for its own purposes, and not for the use of another state, seems, therefore, to be applicable. *Clearly the State of Colorado cannot exercise the pow-*

er in this state, and any authority conferred by its laws to do so would be void, for it is fundamental that the soverignty of any government is limited to persons and property within the territory it controls." (Citing cases.)

"While this state may be interested and even indirectly benefited in the manner above indicated by the reclamation and settlement of lands in another State, it would be difficult, we think, to uphold the exercise of eminent domain in this state on the ground that such reclamation and settlement in another state is a necessity of the government of this state, in view of the fact that within its own boundaries and in all parts of the state there are vast areas yet uncultivated capable of irrigation and reclamation."

After a review of the "mill" cases from the New England states, he continues:

"Since the purpose is solely to irrigate lands in another state, it is not material that the headgate is to be located but a short distance above the southern boundary line of this state, or that the lands to be irrigated are located just over the line in the adjoining state. It would make no difference in principle if it was proposed to divert the water from some stream in the interior or elsewhere in our state much farther removed from the lands to be irrigated, or if it was proposed to irrigate lands in another state situated at a greater distance beyond our territorial limits. * * *

* * * *It is a familiar elementary principle that the laws of a state have no extra-territorial effect.* And it is not necessary for a state statute to contain words expressly confining its operations within the state.

* * * * * * *

In a concurring opinion in Salisbury Mills vs. Forsaith, (57 N. H. 174) it was said: 'It is one of the plainest elementary rules, that no legislature can extend its laws to territority beyond the borders of its own state. How, then, can the courts of this state have any jurisdiction over dams and mills in another state?' And in Wooster vs. Great Falls Mfg. Co. (39 Me. 246) it was said by the Court: 'All legislation is necessarily territorial. The statutes of a state are binding only within its jurisdiction. The legislature cannot, if they would, authorize acts to be done in a foreign territority. * * * They cannot affect or control property elsewhere, and it is not to be presumed they intended to exceed their jurisdiction.' Mr. Justice Story, in Farnum vs. Blackstone Cand., 1 Sumner, 62, Fed. Cas. No. 4,675, remarked: 'Every legislature, however broad may be its enactments, is supposed to confine them to cases or persons within reach of its sovereignty.' "

In conclusion the Colorado citizens were denied the right to expropriate a right of way for their canal and incidentally denied the use of water from the stream in Wyoming.

Grover Irrigation & Land Co. vs. Lovella Ditch Co., 21 Wyo. 204, 240, 255, 260.

We have no quarrel with the foregoing decision or its effect upon the Colorado citizens. Without doubt Wyoming should fully protect her territory and waters from foreign servitudes and her Supreme Court very properly denied to Colorado citizens the right to make Wyoming domain servient to any use of water in Colorado, even though some benefits might accrue to Wyoming thereby. "What it has it may keep and give no one a reason for its will." *But we fail to see any merit in the claim of Wyoming for perpetual servitude upon the domain of Colorado, the waters of her streams, when she at the same time denies to Colorado a similar servitude when the conditions are reversed.* Wyoming very properly refused to permit a like servitude upon Crow Creek and properly retained the stream for herself for her future as well as her present needs. It would seem that Colorado would have an equal right to deny to Wyoming a servitude upon the waters of the Colorado branch of the Laramie River.

Further citation would seem unnecessary to define the doctrine of prior appropriation irrespective of state lines as a doctrine of extra territorial servitudes, without consent of the servient state, to all or a portion of the waters of the stream in one state for the exclusive benefit of another state, and therefore inapplicable for determination of the rights of equal sovereign states to their control and use of waters of streams common to both.

(d) Exclusive Claim—Equal Division.

As we understand the term "equal" when used with reference to the states, it refers to that equality in the family of states which obtains with nations in the family of nations. Each state has an equal right to not only govern itself but as well

to maintain itself and improve its domain, increase in population and promote for the present and for all time the general welfare of itself and its citizens. But if, (purely by way of illustration) we were to use a narrower construction and say that equal states have the right to enjoy an equal part of an interstate stream, even then the doctrine of appropriation is inapplicable for it takes from one state an exclusive (not equal) portion of the waters of the stream and gives it to the other without remuneration. The rule of priority is unequal among the users of water. It gives to the one and excludes the other. It cannot, therefore, apply if each state is entitled to an equal portion of the water of a river common to both.

(e) States Look to Future—Not Past.

Still another thought suggests itself. Priority is a rule of the past and not of the future. States must look to the future more than to the past. They must preserve and provide not for the past, but little for the present, and more for the future. As well observed by Mr. Justice Holmes:

> "We are of opinion, further, that *the constitutional power of the state to insist that its natural advantages shall remain unimpaired by its citizens is not dependent upon any nice estimate of the extent of present use or speculation as to future needs.* The legal conception of the necessary is apt to be confined to somewhat rudimentary wants, and *there are benefits from a great river that might escape a lawyer's view.*
>
> But the state is not required to submit even to an aesthetic analysis. Any analysis may be inadequate. It finds itself in posses-

sion of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will."

Hudson Co. Water Co. vs. McCarter, 209 U. S. 349, 355.

Priority looks alone to the past. Its antiquity is its chief asset. The state on the other hand may find its future needs so imperative that it must extinguish, by the power of eminent domain, even the usufructuary property rights it has permitted its citizens in its streams and take the waters for a greater need. How then could the limited right of a state, determined upon rules of priority of appropriation, as regards another state, be reconciled with its future imperative necessities. It may extinguish, or resume as it were, the property of its citizens, be they ever so ancient, but it cannot take away the rights of another state or the property of its citizens. (See authorities *supra*). Bound hand and foot it would find itself, ensnared within the meshes of a net of private property law improperly applied to interstate relations, and would be helpless to control a resource within its domain and burdened forever with foreign servitude against its will. It would find itself bound down by antiquities and powerless to defend itself or to provide for the then present or its future needs.

(f) Conclusion.

It is the stream of water rising and flowing within the domain of the state (not mere private usufructuary rights) which is and ever must remain one of its greatest resources. By preservation of the stream it provides for its present and future necessities. It may grant to the citizen his usufructuary

right by any system of private property law it may choose, whether riparian, appropriation, both in combination or any other and new system it may devise, but always inferior and subordinate to the right of the state to have the last and final word. The river after all must ever remain within its sovereign control. The river it must now and for all time keep, preserve and protect and no system of private property law now devised, either riparian or appropriation, can adjust interstate relations and at the same time preserve the river, as a river after all, for the state and all its future generations.

And whatever claim of priority of appropriation Wyoming may have made; whatever she may have proved or failed to prove of the early claims of her citizens to the waters of the river from Colorado, the fact remains, after all, that the river in Colorado is her great natural resource, which she has and must keep, now and for all time irrespective of the claims, or the assent or dissent of her private citizens. And likewise too with that portion of the river rising and flowing in Wyoming. It is Wyoming's resource and her's in a greater degree than mere past or present user. It she must likewise keep now and for all time. Either state may tomorrow sweep aside with but pecuniary reward all the rights of her citizens vested and recognized under laws of appropriation varying as they do in the two states, and may retake the stream as of her first and former estate, to do with as she may will and as her future needs and conditions may require, but this she cannot do if the river shall have been taken away by extra-territorial servitudes of the neighboring state.

Wyoming here asserts claim to all the waters of the Colorado portion of the Larimie River (save for the inconsequential use in the narrow mountain

valley) and we have presented the case from that viewpoint. But whether the lower state shall demand all or part of the water by prior appropriation, the principle is the same and the difference in effect is but one of degree. The right in any event is exclusive and would create a perpetual servitude upon the upper state and its resources, without its consent, for the exclusive use of the water of the stream.

We believe sufficient appears, without further discussion of authorities to warrant us in drawing the conclusoin that the doctrine of priority by appropriation is a rule of local law, *intra-state and not interstate* in application and defines merely the right of one citizen with regard to the rights of other citizens of the state wherein the appropriation is made and to some degree his relation to the state itself in the administration of the usufructuary rights of the several appropriators; that the usufructuary right is exclusive in the appropriator and if his needs so require he may consume all the water of the stream regardless of other appropriators or the location of the lands to which the water is applied; that the application of this rule of usufructuary private right to interstate controversies would be in violation of the equal sovereign rights of each of the states involved for the several reasons which we have assigned and that the application of the rule would be to declare an involuntary, exclusive servitude upon the property and natural resources of one state for the benefit of a neighboring state and would amount to extra-territorial expropriation of the property of one state for the benefit of another state and its citizens.

There are other and more practical reasons why the rule cannot be applied between the states. The difficulty encountered is not so much the interpreta-

tion of the law as it is the enforcement thereof. In fact the *intra state* administration of the law of priority of appropriation has involved solution of many complicated problems constantly presenting themselves in the years of the development of this state or local administration and these problems must be met in the future. We shall therefore comment at some length upon this phase of the subject.

(3) THE DOCTRINE OF PRIOR APPROPRIATION, REGARDLESS OF STATE LINES INEQUITABLE AND INCAPABLE OF ADMINISTRATION.

(a) Change or Conflict of Laws.

Counsel for plaintiff, in one portion of their supplemental brief, contend in substance that inasmuch as both Colorado and Wyoming have adopted in its fundamental essentials the doctrine of appropriation, that this rule must be applied between the states and is the principle of law which should govern this controversy. But counsel overlook the fact that the systems prevailing within the two states are radically different, save for priority and that even under the fundamental rule of priority there are different fundamental limitations to the right in each state. They appear to have adopted the theory that if the two states involved in the controversy have adopted the doctrine of appropriation, then that principle must govern in a controversy between them concerning waters of a stream common to both, irrespective of differences in the principle as applied, and overlook the reserved power of the state to extinguish all private titles according to its sovereign will. On the other hand, it is contended, if one state has adopted the doctrine of appropriation and the other adhers to the common law of riparian rights, that then the

water in the streams common to both states must be divided upon an equitable basis. Mr. Kinney is cited as authority but we observe, he cites no authorities sustaining his position. It will be of interest to know upon what theory the plaintiff would attempt to solve the problem if one of the states to the controversy had adopted the law of appropriation and the other had both systems, that is to say, that it recognized the common law doctrine of riparian rights, but modified it by permitting, under certain conditions, the priority of appropriation to govern, as has been done in several of the states, notably California and Nebraska. Again, it is of interest to ask what would be the result if the principle of appropriation were declared to be the established law as between two states in which priority of appropriation governed and, thereafter, one of these states, as it undeniably has the right to do, should change its position and adopt the common law doctrine of riparian rights in place of its previous law of priority of appropriation. It is apparent at a glance that the determination of the rights of the various appropriators in the two states upon the basis of priority of appropriation would be thrown into complete and absolute confusion if one of the states should thereafter repudiate the doctrine and adopt the common law. "Neither state can legislate for or impose its own policy upon the other." Moreover, "Congress cannot enforce either rule upon any state."

The topographical and other natural conditions surrounding the State of Colorado are peculiar. The Court will take judicial notice of these, although for that matter, a full statement of these conditions is given in the evidence.

In fact, we are indebted to counsel for the plaintiff for a statement to the effect that Colorado is up-

on the apex or crest of the continent and is situated in an arid region requiring irrigation for successful agriculture. We add that the rainfall in the arable sections of the state is not sufficient without irrigation to produce successful crops and that irrigation is therefore a necessity, so much so that water for irrigation is probably, aside from the land itself and the things which are included within the term land, the most valuable asset in the state, and that every effort has been put forth by the state and its citizens to develop irrigation systems whereby water for irrigation might be provided, including the construction of reservoirs for the conservation of flood waters which would otherwise escape without beneficial use. The streams rising in Colorado flow out of the state in all directions. To the east the main streams are the South Platte and Arkansas rivers and other smaller streams which need not be mentioned; to the south are the Rio Grande and San Juan rivers with other smaller ones; to the west, the Grand, the Dolores, and the Green river which, uniting with the Grand, form the Colorado river; and to the north, the North Platte, the Laramie and other smaller streams. From no other state does Colorado receive any water, with the exception of a few small streams entering the state from Wyoming in certain portions of its northern border, and the further exception of the Green river which rises in Wyoming, flows into Utah and then loops back for a very short distance into the western border of this state. The exceptions are merely sufficient to prove the rule.

The strange feature of this case is that the topographical position of Wyoming is similar to that of Colorado and that streams leave her borders on the west, north and east, and somewhat to the south, and we are impressed with the thought expressed in the

opinion of the Court in Bean vs. Morris, wherein the right of an appropriator in Montana was determined as against an appropriator in Wyoming, and the Court said, assuming that Montana is willing to have rights acquired against her citizens by appropriators in the lower states, "Montana cannot be presumed to be intent on suicide, and there are as many if not more cases in which it would lose as there a' in which it would gain if it invoked a trial of strength with its neighbors." Surely Wyoming is intent upon suicide, but the regrettable feature of the situation from our standpoint is, that if she is permitted to commit suicide, she at the same time will murder Colorado.

(b) Disappearing Rivers.

Colorado is largely mountainous and this mountain area is the source of supply of her water. The eastern portion of the state, generally speaking about one-third the area of the state, is in the Great Plains region, and on the north, west and south, while there are no areas which may be properly called plains, there are, nevertheless, isolated areas of greater or less extent, arable in their nature and capable of cultivation, but all of these areas depend upon the supply of water furnished by the mountains.

These streams after leaving the mountains have a history which is the converse of that of the streams in the humid regions. After the streams in Colorado have received their supply of water from various sources in the mountains, and in their course enter the Great Plains areas, because of the aridity of the climate they immediately begin to lose or diminish, instead of increasing in their flow like streams in the less arid sections of the country. This is the natural

condition and it is modified only in this, that diversion of water on the upper reaches of the stream, more particularly in the conservation of flood waters which usually come in the latter part of May and the first of June, and the application thereof upon the lands under irrigation, results in producing an unnatural condition for the area, in that the lands under irrigation become to a degree saturated with water and there is a constant and ever increasing amount of return and seepage water from these lands into the stream. Fortunately for Colorado, the earliest development in irrigation was upon lands lying adjacent to the mountains and the development which resulted brought about in turn greater demands for water, thereby bringing about further development through the construction of reservoirs with the general result that through the use and re-use of the return and seepage waters, the irrigation in the state has progressed step by step down stream until today many times the amount of land for which water was first available is now receiving a satisfactory supply of water. To put it in another way, irrigation has produced an unnatural condition which, in a limited way, causes these streams to receive a source of supply in a manner similar to the natural increase in the streams in humid regions. Of course we do not contend that the actual amount of water in the state of Colorado is increased. What we do contend is, that the process of irrigation has resulted in an enlarged flow of the stream during the seasons in which in earlier years the stream was either low or practically dry, depending upon the location considered. The flood waters which formerly passed without benefit to any one, are now, so far as it is possible to do so

to advantage, intercepted, stored and later used for irrigation and the flow of streams is by means of this irrigation equalized and maintained during the season of the year when the streams were of nature practically dry, and in some instances absolutely dry along portions of their courses.

Let us illustrate by referring to the Arkansas river which is the stream considered by the Court in the case of Kansas against Colorado. This stream leaves the mountains some distance west of Pueblo and enters its course across the plains, naturally losing water with every foot of its length. From the point where it leaves the mountains to the state line is a distance by meander of possibly 150 miles and until the stream enters a region of higher precipitation, there is a constant loss to such an extent that it was contended in the Kansas-Colorado case that the stream was a broken river, in other words, that there was a length of its bed or channel in which no water flowed under normal conditions. However, the application of the water for irrigation on the upper reaches of the stream has resulted, as described, in a very rapid increase of return, seepage and percolating water to the stream and the flow of the stream is definitely known to be greater at the state line than it was before any irrigation was practiced in Colorado with the possible exception of the flood period. This is also particularly true of the South Platte river upon which the city of Denver is located.

In the absence of this artificial condition which of course is not yet complete, it being a condition which is enlarging and progressing from year to year, it is a scientific fact which cannot be denied, that in order to supply 100 cubic feet, for illustration, in western Kansas

from the Arkansas river, or in western Nebraska from the Platte river, it would be necessary to permit many times that amount of water to pass, say the City of Pueblo on the Arkansas river, or the city of Denver, on the Platte river. In other words, the citizens of Colorado, particularly those on the upper reaches of the stream, must be deprived of a large amount of water necessary for their well being in order to supply a small amount of water to persons in Kansas and Nebraska. Consider in this connection the U. S. Census report 1910, giving the total area of Colorado as 66,341,120 acres, of which only 2,792,032 or 4.2% is irrigated.

May we direct attention to the evidence upon these points.

(See testimony of John E. Field, State Engineer of Colorado, pp. 1382-1387;
Prof. L. G. Carpenter, pp. 2992-3042; 3077-3092).

The unnecessary loss occasioned by depriving the state of origin of control of its waters and by causing the water to pass down losing streams in order to supply some prior appropriator in another state would appear to be so wasteful and so lacking in its applicability to the situation as to be inequitable and unjust.

While the state may determine its own local rules whereby it may obtain the greatest good from a limited resource and may permit the use, subject always to the reserved power of the state, of its waters in order of priority, yet whenever the application of such a rule, without regard to state boundaries, would not only take a natural resource from one state

and give it to another, but more, in so doing would waste the greater part of the resource it would appear wholly inequitable and inapplicable.

The law is therefore purely local, and its operation or the operation of any other law which the state may substitute for it, is confined to the artificial boundaries which define the territorial bounds of the state. These boundaries however are no more artificial in their effect upon the law of waters than they are in their effect upon many other laws,—criminal, property rights, etc. They define the territorial limits of jurisdiction. They are analagous to international boundary lines.

(c) Administration—Colorado River.

Let us take another illustration. Of these facts the Court will take judicial notice: The Green river rises in Wyoming, flows across the southern border of the state into Utah, loops back from Utah for a short distance into Colorado, returning thence into Utah where it, in conjunction with the Grand river from Colorado, forms the Colorado river. It flows thence southwesterly into Arizona, forming a portion of the boundary between Arizona and Nevada, and below that the boundary between California and Arizona, and thence into Mexico, emptying into the Gulf of California. This stream, in other words, flows within, or borders upon six states and also passes through a portion of Mexico, and irrigation is practiced in each one of these six states. While we are unable to state that water is diverted from this river in each of these six states, nevertheless, the probability is that such is the case, for it is a recognizezd fact that Wyoming, Colorado, Utah, Arizona, Nev-

ada and California each require irrigation and many large projects have been undertaken by the United States Reclamation Service and by private individuals diverting water from this stream along its course, the better known probably being those in California and Arizona, to omit the innumerable diversions upon the tributaries. The records of the United States Geological Survey further show diversions from the stream at numerous places along its course on both the upper and lower reaches, and measurements have been taken for a number of years, reported in Water Supply Papers, numbers 395 and 396, from which is apparent that the sources of supply for this stream are so remote one from another that, while there may be in a measure a continuity of flow throughout the course of the stream and its various tributaries, nevertheless, there are points of high and low flow apparent in various sections of the length of the stream. Could any advocate of the doctrine of appropriation regardless of state lines advance any hypothesis upon which this stream and its tributaries could be administered and the water apportioned to the various appropriators in the seventeen hundred or more miles of its length, upon the basis of priority of appropriation. It is impossible and the doctrine of appropriation regardless of state lines cannot be the law. Impossible conditions do not make law.

(d) Adjudication.

There is another feature wherein it is apparent that appropriation regardless of state lines cannot be the doctrine governing cases such as the one at bar. In the early history of the development of the arid west when diversions were small and few in number, the rights of respective appropriators were easily determined and enforced. As development progressed, it soon became apparent that some system of determination or adjudication of these rights was imperatively necessary and with it a method of distribution under some authorized governmental agency. In Colorado this necessity found expression in a statute requiring all rights to the appropriation of water to be determined in judicial proceedings and that the decree of the courts having jurisdiction should thereafter govern in the distribution of water, and that water officials, officers of the state, should thereafter distribute the water in accordance with the priorities found and determined in the decrees of the courts. In Wyoming the system is somewhat different. In the first place application is made to the state engineer for the right to divert water. This official passes upon the application and if unappropriated water remains in the stream he issues a permit which requires construction to be done within a limited period which may in turn be extended. Thereafter the question of the determination of the right—in other words, the decree—is made by the board of control which consists of the state engineer and the superintendents of irrigation. From this tribunal an appeal lies to the courts.

But regardless of the procedure, both states, and this is true of all the others where irrigation is practiced, found it necessary to provide a system whereby

the rights of the various appropriators could be determined, according to local state law with no reference to the laws of other states, and then the distribution of water governed according to those rights. Wyoming has had an adjudication, we do not know whether it is yet final, of the rights of the appropriators from the Laramie river in that state. To this proceeding Colorado was not a party, nor could it have been a party, neither could any of the appropriators in Colorado have been parties. Likewise the appropriations from the Laramie river in Colorado have been adjudicated by the courts of this state and to these proceedings neither the state of Wyoming nor the appropriatirs of water in Wyoming could have been parties.

There is therefore, no judicial determination of the rights of the respective appropriators in the two states, neither are the rights of the individual appropriators in the two states involved in this cause except as they become so through the soverign states to which they respectively belong. Congress, even assuming that it has jurisdiction in the matter (which we do not concede) has provided no method whatsoever for determination of the rights of these individual appropriators except as their rights may be properly adjudicated in the courts of equity of the United States. It is therefore pertinent to ask, if priority of right regardless of state lines is the principle of law which governs this controversy, how are the rights of the respective individuals to be determined, having due regard to the conflicting laws of each state, and after determination how are they to be enforced. Possibly this Court might appoint an officer or direct a United States Marshall to organize a body of men to police the stream and divide the water according to the priorities which this Court might undertake to

adjudicate, but the very suggestion shows the absurdity of the contention. No such procedure was ever in contemplation either by congress or by the respective states where water is used for irrigation. The entire adjudication and administration of priorities is founded and has been constructed on the theory of state control and is utterly in conflict with any other theory. Manifestly the doctrine of priority of appropriation does not adapt itself to interstate questions. The machinery for its administration has never been in contemplation of the Federal Government and we believe, could not be without Constitutional amendment, and no method has been provided either for the adjudication of these individual rights or for the administration of the system thereafter.

No decree, adjudicating the rights of the individual appropriators, or of the various ditches and reservoirs, could be drawn based upon the evidence introduced in this case for the reason that the same is wholly inadequate for any such purpose.

(4) ADMINISTRATION BY PRIORITY OF APPROPRIATION IMPRACTICABLE.

(a) Appropriation by Canals.

Diversion and uses of water under the rule of priority require the most rigid police regulation even in their simplest form, viz: by ditches for immediate application to lands. Many factors enter into this administration which are not revealed by the mere assertion of the simple rule of "first in time first in right".

The fundamental basis of the rule of priority of appropriation is beneficial use. The right to divert is usufructuary to the uttermost degree. Beneficial use gives the right and the instant beneficial use ceases the right terminates. The mere fact that a

canal has been constructed and lands have been irrigated does not determine that the appropriator is entitled to take water from the stream to the full capacity of the canal so long as he may wish so to do. The capacity of the canal is but the outside limit to which he may go in diverting the water of the stream under his usufructuary right and the quantity which he has the right to divert is first, and last, determined by the actual necessities of the lands to be served. This necessity in turn varies from day to day and year to year, with the difference in seasons and ever varying natural conditions, and necessarily, is as varied as the climatic and other conditions in different regions.

The appropriator's right to divert is further limited to his established uses. These established uses are measured not by the capacity of his ditch but by his previous diversions, measured by time as well as by quantity, and he is not permitted to enlarge his demands upon the stream, even within the capacity of his already established ditch, either as to time or quantity of flow, so as to deplete the supply which theretofore has passed to junior appropriators, and, in turn, the appropriation is confined to the time of the year in which the use has occurred and after which the junior has enjoyed the stream for his purposes.

Cache la Poudre Res. Co. vs. Water Supply & Storage Co., 25 Colo. 161;
Seven Lakes Res. Co. vs. New Loveland & Greeley Irr. & L. Co. 40 Colo. 382;
Woods vs. Sargent, 43 Colo. 268;
Colo. Mill & Elev. Co. vs. Larimer & Weld Irr. Co. 26 Colo. 47.

Each junior appropriator has a right to have the conditions on the stream remain as they were when he initiated his appropriation and the senior appropriator, irrespective of the size of his ditch, cannot enlarge his demands upon the stream either in time or quantity to the detriment of a junior.

Vogel vs. Minn. Canal & Res. Co. 47 Colo. 534;
Comstock vs. Ramsey, 55 Colo. 244.

Beneficial use being the basis and extent of the right of the appropriator, irrespective of the size of his ditch or the maximum quantity which his decrees permit him to divert, he cannot divert water from the stream and permit the same to be wasted and his right to divert is necessarily limited to that quantity required to supply his established and present necessities at the particular time the diversion is made and the extent of this necessity determines the quantity which may be diverted. If he attempts to divert more water than his immediate necessities require the water official must cut off his diversion at the source to the extent of the excess diversion.

Wyo. Comp. Stat., 1910, Sec. 741, p. 252; Sec. 802, p. 266;
Farm Inv. Co. vs. Carpenter, 9 Wyo. 110, 125;
Ryan vs. Tutty, 13 Wyo. 130;
X. Y. Irr. D. Co. vs. Buffalo Creek Irr. Co., 25 Colo. 529;
Ft. Lyons Canal Co. vs. Chew, 39 Colo. 392;
Town of Sterling vs. Pawnee Ditch Extension Co., 42 Colo. 421.

All appropriations on every tributary, as well as those from the principal stream, must be considered

in order that the appropriations upon the stream as *a whole* may be so administered as to supply the *needs* of each appropriator and at the same time prevent waste of the valuable natural resource, the water.

Strickler vs. Colorado Springs, 16 Colo. 285.

The above cited statutes of Wyoming provide in part as follows:

> "Rights to the use of water shall be limited and restricted to so much thereof as may be necessarily used for irrigation or other beneficial purposes as aforesaid; irrespective of the carrying capacity of the ditch, and all the balance of the water not so appropriated shall be allowed to run in the natural stream from which such ditch draws its supply of water, and shall not be considered as having been appropriated thereby;
>
> Said water commissioner shall, as near as may be, divide, regulate and control the use of the water of all streams within his district by such closing or partial closing of the headgates as will prevent the waste of water or its use in excess of the volume to which the appropriator is lawfully entitled."

The authorities above cited are to the same effect.

The conditions are further complicated by the rules and laws obtaining in each of the states, wherein the fundamental doctrine of prior appropriation obtains, and *in no two of them are the rights ac-*

quired under the doctrine of the same character or controlled by the same limitations.

For illustration in Colorado the beneficial use of the water is not confined to any specific lands and the appropriator may change the place of application so long as he does not by so doing increase the draft upon the stream either as to the time of the diversion, the duration thereof or the quantity diverted.

Seven Lakes Res. Co. vs. New Loveland & Greeley Irr. & L. Co., 40 Colo. 382;
Diez vs. Hartbauer, 46 Colo. 599;
Ironstone Ditch Co. vs. Ashenfelter, 57 Colo. 31.

In Wyoming, on the other hand the use of the water is limited to a specific tract of land, to which it is made appurtenant and the appropriator is limited to the use of water upon this particular tract, furthermore the maximum amount of the diversion is limited to 1 cubic foot of water per second of time to 70 acres of land.

Wyoming Comp. Stat. 1910, Sec. 724, p. 247.

The foregoing are but a few of the many limitations that attach to the use of water by canals under the rule of prior appropriation, and in order that the greatest benefit to the state and people may be obtained, and none of this valuable resource may be wasted, an organized policing of the streams is required. Where there is an abundance of water little supervision is required but in regions where the demands are great and the quantity limited the administration of the streams becomes a most complicated and trying problem. Each tributary stream has its water commissioner and many deputies and, in turn,

the various water commissioners of all the tributaries are under the supervision of division chiefs or engineers and these in turn under the direct supervision of a State Engineer, who is the chief police officer of the state. The purpose of these various officials and the extent of their respective jurisdictions, varies with the laws of each state according to the local conditions and necessities of the people.

The difficulties presented by the different degrees of vigilance upon the part of the officers and the different methods obtaining within different jurisdictions, may well be illustrated by the prevention of waste in the Cache la Poudre valley in Colorado (where water is scarce and valuable) and the indifference to enormous waste on the Laramie Plains in Wyoming (where water is over abundant and of less value).

(a-1) Waste of Water—Conflict of Administration.

We have observed that both in Wyoming and Colorado waste of water is forbidden. The need of the appropriator determines the extent of his right and, if he has no actual need, the water must not be diverted no matter what the capacity of his ditch or the amount of his decree. Mere subterfuge or pretext for use do not take the place of actual need and the appropriator is limited to his actual necessities and the use of water without waste.

When we speak of "waste", we refer to the unnecessary loss of water and not to the loss always incident to proper diversion and storage. Loss of water by seepage and evaporation in canals when in use to supply the actual needs of the farmer and from reservoirs during the periods of storage, is an incidental and unavoidable loss, which is not "waste"

within the meaning of the term as we use it. The loss incident to the storage and delivery of water through the inter-watershed storage and diversion system of the Wheatland enterprise in Wyoming would, like the incidental loss on the similar tunnel project in Colorado, be unavoidable and is the same character of unavoidable loss that occurs in all irrigation. The evaporation from the Wheatland Reservoir alone is conceded by Wyoming witnesses to be not less than five (5) ft. in depth each year, but this loss, as well as that occasioned by the use of water-ways and long canals for carriage of water to lands, is no more a waste than is the same character of a loss with the Greeley-Poudre system or any other irrigation system.

Necessity for water is so great in the Cache la Poudre valley that Colorado and her citizens have been compelled at the cost of more than a million dollars to drive the Greeley-Poudre Tunnel, here involved, in order to obtain but a relatively small portion of the water of the Colorado portion of the Laramie and it requires several million dollars more to store and deliver the water. Waste is not tolerated under the Colorado system of administration of priorities and diversion and distribution is under most rigid supervision at all times.

On the other hand methods of administration in Wyoming are directly the reverse. Water has been so abundant in the Laramie river valley that practically no administration has been required. Each appropriator has been permitted to help himself and to use or waste the water according to his personal whims, with the result that enormouns quantities of water are there annually wasted, notwithstanding the claim here made by plaintiff that all waters have been appropriated. So

lax are the methods of administration and so enormous is the unnecessary waste that mere economy in application of water would more than compensate for any possible diminution of the stream by the Colorado tunnel project. (See Marginal pages, printed record, 94, 1110, 1280-4, 1288, 2733-50, 3562-76.)

The lax methods of distribution, and the failure of canal owners to so construct their canals that they may divert water from the river in low stages are well stated by Mr. Grant, Wyoming water commissioner for the Laramie river during the dry year, 1913, on marginal pages 1276-89 inclusive of the printed abstract of record.

In part he said:

"Most of the ditches on the big Laramie river are what you might call two-story ditches; that is they were above the bottom of the creek so they would have to have a dam to divert at low stages. At high water they got all the water they needed.

* * * * * * * * *

There were a number of what I called two-story ditches. The average ditch does not cut the bottom of the river. A great many of the ditches are two-story. With a two-story ditch the irrigator obtains all the water he wants when the river is high, but at low stages it requires a dam. At such times the user goes to the head and throws some obstruction in the stream to suit his desires. The change of elevation of water of course makes a change of intake capacity in these two-story ditches. *The irrigators settled their questions themselves;* they

probably would be disgruntled, but didn't bring complaints to my office. From the conditions I noted there on the channel of the river, it looked to me that the same conditions prevailed as they had in the past. (1282-4)

On both the Big and the Little Laramie rivers it is practically physically impossible for any water commissioner to properly apportion the waters with the appliances that exist at the present time. The Little Laramie is better as to headgates than the Big Laramie. *Everything is so crude on both rivers that an apportionment acording to the legal rights of the parties is practically out of the question,* unless one has a current meter to measure it, and then it is a matter of a good deal of labor to try to regulate the water. Each rating consumes considerable time and expense. So that, for the *orderly administration* of that water supply the conditions are not there. * * * The Big Laramie is passing through the same history that all streams have passed through until a certain pressure is brought to bear on them, when they have to put in certain devices to regulate the water." (1288-89.)

Engineer Woodhall on marginal pages 2733-51 describes the conditions prevailing upon the Laramie Plains as compared with those obtaining in the Poudre valley. He describes in detail the enormous and unnecessary waste of water obtaining on the Laramie Plains during the dry season of 1913. He recites the deliberate diversion by large canals of great quantities of water on mere pretext for use

and subsequent discharge thereof into great evaporation basins, where there was no return to any stream. (2741-3.) In December, 1913, two large canals of the Little Laramie river, under pretext of domestic use for watering a few head of stock, were diverting to three-fourths their capacity and discharging the water into Big Basin, a waste lake some 75 feet lower than the river, there to remain until evaporated (2741). He also described a similar condition under the Big Laramie canals, including the Pioneer canal and the recently constructed Lake Hattie Reservoir system (2743-50).

So abundant has been the suply of water from the Laramie River that it has become the custom of the residents of the Laramie Plains to run water in their ditches indefinitely under pretext of supplying water to live stock notwithstanding the enormous and unnecessary waste. This is well illustrated by the case of the Pioneer Canal (the large canal on the Big Laramie River heading not far below the interstate line). Mr. E. D. Titus had been superintendent of the canal for 15 years (858). By July 15 all necessity for irrigation under the canal ceases (866). The area under the canal is well supplied with wells (867) and is a region of lakes and ponds formed by unnecessary waste of water. Notwithstanding these conditions, it has been the prevailing custom to run from 50 to 60 cubic feet of water continuously from July 15 into December of each year for the sole alleged purpose of supplying drinking water to about 2,000 head of cattle running at large in that vicinity, and possibly (but not probably) a few of the 250 people residing under the canal. Mr. Titus states:

> "They keep water running on the meadows from the time I turn it on until they shut it off. After that I do not run a large

head of water, because there is no demand, but *I keep running water into December* for domestic and stock use. * * * * *

After they have ceased irrigating I would run as low as 50 second feet or 60, enough to carry through to the lower end—for watering these cattle and people. Very little water went back to the river or into the numerous lakes. * * * *The people and stock and seepage and evaporation consumed this 50 second feet running constantly.*" (867-8)

(Note: This reference erroneously given as at p. 967, Vol. II., p. 196, orig. brief.)

Computation reveals:—One cubic foot per second delivers 2 acre feet every 24 hours; 50 cubic feet per second equals 100 acre feet per day, which, running for 150 days, would make a total of 15,000 acre feet of water needlessly diverted by the Pioneer Canal each year under pretext of furnishing drinking water for a few people and cattle in a region already filled with wells, lakes and ponds.

John E. Field, former state engineer of Colorado, and an expert of national repute, describes the lack of administration on the Laramie River in Wyoming on marginal pages 3562-76 of the record and also compares the conditions in that region with those of the Cache la Poudre valley. He attributes the enormous waste in Wyoming region to the great abundance of water, no actual shortage ever having been felt, and the custom prevailing of each appropriator helping himself irrespective of his needs (94, 1110), without necessity of supervision or of attempt to control the diversions. By way of illustration he computed the loss by mere evaporation from the un-

necessary waste lakes and ponds on the Laramie Plains into which water is permitted to discharge never again to be used, and concludes by saying:

> "Unnecessay loss fom evaporation on the Laramie Plains is equal to or greater than the proposed diversion of the Greeley-Poudre Irrigation District from the Laramie River. This proposed diversion, under the present construction, I stated to be about 56,000 acre feet per annum in normal years. 60,000 acre feet per annum are calculated to be the unnecessary loss and waste of water by methods employed on the Laramie Plains. (3575)
>
> If Wyoming appropriators would eliminate the unnecessary waste on the Laramie Plains region alone, it would result in a saving of more than enough water to supply the entire diversions of the Greeley-Poudre system from the Laramie River." (3576)

The foregoing quotations, of the many available in the record, will serve to illustrate the conditions that confront the one item of unnecessary waste included within the general administration of diversion and distribution of water by priority of appropriation irrespective of state lines. Wyoming here asserts that she has made prior appropriation of all the waters of the Laramie River, including those which rise in Colorado, and in her supplemental brief tabulates the canals and reservoirs by means of which she contends she made appropriation prior to the initiation of the Greeley-Poudre project (August 25, 1902). Wyoming, however, has made no attempt to regulate and administer the diversions made by

her canals and has made no effort to curtail unnecessary waste. She insists that conditions shall continue upon that river as they have in the past, if this were not so, no claim would here be made that all the waters are necessary to supply the demands of her alleged prior canals for, as we have observed, elimination of unnecessary waste would more than compensate for any depletion of the river by reason of the Colorado tunnel diversion. In other words, she insists that she be permitted to continue to both waste and use; that she has a prior right so to do, and that Colorado shall be prohibited from diverting any water for the imperative necessities of her people, which diversion may interfere with accustomed waste and use of the waters of the stream by Wyoming.

Administration of diversions of water under the rule of priority of appropriation, irrespective of state lines, would be confronted at the outset with the foregoing conditions. And the question of the means or method by which this problem could be solved naturally presents itself. Wyoming would doubtless insist, as she does here, that her appropriators would have a right to continue to both waste and use in the future as in the past, while Colorado would insist that she had a right to divert irrespective of the claims of Wyoming.

We do not venture to speculate upon the means or method by which this controversy could be determined and thereafter regulated. Neither state would have any right beyond its own borders, and its laws or the decisions of its court would have no extra-territorial force or effect. Both states deny foreign servitudes, and there could be no assumption of reciprocal easements. The conflict would be irreconcilable. If Wyoming were adjudged the right to continue in the future as in the past (and such is her

assertion) then acres of thirsty land in Colorado would remain unproductive. The one state, like the prodigal son, would waste the common asset in riotous living and extravagance, while the other member of the family of states would go in want. Yet who in such a case would be the final judge and who would enforce the final order?

(a-2)Enlarged Demand to Junior's Detriment.

The conflict of administration is further illustrated by enlarged demands upon the stream by a senior appropriator to the detriment of a junior. As above noted, the appropriator is limited by his actual needs and the previous use of the water to supply those needs, irrespective of the size of his canal or the amount of his decree, both of which but fix the maximum to which his diversion may go in any event, and further, that he may not enlarge his demands upon the stream, under pretext of his prior appropriation, either in time or quantity, to the detriment of a junior, who is entitled to have the conditions upon the stream remain as they were when his right was initiated. If the senior is permitted to change these conditions by diverting a larger quantity of water or for a longer period of time than he had theretofore, the supply of the stream is cut off from the junior to the extent of the enlarged draft. Such problems constantly confront the state administration of priorities.

Perhaps no better illustration of such an enlarged demand could be found than that asserted, with some semblance of seriousness, by Wyoming in this case. According to plaintiff's Exhibit N, the decree of adjudication upon the Laramie River, and the tabulation appearing in plaintiff's supplemental

brief, pp. 24-5, the Pioneer Canal, diverting water from the Big Laramie River not far below the intertate line, was decreed appropriations as of 1879 and 1884, respectively. By the terms of the decree (Ex. N), the canal was awarded appropriation for 49,030 acres of land, although the evidence showed that never more than 15,000 acres had been irrigated, and in 1913 the canal was serving about 11,556 acres (824, 844 plaintiff's supp. brief, p. 20). Promoters entered the Wyoming area in the spring of 1908 and thereafter initiated and constructed the new Lake Hattie enterprise and enlarged the upper portion of the old Pioneer Canal for joint use by the new enterprise (see pp. 202-221, Vol. II, def. orig. brief and tables). In 1912 the then owners of the new Lake Hattie system, finding themselves with a large reservoir on their hands but with limited lands capable of service, conceived the idea of in effect taking the waters of that lake to the higher levels by a system of exchange by which they would discharge into the river below the reservoir an amount of water equivalent to that which they would take directly from the stream by means of the higher line of canal in contemplation. They accordingly caused a survey to be made and on July 11, 1912, made filing for which permit No. 2719 enl. was granted on July 3, 1913, permitting the exchange of water, but specifically providing that no additional draft should be made upon the stream than that authorized by previous permit 8612, filed April 21, 1908, by the same appropriators. (See cert. copy of permit, def. Ex. No. 160.)

Notwithstanding the above facts the State of Wyoming sought to cloud the situation in this case by attempting to show some possible, though not actual, connecton between this new survey line of 1912 and the old Pioneer Canal, and also certain dis-

connected "fly line" surveys that had been run within a general vicinity, covering an area of 25 miles, by independent engineers in the years previous and thereby evidently intended to leave the impression that the new Pioneer High Line, if ever built, would be entitled to demand water from the stream as of the date of the original Pioneer Canal.

We discussed this situation in Vol. II of defendants' original brief, pp. 234-53, wherein the survey line is designated the "Mythical Pioneer High Line Canal," by reason of the fact that to this day the whole project has never progressed beyond a mere survey line followed by a permit issued in 1913. On pages 37-9 of plaintiff's supp. brief this mere survey line is still treated as a possible claim under color of the original appropriation of the Pioneer Canal, thereby to cloud the intervening claim of the Greeley-Poudre system of Colorado, initiated August 25, 1902. In other words, in effect the plaintiff would leave the impression that it was entitled to claim an enlarged draft upon the river by virtue of the Lake Hattie system and this survey line to the depletion of the stream and the detriment of the junior.

Let us assume for purpose of argument that the Wyoming authorities should hereafter permit the new Lake Hattie system, initiated in 1908, and the Pioneer High Line Canal survey, initiated in 1912, to claim and divert water from the Laramie River under color of the original Pioneer appropriations of 1879 and 1884, while, on the other hand, Colorado and her citizens should insist upon the right to divert water from the upper branches of the stream in that state by the tunnel system, under priority of August 25, 1902, as determined and fixed by her District Court (plff's. Ex. No. 179). An irreconcilable conflict would at once arise, and while it is the unques-

tioned rule that a senior cannot lawfully enlarge his demand upon the stream either in time or quantity to the detriment of a junior, nevertheless such would be the situation, and, while in this instance the geographical position of the junior upon the stream would permit it to take the water and defy the senior in its enlarged demands, yet in the final end the problem would have to be met and solved by some one. The power of neither state would extend beyond its borders, no state official would have authority to adjust the controversy, and the Constitution neither directly nor by implication grants any such authority to Congress. How or by whom the controversy would be settled and the order enforced would be an open question. If necessity should require this Court to settle such a controversy then it would be made the tribunal for the settlement of all controversies between individual appropriators wherever occurring and the burden heretofore borne by the courts of the several states would be transferred *en masse*. It is very evident that the state courts, understanding as they do the local conditions and necessities, are in a better position to adjust the conflict between individual appropriators than would any other courts of the land. But if priorities must obtain irrespective of state lines, then the local courts would be shorn of their jurisdiction and some other court or tribunal would of necessity assume the task.

(b) Appropriation by Reservoirs—Exchanges.

Thus far we have considered but the most elementary principles governing the simpler diversions by ditches. When, however, the use of water, diverted from the river and temporarily stored on its way to the land, enters the problem, the administra-

tion becomes doubly complicated and immediately there occurs what is termed an "exchange" system whereby a junior reservoir may turn a definite quantity of water into the stream above the headgate of some lower but senior appropriator and take in return an equivalent amount from the stream through some higher but junior ditch controlled by the reservoir people, thereby compensating for the depletion of the stream by the junior. This in turn, repeats itself and intermediate loans and exchanges are so made that frequently the most junior but upper ditch upon the stream is taking the water of the most senior but lowest ditch, and yet, in turn, the quantity of water which the junior turns from its reservoir to compensate for the depletion is re-loaned and exchanged several times in such a manner that finally the depletion is compensated by still other reservoirs which have taken the water delivered to the stream for the first exchange. Under this system, necessary to obtain the greatest beneficial use from the water, a complicated system of accounting is necessary and the office of the water commissioner comes to be sort of clearing house for the stream, debiting and crediting as each exchange occurs, and each of the water commissioner districts in turn is compelled to carry on its system of diversions and exchanges in such a manner as not to infringe upon appropriations lower down along the principal stream or upon any of its tributaries which may be affected.

These systems of administration are the natural development of half a century of legislation and administrative experience and vary not only in each state, but even to some degree in the districts within the states, according to the natural conditions obtaining and the necessities of the people. Each pressing necessity demands still more complicated adminis-

tration and the present system is but the beginning of what is yet to come.

This more perfect development demands the most exacting local administration, always open to immediate regulation by local courts, by officials not alone familiar with the conditions and necessities of the community, but as well responsive to the people and the state, and not to some distant authority unfamiliar with local conditions and unable to afford such immediate relief or correction as may be required in order to obtain the maximum benefits from the use of the water in the production of crops.

If such exchanges were undertaken upon an interstate scale, this efficiency would not only be reduced by the complications that must inevitably arise and must then be settled by more remote authority, but even more, the problem would be, by what authority? The administration would, at best, require as great a force of local supervisory officials in all parts of the states through which the stream should pass, but how such could be appointed and under whom they should act, and, at the same time, be responsive to constant local judicial control, we are unable to conjecture. Add to this the conflict of state laws and the problem becomes incapable of solution.

(c) Other Considerations—Conclusion.

To continue the discussion of the various limitations of the right of the appropriator and the necessary details of correct administration would occupy many pages of this brief. Sufficient appears, however, for our present purposes.

To clearly understand the inevitable result of the application of priority irrespective of state lines,

in view of what we have just said, the conditions upon the Platte River in Colorado, Wyoming and Nebraska will serve as a good example.

A sketch map of the Platte River appears in the upper left-hand corner of the large map (Ex. 1) attached to the answers of the corporate defendants. The Platte River enters the Missouri at the eastern boundary of Nebraska. Passing up stream through Nebraska, it divides into two branches at the city of North Platte. The north branch (North Platte) continues northwesterly into Wyoming, through that state and thence southerly into North Park, Colorado, where it has its principal source. The south branch (South Platte) continues through western Nebraska and northeastern Colorado to South Park near the center of the state. This south branch receives its waters from many tributary streams from the mountains of Colorado. Included within the drainage area of the north branch is the Laramie River, which has its source partly in Colorado and partly in Wyoming, and thence flows into the north branch at old Ft. Laramie. The diversion here in controversy is from one tributary of the north branch of the river through an intervening divide to a tributary of the south branch of the same stream. The various ditches and reservoirs upon this stream will serve to illustrate the conditions which confront an administration of the waters of a stream and its tributaries, according to the rule of priority of appropriation irrespective of state lines.

Purely by way of illustration and outside the record, we observe that the public records of the State Engineer of Colorado reveal the following number of decreed water rights from the south branch of the Platte in that state:

Decreed Water Rights—South Platte Drainage.

River.	Water District.	Ditches.	Reservoirs.
South Platte	No. 1	221	120
South Platte	No. 2	80	30
South Platte	No. 23	478	18
South Platte	No. 64	64	6
Cache la Poudre	No. 3	110	56
Thompson	No. 4	81	18
St. Vrain	No. 5	173	55
Boulder	No. 6	122	34
Clear Creek	No. 7	105	24
Plum Creek	No. 8	210	25
Bear Creek	No. 9	31	9
Total		1,675	325

The same records reveal the following number of decreed water rights within the north branch of the Platte in that state:

Decreed Water Rights—North Platte River Drainage.

River.	Water District.	Ditches.	Reservoirs.
North Platte	No. 46	177	2
North Platte	No. 47	388	2
Laramie	No. 48	90	19
Total		655	23

From the foregoing tables it appears that there are 2,330 decreed ditches and 348 decreed reservoirs from the Platte River (both branches) in Colorado.

The public records of the State Engineer of that state further reveal that there are claims for incomplete appropriations in excess of those already decreed, but consideration of these is unnecessary for the purposes of this illustration.

It is safe to assume that the decreed rights from the North Platte branch in Wyoming are far in excess, numerically, of those in Colorado. Plaintiffs' Exhibit N (a compilation of the decreed rights on the Laramie River in Wyoming) reveals 483 decreed rights upon the Laramie River and tributaries in that State and, for purpose of illustration, we feel warranted in saying that probably not less than 1,000 ditches and reservoirs have been decreed from the North Platte and tributaries in Wyoming. The evidence in this case shows that several large enterprises dating not earlier than 1908-9 have been completed or are in the process of construction within the Laramie River branch and the published reports of the office of the State Engineer of Wyoming likewise show that hundreds of permits have been issued for projects in the North Platte drainage not yet decreed. We shall pass these undecreed appropriations in the same manner we have those in Colorado.

The published reports of the office of the state engineer of Nebraska show a large number of decreed reservoirs and ditches within the Platte River drainage (both branches) in that state and we feel warranted in assuming that not less than 300 diversions, large and small, are there decreed.

The sum total of the foregoing figures reveals that administration under the rule of priority, irrespective of state lines, would require readjudication

and police regulation of upwards of 4,000 diversions already established and decreed by state authorities upon the Platte River alone and, in the years to come, probably a like number of new and now more or less incomplete enterprises.

In view of the fact that the right of the appropriator is not defined by the capacity of his ditch or the maximum amount awarded him in his decree but is limited to his actual necessities during each day of the year and that his diversions must constantly be regulated and restricted to the extent of his then present necessities, and further in view of the complicated conditions arising from exchanges and other administrative features existing upon each of the tributaries as well as upon the stream itself, it is self-evident that the difficulties confronting interstate administration of the Platte River would become so involved that to give each appropriator his just dues and no more and at the particular time his necessities demand, would be next to impossible. If such should be declared to be the rule, the rights of all must be protected and enforced, the least must receive the same consideration as the greatest and that too at the particular time when the crop demands water in order that loss may be avoided.

Yet no state official has power to control the regulation beyond his own borders or other than as prescribed by local laws, rules and regulations. No state court or tribunal has power to fix by decree rights of appropriation in other states, to adjust conflicting claims, or to determine from day to day the rights of foreign users. The system prevailing in one state is so different from that of a neighboring state that irreconcilable conflict is inevitable. The problem presented under one system of state law is, at best, difficult and involved, but where a conflict of

laws would enter, the problem of administration would be incapable of solution.

In order to take the initial step toward administration of the rule, all of the states would be compelled to repeal their present laws, rules and regulations and to adopt one uniform system *irrespective of local conditions or necessities.* But this may not be done without the voluntary consent of all, neither state may legislate for the other and Congress can legislate for none.

> "Neither state can legislate for or impose its own policy upon the other.
>
> Congress cannot enforce either rule upon any state."
>
> Kansas vs. Colorado, 206 U. S. 46, 94, 95.

If this court should decide that the private usufructuary rights of the individual appropriators preclude the states from asserting greater rights to the river and that priority shall obtain irrespective of state lines, then such rights must be adjudicated by the court in this and similar cases. This would necessitate a determination not of the rights of the states, but of *each individual claimant* and the rights of each, great or small, would have to be separately considered and passed upon. The mere suggestion of the problem portrays the insurmountable obstacles to be encountered.

The decrees of the state courts bind only those within their jurisdiction.

> Pennoyer vs. Neff, 95 U. S. 714.
> (See supra, p. 257 to 262).

We refuse to recognize Wyoming decrees and they ours.

What court, other than this, could enter upon such an adjudication?

Even should this court undertake this individual adjudication, its enforcement would next confront us. Shall an army of United States marshals police the stream and regulate the diversions? No state officials have power to enforce other than the laws and decrees of their own state.

Then too, conditions are constantly changing. New rules and laws of one character may become imperative in Colorado but Nebraska or Wyoming need new laws entirely the reverse of those required in Colorado. Who then shall enact these laws? The subject is no longer within the control of the states because their juridiction has been denied them. Congress cannot legislate, for it has no power so to do. (206 U. S. 90-92.) The canals divert waters from streams washing lands long sinced passed into private hands and not public lands of the United States. This court cannot legislate. Who then shall remedy the evil or supply the new rule? The United States asserted the right so to do but this court declared the contrary. (206 U. S. 85-93)

Further pursuit of this line would be but to multiply indefinitely the examples of questions such a rule of law would provoke and but further reveal the conflict of jurisdiction. Problems unheard of today will clamor for recognition and solution on the morrow. But fifty years ago Colorado was an arid waste. Today more than 3,000,000 acres of land are productive to an intensive degree, through irrigation fostered, protected, encouraged and regulated by the state. What another fifty years will bring we can but conjecture. Very evidently, in the language of Mr. Justice Field:

"It is, therefore, a matter of good sense and practical wisdom to leave their control and management with the states."

Escanaba Co. vs. Chicago, 107 U. S. 678, 688.

(5) Prior Appropriations Restricted by State Lines.

Without reviewing the preceding pages and the various subdivisions of the discussion of both the law and administration of the general principles of the prior appropriation, we conclude: That the doctrine of prior appropriation is one of private usufructuary property law *intra-state* in its character, varying in each of the states where adopted according to the local conditions and necessities and exactly alike in no two thereof; that it is inequitable and inapplicable either as a rule of law or administration for *interstate* regulation of streams, and that the general principles of appropriation cannot apply in the settlement of controversies involving the rights of sovereign states.

VII.—BY WHAT PRINCIPLES THE CASE IS TO BE CONTROLLED.

In the previous pages we have discussed at length that part of the first subdivision of the order for reargument which reads:

"whether the rights asserted are to be tested and determined solely by the application of the general principles of prior appropriation, without regard to state boundaries, or whether, on the contrary, the general principles of prior appropriation are subject to be restricted or their operation limited in this case by state lines,"

and have there observed that the general principles of prior appropriation are but rules of private property law for *intra-state* regulation and control of the uses of waters of streams, to be restricted and their operation limited by state lines and that the general principles of appropriation cannot apply to the settlement of controversies involving the rights of states.

Having arrived at the conclusion that "the general principles of prior appropriation are to be restricted or their operation limited in this case by state lines" we are now directed by the order to state "by what principles, under that assumption, the case is to be controlled."

In the opening pages of this brief we observed that this original proceeding is between two states of the Union each asserting sovereign rights, that the rights of the private citizens or appropriators of either of the states are included within the greater right of the state and that if the case against Colorado fails it fails also as against the corporate defendants.

The controversy is one between two sovereign states and rises therefore above a mere suit to determine the rights of the individual appropriators within each of the states; the action complained of is state action and the principles of law which apply between states are not those which would be applied between individuals.

Missouri vs. Illinois, 180 U. S. 208, 242, 200 U. S. 496.

Kansas vs. Colorado, 185 U. S. 125, 206 U. S. 46.

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258.

Bean vs. Morris, 221 U. S. 485.
Georgia vs. Tennessee Copper Co., 206 U. S. 230.

As observed by Mr. Justice Brewer in *Kansas vs. Colorado, supra*:

> "It is the State of Kansas which invokes the action of this court, charging that through the action of Colorado a large portion of its territory is threatened with disaster. In this respect it is in no manner evading the provisions of the Eleventh Amendment to the Federal Constitution. *It is not acting directly and solely for the benefit of any individual citizen to protect his riparian rights.* Beyond its property rights it has an interest as a state in this large tract of land bordering on the Arkansas river. Its prosperity affects the general welfare of the state. *The controversy rises, therefore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint. Georgia vs. Tennessee Copper Co.*, decided this day, *post*, p. 230." (206 U. S. 99.)

It is well to observe at the outset that the rule of interstate servitudes or easements cannot here apply. Neither state recognizes and on the contrary repudiates any such, whether asserted under the private usufructuary doctrine of appropriation, or otherwise. Such extra-territorial easements or servitudes are thus referred to in the cases:

> "But it does not follow that every matter which would warrant a resort to equity by one citizen against another in the same

jurisdiction equally would warrant an interference by this court with the action of a state. It hardly can be that we should be justified in declaring statutes ordaining such action void in every instance where the Circuit Court might intervene in a private suit, upon no other ground than analogy to some selected system of municipal law, and the fact that we have jurisdiction over controversies between states.

The nearest analogy would be found in those cases in which an easement has been declared in favor of land in one state over land in another. But there the right is recognized on the assumption of a concurrence between the two states, the one, so to speak, offering the right, the other permitting it to be accepted. *Manville Co. vs. Worcester*, 138 Massachusetts, 89. *But when the state itself is concerned and by its legislation expressly repudiates the right set up*, an entirely different question is presented."

Missouri vs. Illinois, 200 U. S. 496, 521.

"When a right is asserted in favor of land in one jurisdiction over land in another, different principles are involved from those that suffice when both parcels are subject to the same law. When such rights have been recognized it has been on the ground of an assumed concurrence between the two states, the one, so to speak, offering the right, the other permitting it to be accepted. *Manville Co. vs. Worcester*, 138 Massachusetts, 89. *Missouri vs. Illinois* 200 U. S. 496, 521. But still there are two parcels of land subject to different systems

of law; and although the rights and liabilities in respect of each may require a consideration of the other if they are to be dealt with completely, the fact remains that each may be regulated by the state where the land lies *according to its sovereign will. Kansas vs. Colorado*, 206 U. S. 46, 93."

Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 258, 260.

"* * * we pass at once to the question of *private* water rights as between users in different states.

We know no reason to doubt, and we assume, that, subject to such rights as the lower state might be denied by this court to have, and to vested private rights, if any, protected by the Constitution, the state of Montana has full legislative power over Sage Creek while it flows within that state. *Kansas vs. Colorado*, 206 U. S. 46, 93-95. Therefore, subject to the same qualifications, we assume that the concurrence of the laws of Montana with those of Wyoming is necessary to create easements, or such private rights and obligations as are in dispute, across their common boundary line. *Missouri vs. Illinois*, 200 U. S. 496, 521. *Rickey Land & Cattle Co. vs. Miller & Lux*, 218 U. S. 258, 260. But with regard to such rights as came into question in the older states, we believe that it always was assumed, *in the absence of legislation* to the contrary, that the states were willing to ignore boundaries, and allowed the same rights to be acquired from outside the state

that could be acquired from within. *Manville vs. Worcester,* 138 Mass. 89 (and other cases)."

Bean vs. Morris, 221 U. S. 485, 486.

The same general qualification appears within each of the foregoing. In *Missouri vs. Illinois*:

"But when the state itself is concerned and by its legislation expressly repudiates right set up, an *entirely different* question is presented." (200 U. S. 521).

In *Rickey Land & Cattle Co. vs. Miller & Lux*:

"Each may be regulated by the state where the land lies according to its sovereign will. (p. 260)

But whatever this court may decide, *if a private owner should derive advantage from such a decision it would not be in his own right, but by reason of and subordinate to the rights of his state,* and those rights, the petitioner insists, can, or at least should be, determined only in a suit brought by the state itself." (p. 261.)

And in *Bean vs. Morris*:

"We believe that it was always assumed *in absence of legislation to the contrary,* that the states were willing to ignore boundaries, etc." (p. 487)

Here, however, "the state itself is concerned and by its legislation expressly repudiates the right set up" and Colorado repudiates the right as well by her answer herein as by her constitution, laws and the decisions of her courts and "an entirely different question is presented" Colorado asserting that the

part of her domain "may be regulated by the state where the land lays according to its sovereign will," and there is no "absence of legislation to the contrary."

As stated by Mr. Justice Campbell:

> "The state has never relinquished its right of ownership and claim to the waters of our natural streams, though it has granted to its citizens, upon prescribed conditions, the right to the use of such waters for beneficial purposes and within its own boundaries. The property right, however, in the natural streams, and the waters flowing therein, has never been renounced or relinquished by the state, and it has at all times asserted not only its right of ownership, but the unrestrained right, within its own boundaries, to distribute its waters to those who have, under its authority, acquired, by perfected appropriations, the right to their use.
>
> This constitution of ours was ratified and adopted by the legal voters of the state in accordance with the conditions prescribed by the enabling act of congress, and the president of the United States in his proclamation admitting Colorado into the Union found the fact to be that the fundamental conditions imposed by congress on the State of Colorado to entitle it to such admission had been complied with. Congress, in passing the enabling act, and the President, in issuing his proclamation, were aware of the existing physical conditions and of the topography and geography of the state. The federal government, by its lawmaking and

executive bodies, knew that the natural streams of this state are, in fact, non-navigable within its territorial limits, and practically all of them have their sources within its own boundaries, and that no stream of any importance whose source is without those boundaries, flows into or through this state. The entire volume of these streams is therefore made up of rains and snows that fall upon the surface of lands included within the exterior lines of this state and of springs which issue from the earth within the same area. Such being the peculiar conditions, the state was justified in asserting its ownership of all the natural streams within its boundaries. When Colorado was admitted into the Union with such a constitution, the federal government, through its lawmaking and executive departments, thereby recognized and confirmed such right of ownership as belonging to the state in its sovereign capacity. We therefore find it to be not only that our state constitution and pertinent statutes, but the decisions of the courts and duly announced public policy, all are in accord on the proposition to which the federal government has, as we have just shown, given its consent that the waters of the natural streams of this state belong to the people, to the state, in its sovereign capacity, *and that its right to their distribution and control within its borders is free from any interference by any other sovereignty.*

There is nothing in Lamson vs. Vailes, 27 Colo. 201, 61 Pac. 231, at all inconsistent

with this conclusion. In that case this court declined to pass on the question which is involved in the pending action, because it was not necessary to the decision of that controversy. This court, by then withholding expression of opinion, did not intend to intimate, and did not intimate, that this state did not have full control over its natural streams and the distribution of their waters. The right of congress to regulate and control navigable interstate streams and the jurisdiction of the Supreme Court of the United States to determine, in a controversy between two or more sovereign states over the waters of an interstate stream, whether they are reasonably exercising their inherent powers of sovereignty, are not overlooked or questioned by us; but these considerations do not, for the reasons above stated, affect or bear upon the right of ownership and control by Colorado of its own natural streams, and its power and authority to regulate the distribution of their waters, within its own territory, for beneficial purposes. We find nothing in *United States v. Rio Grande Irrigation Co.*, 174 U. S. 690, 19 Sup. Ct. 770, 43 L. Ed. 1136; *Kansas v. Colorado*, 206 U. S. 46, 27 Sup Ct. 655, 51 L. Ed. 956; *Rickey L. & C. Co. v. Miller & Lux*, 218 U. S. 258, 31 Sup. Ct. 11, 54 L. Ed. 1032; *Bean v. Morris*, 221 U. S. 485, 31 Sup. Ct. 703, 55 L. Ed. 821, or in any other case that has been brought to our attention, which militates against our conclusion, when these cases are considered, as they should

be, in connection with the facts on which they were determined. We therefore conclude that the general assembly, in order to protect the rights of the state in our natural streams and their waters, and the interests which its citizens have acquired thereunder, may make a valid appropriation of money for the purpose of protecting and defending them."

Stockman v. Leddy, 55 Colo. 24, 28.

Colorado has by statute affirmed the doctrine steadfastly adhered to by her from the date of her admission, repudiating any and all claims of other states to her waters or any portion thereof.

See S. L. Colo. 1917, Chap. 151, p. 539.

Wyoming likewise has denied and repudiated the doctrine of servitudes or easements across her borders.

Grover Irr. Co. v. Lovella D. Co., 21 Wyo. 204 (see quotation *supra*).

Servitudes or easements across the interstate boundary between the two states, whether under color of the doctrine of priority of appropriation or otherwise, are therefore requdiated by both states, and further discussion of any such doctrine is unnecessary.

The settlement of controversies over the waters of international rivers is usually regarded as one of policy to be adjusted by treaty.

Opinions of Attorneys General, Vol. XXI, 274, 283.

Kansas v. Colorado, 185 U. S. 125,.140, 144.

Kinney on Irrigation & Water Rights (2d Ed.), Vol. 3, p. 2195.

And while the several states of the Union have, by the first clause of Section 10, Article I of the

Constitution, surrendered their powers to enter into any treaty alliance or confederation, by paragraph 2 of the same section they have reserved the right, by "consent of congress," to "enter into any agreement or compact with any other state".

Section 10, Article I, Constitution of United States.

By the foregoing section it is apparent that the states still have the power, consent of congress having been obtained, to adjust their interstate controversies over rivers by "agreement or compact."

Missouri vs. Illinois, 180 U. S. 208, 238.
200 U. S. 496, 518.
Kansas vs. Colorado, 185 U. S. 125, 140.

Mr. Wiel asserts that such will be the ultimate solution of interstate controversies over streams, saying:

> "Between states, each is entitled to have for its prosperity an equitable apportionment of benefits from an interstate stream. Consequently, control of interstate streams is likely to gravitate toward the formation of joint commissions between the states to supervise their use and make regulations."

Wiel on Water Rights, (3rd Ed.) Vol. 1, p. 372.

Yet if independent nations fail to adjust their controversies by treaty their differences would be of such a nature as to justify a settlement by force and the same methods of settlement would apply between states of the Union were it not for the surrender of such power in the Constitution.

Missouri vs. Illinois, 180 U. S. 208, 241;
S. C. 200 U. S. 496, 518.
Kansas vs. Colorado, 185 U. S. 125, 143,
S. C. 206 U. S. 46, 95-7-8.

As stated in *Missouri vs. Illinois, supra*:

> "If Missouri were an independent and sovereign state all must admit that she could seek a remedy by negotiation, and, that failing by force." (180 U. S. 241)

By Mr. Justice Brewer in *Kansas vs. Colorado, supra*:

> "The powers affecting the internal forces of the states not granted to the United States by the Constitution, not prohibited by it to the states, are reserved to the states respectively." (206 U. S. 90.)
>
> "If the two states were absolutely independent nations it would be settled by treaty or force, neither of these ways being practicable, it must be settled by decision of this court." (206 U. S. 98).

And as observed by Mr. Justice Holmes in *Missouri vs. Illinois*:

> "The nuisance set forth in the bill was one which would be of international importance—a visible change of a great river from a pure stream into a polluted and poisoned ditch. The only question presented was whether as between the states of the Union this court was competent to deal with a situation which, if it arose between independent sovereignties, might lead to war. Whatever differences of opinion there

might be upon matters of detail, the jurisdiction and authority of this court to deal with such a case as that is not open to doubt." (200 U. S. 518.)

It would thus appear that this controversy over a portion of the waters of one branch of an interstate stream is of equal dignity with a controversy between independent nations, and this court is called upon, in this and similar cases, to decide the controversy on the broader grounds of interstate and international law.

Kansas vs. Colorado, 185 U. S. 125, 146;
Id. 206 U. S. 46, 97.
Missouri vs. Illinois, 200 U. S. 496, 520.

As observed by Mr. Justice Brewer in *Kansas vs. Colorado, supra*:

"Nor is our jurisdiction ousted, even if, because Kansas and Colorado are states sovereign and independent in local matters, the relations between them depend in any respect upon principles of international law. International law is no alien in this tribunal. * * * In other words, through these successive disputes and decisions this court is practically building up what may not improperly be called interstate common law." (206 U. S. 97.)

In controversies involving interstate streams two fundamental principles control.

The *first*:

"Each state has full jurisdiction over the lands within its borders. * * * It may determine for itself whether the common law rule in respect to riparian rights

or that doctrine which obtains in the arid region of the West of the appropriation of waters for the purposes of irrigation shall control. Congress cannot enforce either rule upon any state."

Kansas vs. Colorado, 206 U. S. 46, 93.

Or, in other words:

"The states have authority to establish for themselves such rules of property as they may deem expedient with respect to the streams of water within their borders, both *navigable and non-navigable.*"

United States vs. Cress, 37 Sup. Ct. Rep. 380, 381.

The *second*:

"One cardinal rule, underlying all the relations of the states to each other is that of *equality of right.* Each state stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none." (206 U. S. 97.)

The controversy should be so settled that the sovereign powers of both states are preserved and at the same time establish justice between them:

"Whenever, as in the case of Missouri vs. Illinois, 180 U. S. 208, the action of one state reaches through the agency of natural laws into the territory of another state, the question of the extent and the limitations of the rights of the two states becomes a matter of justiciable dispute between them, and this court is called upon to settle that dis-

> pute in such a way as will recognize the *equal rights of both* and at the same time establish justice between them." (206 U. S. 98.)

A greater degree of caution is manifest in such controversies than would obtain in suits between citizens within the same or different jurisdictions. And the complaining state should be required to establish the injury and its right to relief upon the clearest and most indisputable testimony before this court would be warranted in preventing the other state from exercising its sovereign control over its natural resources.

In Missouri vs. Illinois, 180 U. S. 208, 248, Mr. Justice Shiras thus announced the degree of proof required before injunction would issue to restrain a nuisance upon an interstate stream:

> "We fully agree with the contention of defendants' counsel that it is settled that an injunction to restrain a nuisance will issue only in cases where the fact of nuisance is made out upon determinate and satisfactory evidence; *that if the evidence be conflicting and the injury doubtful, that conflict and doubt will be a ground for withholding an injunction;* and that, where interposition by injunction is sought, to restrain that which is apprehended will create a nuisance of which its complainant may complain, the proofs must show a state of facts as will manifest the danger to be real and immediate."

And in the same case on final hearing, after proof, Mr. Justice Holmes thus distinguished be-

tween state controversies and those between individuals and announced the greater caution and degree of proof required in the former:

> "It may be imagined that a nuisance might be created by a state upon a navigable river like the Danube, which would amount to a *causus belli* for a state lower down, unless removed. If such a nuisance were created by a state upon the Mississippi the controversy would be resolved by the more peaceful means of a suit in this court. But it does not follow that every matter which would warrant a resort to equity by one citizen against another in the same jurisdiction equally would warrant an interference by this court with the action of a state. It hardly can be that we should be justified in declaring statutes ordaining such action void in every instance where the Circuit Court might intervene in a private suit, upon no other ground than analogy to some selected system of municipal law, and the fact that we have jurisdiction over controversies between states.
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> * * * * * * * * *
>
> *Before this court ought to intervene the case should be of serious magnitude, clearly and fully proved, and the principle to be applied should be one which the court is prepared deliberately to maintain against all considerations on the other side.* See *Kansas vs. Colorado*, 185 U. S. 125.
>
> As to the principle to be laid down the caution necessary is manifest. * * * To decide the whole matter at one blow by

an irrevocable fiat would be at least premature." (200 U. S. 520.)

In that case this court refused to enjoin Illinois from discharging sewage and other waters into the Mississippi river, where it appeared from the evidence that other cities, including those in Missouri were contributing to the same condition and the proof of the injury was inadequate to justify an injunction.

In the present case we contend that the proof by Wyoming falls so far below the allegations of the bill that it is not brought within the principles governing such controversies. Not only has Wyoming failed to sustain the allegations of the bill, but on the other hand, the evidence shows beyond a contradiction that Wyoming is herself sanctioning and permitting the very acts of which she complains against Colorado. She complains of diversions from the watershed of the river and yet the proof is uncontradicted that such is the prevailing custom under sanction of Wyoming laws and court decrees, not only on the Laramie river, but elsewhere over the state (1503-18) and that Wyoming is in fact diverting water out of the Cache la Poudre watershed into the Laramie drainage while here she complains of the Colorado diversion from the Laramie to the Cache la Poudre (1516-18, 1577, 1595. See also pp. 27-39, Vol II, Def. Original Brief.) She complains that she had appropriated all the waters of the Colorado branch of the Laramie river prior to the time Colorado commenced work on her tunnel diversion system (Aug. 25, 1902) and yet the evidence shows without contradiction that long after the Colorado project was commenced, Wyoming granted permits for numerous and immense projects from the same river, beginning, with one exception, not earlier than

1907 and principally during the years 1908, 1909, 1910 and 1912, and thereby determined, by decisions of her state engineer (Wyoming Comp. St. 1910, Sec. 729, p. 248; also p. 3918 of record); that sufficient water yet remained in the stream to supply the enormous new and far junior projects. (See pages 192, 226, Vol. II, defendant's original brief and tables; see, also, marginal pp. 3916-3933 of record and exhibits). She further asserts that all the waters of the Colorado branch of the stream are required for her prior diversions, while the proof shows that she needlessly annually wastes more water than will be diverted by the Colorado tunnel. (See pp. 299 to 307, this brief.) In short, the proof is not only conflicting, but, on the contrary, conclusive against the allegations of the bill.

Defendants contend that Wyoming has wholly failed to prove the allegations of her bill and that the same should be dismissed.

While we might here conclude the argument, nevertheless, so important is the controversy and so far reaching will be the precedent, that fairness to all concerned demands extended consideration of the great case of *Kansas vs. Colorado, supra.* So far as we are able to ascertain, that was the first and the last controversy between states over the use of interstate streams for irrigation, to have come before this Court, and we are unable, after extended search, to find any record or report of settlement of a similar controversy anywhere on either hemisphere. The equality and dignity of the states and the extent of their jurisdiction over the natural resources and waters within their borders, announced in the decision in that case and in the former case of *Missouri vs. Illinois,* would seem to have determined the fundamental principles of interstate law governing contro-

versies between states of the Union over rivers common to two or more thereof, and to have established the degree of certainty of proof required of a complaining state before her neighboring state may, in justice and recognition of the equal dignity and sovereign rights of both, be restrained in the use of her own territory and resources to the alleged detriment of the complaining state.

Kansas vs. Colorado.

The case of *Kansas vs. Colorado*, involved the Arkansas River, which rises in the mountains of Colorado and flows out across the plains of eastern Colorado, and thence across southwestern Kansas into Oklahoma. The State of Kansas, by leave of court, filed her complaint against the State of Colorado, charging:

> "That the State of Colorado and her citizens acting under her authority, had diverted and were threatening to divert, within the territorial limits of Colorado, the waters of the Arkansas river for the purposes of irrigation, under claim that Colorado, as a sovereign state, was the owner of all the waters within her borders;
>
> That these ditch owners and the State of Colorado are now diverting the waters flowing in the bed of the Arkansas river and its tributaries, and carrying them to great distances from their natural courses, and discharging them for agricultural purposes on 'arid and non-riparian lands,' where such waters are *wholly lost* to such streams and to the State of Kansas and its inhabitants. That such diversion is carried to

such an extent that no water flows in the bed of said river from the State of Colorado into the State of Kansas during the annual growing season, and the underflow of said river in Kansas is diminishing and continuing to diminish, and if the said diversion continues to increase, the bottom lands of said valley will be injured to an enormous extent, and a large portion thereof will be utterly ruined and will become deserted and be a part of of an arid desert;

That by reason of the prior settlement, occupation and title of the inhabitants of Kansas upon and to the lands situated in the valley of said river, including those upon its banks, Kansas and the owners of land in the valley acquired, and now have the right to the uninterrupted and unimpeded flow of all the waters of the river into and across the State of Kansas; which rights accrued prior to any of the diversions by or in Colorado, and prior to the accruing of any rights claimed by that state, or by persons, firms or corporations therein now taking water from the river or its tributaries."

After setting forth the damage to the State of Kansas, by the Colorado diversions, the complainant prayed that the State of Colorado and her citizens be enjoined from diverting the water of the river. (185 U. S. 133, 135, 137.)

To this bill the State of Colorado demurred upon several grounds, among them, because the constitution of the State of Colorado, declaring public property in the waters of its natural streams and sanctioning the right of appropriation, was enacted pur-

suant to national authority and ratified thereby at the time of the admission of the state into the Union. (185 U. S. 138-139.)

In the opinion by Mr. Chief Justice Fuller, the court considered the extreme contentions of the two states, that is, the contention of Kansas that, as a lower riparian owner prior in point of development to Colorado, she had the right to the full and unimpeded flow of the river without diversion by the State of Colorado, and the contention of Colorado, that as a sovereign and independent state, she is justified, if her geographical situation and material welfare demand it, in her judgment, in consuming for beneficial purposes all the waters within her boundaries; and held, inasmuch as the two states could not, under the Constitution of the United States, enter into a treaty nor resort to war with one another, as they might if each were an independent nation, that the controversy between them was justifiable. The demurrer was overruled without prejudice, the court saying (page 147):

> "We think proof should be made as to whether Colorado is herself actually threatening to wholly exhaust the flow of the Arkansas River in Kansas; whether what is described in the bill as the 'underflow' is a subterranean stream flowing in a known and defined channel, and not merely water percolating through the strata below; whether certain persons, firms, and corporations in Colorado must be made parties hereto; what lands in Kansas are actually situated on the banks of the river, and what, either in Colorado or Kansas, are absolutely dependent on water therefrom; the extent of the water-

> shed or the drainage area of the Arkansas River; the possibilities of the maintenance of a sustained flow through the control of flood waters; in short, the circumstances, a variation in which might induce the court to either grant, modify, or deny the relief sought or any part thereof."

Thereafter, Kansas amended her bill by making certain corporations and individuals in Colorado parties defendant, and the Government, through the Solicitor General, intervened on behalf of the United States Reclamation Service, admitting that the court had jurisdiction of the controversy; that navigation was not affected by the diversions in Colorado, and also that the common law of riparian rights never applied within the territorial limits of the State of Colorado, but taking a position antagonistic to both the original parties to the suit, contending, among other things (Vol. 206, page 66), that water flowing in interstate streams was the subject of interstate commerce, and therefore within the jurisdiction of the federal government, or the alternative, that, inasmuch as a conflict between the two sovereign states was involved, there was in the United States an inherent power of sovereignty giving it jurisdiction over the waters of interstate streams; that inasmuch as there were vast bodies of land included within the public domain, the irrigation of which could be more readily accomplished by the Reclamation Service, acting under the authority of the Reclamation Act, June 17, 1902, 32 Stats. 388, therefore: "the decree should embrace, in terms or in effect, a recognition of the national law and of the government's right to direct the matter of water distribution on this non-navigable interstate stream"; and that the doctrine

of riparian rights was unsuited to national control of irrigation from interstate streams, and the doctrine of prior appropriation should be adopted as the plan of national administration.

The State of Colorado, by answer, denied that her diversions of water from the stream had worked any injury to Kansas or her citizens and denied the right of Kansas to insist upon the undiminished flow of the stream; that the Arkansas river, rising in the mountains of Colorado and flowing out across her plains to Kansas, was one of the natural resources of the State of Colorado, and that as a sovereign state she had the right to divert the waters of the stream and use the same for the necessary reclamation of the arid lands within her borders; that her rights as a state of the Union were in all respects equal with those of the State of Kansas, and that as a sovereign state she had the right to divert and use the waters within her territory under such rules and laws as were best adapted to the necessities of the state and her citizens.

In short, three general contentions were made:

Kansas asserted the doctrine of riparian rights with some limited right of irrigation, and insisted that the river should flow undiminished from Colorado;

Colorado asserted her right to use the waters of the river as a natural resource rising within her borders, for the reclamation of her arid lands under her local rules of priority of appropriation;

The United States asserted superior authority and control of the interstate stream, under a general plan of national reclamation.

Upon final hearing the claims of national control by the United States were denied and the full

jurisdiction of each state over the lands, streams and waters within its borders was affirmed, and while the appropriation of waters by Colorado for irrigation was found to have diminished the flow of the river into Kansas and to have worked perceptible injury to portions of the Arkansas valley in Kansas, the bill of the State of Kansas was dismissed without prejudice to her right to institute new proceedings whenever it should appear that a material increase in the depletion of the waters of the Arkansas by Colorado should be injuring the substantial interests of Kansas to the extent of destroying the equitable apportionment of the benefits between the two states resulting from the flow of the river.

The exhaustive opinion by Mr. Justice Brewer clearly defines the sovereign rights of each of the states; their equal powers as states of the Union and the limitations of the exercise of such powers in their relations to one another, in the use of common streams. After a discussion of authorities and the conclusion that the controversy was one of a justiciable nature, he said:

> "Turning now to the controversy as here presented, it is whether Kansas has a right to the continuous flow of the waters of the Arkansas River, as that flow existed before any human interference therewith, or Colorado the right to appropriate the waters of that stream so as to prevent that continuous flow, or that the amount of the flow is subject to the superior authority and supervisory control of the United States. While several of the defendant corporations have answered, it is unnecessary to specially consider their defenses, for if the case against Colorado fails it fails also as against them.

Colorado denies that it is in any substantial manner diminishing the flow of the Arkansas River into Kansas. If that be true, then it is in no way infringing upon the rights of Kansas. And if it is diminishing that flow, has it an absolute right to determine for itself the extent to which it will diminish it, even to the entire appropriation of the water? And if it has not that absolute right is the amount of appropriation that it is now making such an infringement upon the rights of Kansas as to call for judicial interference? Is the question one solely between the States or is the matter subject to national legislative regulation, and, if the latter, to what extent has that regulation been carried? * * *

The primary question is, of course, of national control. For, if the Nation has a right to regulate the flow of the waters, we must inquire what it has done in the way of regulation. If it has done nothing, the further question will then arise, what are the respective rights of the two States in the absence of national regulation?'' (p. 85.)

After noting the power of Congress to regulate commerce among the States and control interstate navigation, but that the United States made no such claim and admitted that the use of waters by Kansas and Colorado in no way affected the navigability of the river, he continued:

''It rests its petition of intervention upon its alleged duty of legislating for the reclamation of arid lands; alleges that in or near the Arkansas River, as it runs

through Kansas and Colorado, are large tracts of those lands; that the National Government is itself the owner of many thousands of acres; that it has the right to make such legislative provision as in its judgment is needful for the reclamation of all these arid lands, and for that purpose to appropriate the accessible waters.

In support of the main proposition it is stated in the brief of its counsel:

'That the doctrine of riparian rights is inapplicable to conditions prevailing in the arid region; that such doctrine, if applicable in said region, would prevent the sale, reclamation, and cultivation of the public arid lands, and defeat the policy of the Government in respect thereto; that the doctrine which is applicable to conditions in said arid region, and which prevails therein, is that the waters of natural streams may be used to irrigate and cultivate arid lands, whether riparian or non-riparian, and that the priority of appropriation of such waters and the application of the same for beneficial purposes establishes a prior and superior right.'

In other words, the determination of the rights of the two States *inter sese* in regard to the flow of waters in the Arkansas River *is subordinate to a superior right on the part of the National Government* to control the whole system of the reclamation of arid lands. That involves the question whether the reclamation of arid lands is one of the powers granted to the General Government.

As heretofore stated, the constant declaration of this Court from the beginning is that this Government is one of enumerated powers. * * *

Turning to the enumeration of the powers granted to Congress by the eighth section of the first article of the Constitution, it is enough to say that no one of them by any implication refers to the reclamation of arid lands. * * *

We must look beyond section 8 for congressional authority over arid lands, and it is said to be found in the second paragraph of section 3 of Article IV, reading: 'The Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States; and nothing in this Constitution shall be so construed as to prejudice any claims of the United States, or of any particular State.'

The full scope of this paragraph has never been settled. Primarily, at least, it is a grant of power to the United States of control over its property. That is implied by the words, 'territory or other property.' It is true it has been referred to in some decisions as granting political and legislative control over the Territories as distinguished from the States of the Union. * * * But clearly it does not grant to Congress any legislative control over the States, and must, so far as they are concerned, be limited to authority over the property belonging to the United States within their limits. * * * The powers affecting the internal affairs of

the States not granted to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, and all powers of a national character which are not delegated to the National government by the Constitution are reserved to the *people* of the United States.

* * * * * * *

This very matter of the reclamation of arid lands illustrates this: At the time of the adoption of the Constitution within the known and conceded limits of the United States there were no large tracts of arid land, and nothing which called for any further action than that which might be taken by the legislature of the State, in which any particular tract of such land was to be found, and the Constitution, therefore, makes no provision for a national control of the arid regions or their reclamation. But, as our national territory has been enlarged, we have within our borders extensive tracts of arid lands which ought to be reclaimed, and it may well be that no power is adequate for their reclamation other than that of the National Government. *But if no such power has been granted, none can be exercised.*

* * * * * * *

As to those lands within the limits of the States, at least of the Western States, the National Government is the most considerable owner and has power to dispose of and make all needful rules and regulations respecting its property. We do not mean that its legislation can override state laws in respect to the general subject of

reclamation. *While arid lands are to be found, mainly if not only in the Western and newer States, yet the powers of the National Government within the limits of those States are the same (no greater and no less) than those within the limits of the original thirteen*, and it would be strange if, in the absence of a definite grant of power, the National Government could enter the territory of the States along the Atlantic and legislate in respect to improving by irrigation or otherwise the lands within their borders. Nor do we understand that hitherto Congress has acted in disregard to this limitation." (pp. 86-92.)

After quoting from the opinion of Mr. Justice White in *Gutierres vs. Albuquerque Land Co.*, 188 U. S. 545, 554, to the effect that the purport of the previous acts of Congress is "reflexively illustrated" by Section 8 of the National Reclamation Act (Act of June 17, 1902, 32 Stat. 388) wherein it is provided that nothing in the act shall be construed as affecting or interfering with the laws of any State or Territory relating to the control, appropriation, use or distribution of water used in irrigation, and that the Secetary of the Interior in carrying out the act shall proceed in conformity with local laws, he disposed of the contention of the United States for national control in the following language:

"But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that *each State has full jurisdiction over the lands within its borders, including the beds of streams and other waters.* (Citing cases.) * * *

> *It may determine for itself* whether the common law rule in respect to riparian rights, or that doctrine which obtains in the arid regions of the West of the appropriation of waters for the purposes of irrigation shall control. Congress cannot enforce either rule upon any State." (pp. 93-4.)

To the argument that Congress had expressly imposed the common law on all the Western territory prior to its formation into States he made answer:

> "But when the States of Kansas and Colorado were admitted into the Union they were admitted with the full powers of local sovereignty which belonged to other States (citing cases), and Colorado by its legislation has recognized the right of appropriating the flowing waters to the purposes of irrigation. Now the question arises between two States, one recognizing generally the common law rule of riparian rights and the other prescribing the doctrine of the public ownership of flowing water. *Neither State can legislate for or impose its own policy upon the other.* A stream flows through the two and a controversy is presented as to the flow of that stream. It does not follow, however, that because Congress cannot determine the rule which shall control between the two States, or because neither State can enforce its own policy upon the other, that the controversy ceases to be one of a justiciable nature, or that there is no power which can take cognizance of the controversy and determine the *relative rights of* the two States. Indeed, the disagreement, coupled

with its effect upon a stream passing through the two States, makes a matter for investigation and determination by this Court. * * * As Congress cannot make compacts between the States, as it cannot, in respect to certain matters, by legislation compel their separate action, disputes between them must be settled either by force or else by appeal to tribunals empowered to determine the right and wrong thereof. Force under our system of government is eliminated. The clear language of the Constitution vests in this Court the power to settle those disputes. We have exercised that power in a variety of instances, determining in the several instances the justice of the dispute. *Nor is our jurisdiction ousted, even if, because Kansas and Colorado are States sovereign and independent in local matters, the relations between them depend in any respect upon principles of international law.* International law is no alien in this tribunal. * * *

'Sitting, as it were, as an international, as well as a domestic tribunal, we apply Federal law, state law and international law, as the exigencies of the particular case may demand.' " (pp. 95-7.)

Of the equal rights of States of the Union, the relation of the citizen and his usufructuary private rights to the State and the rule which must be applied in the settlement of controversies between States he said:

"*One cardinal rule, underlying all the relations of the States to each other, is that*

of equality of right. Each State stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none. Yet, whenever, as in the case of *Missouri vs. Illinois*, 180 U. S. 208, the action of one State reaches through the agency of natural laws into the territory of another State, the question of the extent and limitations of the rights of the two States becomes a matter of justiciable dispute between them, and this Court is called upon to settle that dispute *in such a way as will recognize the equal rights of both and at the same time establish justice between them.* In other words, through these successive disputes and decisions this Court is practically building up what may not improperly be called interstate common law. This very case presents a significant illustration. Before either Kansas or Colorado was settled the Arkansas River was a stream running through the territory which now composes these two States. Arid lands abound in Colorado. Reclamation is possible only by the application of water, and the extreme contention of Colorado is that it has a right to appropriate all the waters of this stream for the purposes of irrigating its soil and making more valuable its own territory. But the appropriation of the entire flow of the river would naturally tend to make the lands along the stream in Kansas less arable. It would be taking from the adjacent territory that which had been the customary natural means of preserving its

arable character. On the other hand, the possible contention of Kansas, that the flowing water in the Arkansas must, in accordance with the extreme doctrine of the common law of England, be left to flow as it was wont to flow, no portion of it being appropriated in Colorado for the purposes of irrigation, would have the effect to perpetuate a desert condition in portions of Colorado beyond the power of reclamation. Surely here is a dispute of a justiciable nature which must and ought to be tried and determined. *If the two States were absolutely independent nations it would be settled by treaty or by force.* Neither of these ways being practicable, it must be settled by decisions of this Court.

It will be perceived that Kansas asserts a pecuniary interest as the owner of certain tracts along the banks of the Arkansas and as owner of the bed of the stream. We need not stop to consider what rights such private ownership of property might give.

'In the case before us, the State of Kansas files her bill as representing and on behalf of her citizens, as well as in vindication of her alleged rights as an individual owner. * * *. *The action complained of is state action and not the action of state officers* in abuse or excess of their powers.'

It is the State of Kansas which invokes the action of this Court, charging that through the action of Colorado a large portion of its territory is threatened with disaster. In this respect it is in no manner evading the provisions of the Eleventh

Amendment to the Federal Constitution. *It is not acting directly and solely for the benefit of any individual citizen to protect his riaprian rights.* Beyond its property rights it has an interest as a State in this large tract of land bordering on the Arkansas River. Its prosperity affects the general welfare of the State. *The controversy rises, therefore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint. Georgia vs. Tennessee Copper Co.*, decided this day, *post*, p. 230.

This changes in some respect the scope of our inquiry. It is not limited to the simple matter of whether any portion of the waters of the Arkansas is withheld by Colorado. *We must consider the effect of what has been done upon the conditions in the respective States and so adjust the dispute upon the basis of equality of rights* as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beenficial effects of a flowing stream. * * * we are justified in looking at the question not narrowly and solely as to the amount of the flow in the channel of the Arkansas River, inquiring merely whether any portion thereof is appropriated by Colorado, but we may properly consider what, in case a portion of that flow is appropriated by Colorado, are the effects of such appropriation upon Kansas territory. * * * May we not consider some appropriation by Colorado of the waters of the Arkansas to the irrigation

and reclamation of its arid lands as a reasonable exercise of its sovereignty and as not unreasonably trespassing upon any rights of Kansas?" (pp. 97-102.)

The local law of riparian rights as applied in Kansas and the equitable division of the waters of the stream between the riparian owners, all having equal rights to the use thereof under the riparian doctrine, is then discussed and the opinion continues:

> "As Kansas thus recognizes the right of appropriating the waters of a stream for the purposes of irrigation, subject to the condition of an equitable division between the riparian proprietors, she cannot complain if the same rule is administered between herself and a sister State. And this is especially true when the waters are, except for domestic purposes, practically useful only for purposes of irrigation." (pp. 104-5.)

After a discussion of the evidence, including the character of the stream, the administration of diversions in Colorado by State authorities, the benefits derived by irrigation from the waters of the Arkansas River in that State and the detriment to certain portions of Kansas, he continued:

> "At one time there were some irrigating ditches in these western counties, which promised to be valuable in supplying water and thus increasing the productiveness of the lands in the vicinity of the stream, and it is true that those ditches have ceased to be of much value, the flow in them having largely diminished.

> *It cannot be denied in view of all the testimony * * * that the diminution of the flow of water in the river by the irrigation of Colorado has worked some detriment to the southwestern part of Kansas*, and yet when we compare the amount of this detriment with the great benefit which has obviously resulted to the counties in Colorado, *it would seem that equality of right and equity between the two States forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation.*" (pp. 113-114.)

After further discussion of certain facts peculiar to the case there presented, Mr. Justice Brewer thus concluded and disposed of the controversy:

> "Summing up our conclusions, we are of the opinion * * * *that the appropriation of the waters of the Arkansas by Colorado, for purposes of irrigation, has diminished the flow of water into the State of Kansas;* that the result of that appropriation has been the reclamation of large areas in Colorado, transforming thousands of acres into fertile fields and rendering possible their occupation and cultivation when otherwise they would have continued barren and unoccupied; that while the influence of such diminution has been of *perceptible injury* to portions of the Arkansas Valley in Kansas, particularly those portions closest to the Colorado line, yet to the great body of the valley it has worked little, if any, detriment, and regarding the interests of both States and the right of each to receive

benefit through irrigation and in any other manner from the waters of this stream, we are not satisfied that Kansas has made out a case entitling it to a decree. At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes.

The decree which, therefore, will be entered will be one dismissing the petition of the intervenor, without prejudice to the rights of the United States to take such action as it shall deem necessary to preserve or improve the navigability of the Arkansas River. The decree will also dismiss the bill of the State of Kansas as against all the defendants, without prejudice to the right of the plaintiff to institute new proceedings whenever it shall appear that through a material increase in the depletion of the waters of the Arkansas by Colorado, its corporations or citizens, the substantial interests of Kansas are being injured to the extent of destroying the equitable apportionment of benefits between the two States resulting from the flow of the river." (pp. 117-118.)

Kansas vs. Colorado, 206 U. S., pages *supra.*

We are uable to concur with counsel for Wyoming in their theory that this great case between

States was determined upon the narrow grounds of the doctrine of private riparian rights, or that the equitable division between the States, of rivers common to two or more of them, is narrowed in its limits to riparian users. We are inclined to construe the language, upon which counsel predicates such an argument, with the remainder and to read the opinion as a whole, rather than to adopt that portion, referring alone to an admission against interest by Kansas, as an announcement by this Court of the general principle controlling the rights of States in their use of interstate streams. The decision as a whole would indicate that Kansas had failed to prove either the allegations of her complaint or that Colorado was exercising her sovereign rights in an inequitable manner with regard to the rights of her neighboring State.

And, while the rights of riparian users within the State are equal one with the other, yet the rights of States of the Union to control the natural resources within their borders are equal one with the other; and it would seem, from the opinion, that any doctrine of equitable apportionment of the waters of rivers between States must be founded upon a broad basis of equitable consideration of all the facts of each case as they appear, with full regard to the equal rights of States of equal dignity, powers and jurisdiction, and not upon the narrower basis of local laws governing mere usufructuary rights of private citizens, which rights are at all times within the control of and may be taken away by the State, according to its sovereign will. The language of the opinion is:

> "But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case *that each State has*

full jurisdiction over the lands within its borders, including the beds of streams and other waters. (Citing cases.) * * *

It may determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid regions of the West of the appropriation of waters for the purposes of irrigation shall control. Congress cannot enforce either rule upon any State." (pp. 93-94.)

"*One cardinal rule, underlying all the relations of the States to each other, is that of equality of right. Each State stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none.* Yet, whenever, as in the case of *Missouri vs. Illinois*, 180 U. S. 208, the action of one State reaches through the agency of natural laws into the territory of another State, the question of the extent and the limitations of the rights of the two States becomes a matter of justiciable dispute between them, and this Court is called upon to settle that dispute *in such a way as will recognize the equal rights of both and at the same time establish justice between them.*" (pp. 97-8.)

"It is the State of Kansas which invokes the action of this Court, charging that through the action of Colorado a large portion of its territory is threatened with disaster. In this respect it is in no manner evading the provisions of the Eleventh Amendment to the Federal Constitution. *It is not acting directly and solely for the bene-*

fit of any individual citizen to protect his riparian rights. Beyond its property rights it has an interest as a State in this large tract of land bordering on the Arkansas River. Its prosperity affects the general welfare of the State. *The controversy rises, therefore, above a mere question of local private right and involves a matter of State interest, and must be considered from that standpoint. Georgia vs. Tennessee Copper Co.*, decided this day, *post*, p. 230.

This changes in some respect the scope of our inquiry. It is not limited to the simple matter of whether any portion of the waters of the Arkansas is withheld by Colorado. *We must consider the effect of what has been done upon the conditions in the respective States and so adjust the dispute upon the basis of equality of rights* as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beneficial effects of a flowing stream." (pp. 99-100.)

It will be noted that Kansas had made appropriations prior to those complained of in Colorado and that diversions by Colorado ditches had cut off the water supply of these canals and had worked detriment to Kansas and her prior appropriations, but this court said:

"When we compare the amount of this detriment with the great benefit that has obviously resulted to counties in Colorado, it would seem *that the equality of right and equity between the two states forbids* any interference with the present withdrawal of

water in Colorado for the purposes of irrigation." (p. 114.)

The above quoted language, when read with the rest of the opinion, would seem to indicate the controlling, fundamental principle to be that of equality of right between the two States and not equality of right between individual citizens of either thereof, and further, that in the exercise of her sovereign right to sustain hereslf and her people and to obtain the benefits from the natural resources within her domain, the upper state may divert the waters of the interstate stream to the injury of the lower State or her citizens, so long as by so doing the upper State shall not deprive the lower State of an equitable portion of the common resource, and, that what may be an equitable portion must be determined upon the facts and circumstances of each particular case construed so as to recognize and preserve the equal rights of both States "and at the same time establish justice between them."

The late Mr. Kinney interpreted the decision as follows:

> "Therefore, as to the rights in and to the waters of interstate streams the law of this case, summed up in a concise statement, seems to be that each State through which an interstate river runs is entitled to make reasonable use of its waters, even to the extent that the state below may be damaged to a considerable extent thereby, provided the upper State does not divert the waters in excess of what will give it an equitable apportionment, all facts considered, of the benefits of the river, which apportionment is not confined to an equal division between the

two States, or the respective States, of the entire natural flow of the stream."

Kinney on Irrigation and Water Rights (2nd Ed.), Vol. III, p. 2216.

But even though we here construe the decision within the narrower limits and assume an equal apportionment of the waters of the stream, we here find that the Laramie River rises not in one, but in both States. The waters of the Wyoming part of the stream, as well as those of the Colorado branch, are available to Wyoming and her citizens. On the other hand, natural conditions are such that Colorado is limited, by her great tunnel and all other means of diversion, to use of but a part (91/250) of the waters of that branch which rises and flows within her borders, and the remainder thereof must forever flow into Wyoming, there to unite with the other waters of the stream for the use and benefit of the lower state. Whatever the injury might be to Wyoming (though none has been proved), this would not appear to be an inequitable use of her own resources by Colorado. Even if we were to assume, for argument, that the Laramie River had its rise wholly within Colorado, and that Wyoming had the right to one-half the waters, in order that both States might obtain equal benefits, Colorado would still be limited to 91/250 of the stream. But in truth she is limited to 91/470 of the waters of the stream common to both States. Diversions of such an amount would not seem inequitable between equal States.

As we read the opinion, after determining adversely the claim of the United States for National control of all interstate streams for purposes of irrigation and reclamation, and after defining the dignity and equality of the States and the jurisdiction of each thereof over the waters of the streams within

her borders, as well as the relation of the States one with the other as members of the Union, this Court decided that, notwithstanding Colorado and her citizens had damaged Kansas by diversion of waters of the river in Colorado, Kansas had failed to prove such a case against Colorado as would justify this Court to intervene and enjoin Colorado and her citizens from use of the stream; and, that this Court would not interfere until such a time as Colorado, by additional use, might so deplete the flow of the stream, to the injury of the substantial interests of Kansas, as to destroy an "equitable apportionment of the benefits between the two States" of equal rights and sovereign powers as members of the Union. And further, that inasmuch as Kansas recognized "the right of apportioning the waters of the stream for purposes of irrigation, subject to the condition of equitable division between the riparian owners, she cannot complain if the same rule is administered between herself and a sister State."

In other words, the decision in *Kansas vs. Colorado* is similar to that in *Missouri vs. Illinois*, where the bill of Missouri was likewise dismissed on failure of Missouri to prove such a case against Illinois as would justify this Court to interfere and prevent Illinois from exercising her sovereign jurisdiction over her territory and her rivers, and where it was held that Missouri had no ground to complain when she, in fact, was contributing to the cause which provoked the controversy.

Applying to this case the principles announced in the above decisions and the other cases, *supra*, we find that Wyoming has wholly failed to prove the allegations of her bill, and even more, has by her own conduct denied her charges against Colorado by permitting appropriations for and authorizing construc-

tion of many new and enormous enterprises in Wyoming, long junior to the Colorado enterprise of which she complains and drawing water from the same stream; and, irrespective of other conclusive proof, has thereby admitted that there was and is ample water in the stream to supply all appropriations junior, as well as senior, to the Colorado enterprise, and that no injury could result to senior appropriations in Wyoming by reason of the Colorado diversion; and that by her official acts, she has contributed to the very depletion whereof she complains. Further, the proof shows that not only is there ample water in the stream for use of all Wyoming enterprises, senior and junior to the Colorado project, but as well that Wyoming needlessly wastes more water than will be withdrawn from the stream by Colorado. And, furthermore, while she complains of Colorado making use of a part of her own waters outside the immediate drainage of that lesser tributary of the Platte River here involved, the proof reveals, without contradiction, that Wyoming is not only diverting from the drainage of the Cache la Poudre over into that of the Laramie (1516-18, 1577, 1595-6) and permitting the great Wheatland enterprise to make an inter-watershed diversion in all respects similar (save possibly for degree) to that whereof she complains in Colorado, (1511-13, Def. Orig. Brief, Vol. II, pp. 27-38), but, even more, that Wyoming generally recognizes and permits such diversions, by official sanction and decrees of her courts, within her own territory, and by means thereof she has been able to effect her most valuable reclamation and development. No proof was offered in support of her claims as a riparian owner and, on the other hand, by her constitution, laws and the decisions of her courts, she has abolished and denied any such; and, lastly, she

has offered no sufficient proof whereby this Court could adjudicate and determine the relative rights of appropriation within either Wyoming or Colorado, if such a rule as she alleges were here applied.

By her failure to prove the allegation of her bill in the above and other respects she has not brought herself within the rule:

> "*Before this Court ought to intervene the case should be of serious magnitude, clearly and fully proved, and the principle to be applied should be one which the Court is prepared deliberately to maintain against all considerations on the other side.* See *Kansas vs. Colorado*, 185 U. S. 125.
>
> As to the principle to be laid down the caution necessary is manifest. * * * To decide the whole matter at one blow by an irrevocable fiat would be at least premature." (200 U. S. 521.)

And:

> "It would seem that equality of right and equity between the two States forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation." (206 U. S. 114.)

We discussed the history of diversions of water from one stream for use upon lands within the drainage of another stream in Part I, Volume II of our original brief, and there observed that such diversions have prevailed throughout the world from antiquity, wherever irrigation is necessary; that such diversions are common throughout the Western States, both with private and public enterprises and those of the United States Reclamation Service; that

such diversions have prevailed in Wyoming and Colorado and that the same are and always have been recognized, permitted and approved by the laws of both of the States and are recognized and decreed by their courts. We also discussed the law of inter-watershed diversions throughout the States, and as interpreted by the courts of the United States, and found the same to be generally sanctioned and approved. We could add but little to that which already appears, and to which no answer has been made by complainant. In Volume II of this Supplemental Brief we shall discuss the facts more at length.

VIII. CONCLUSION.

We therefore conclude:

(1) That the general principles of prior appropriation are rules of *intra state* law; that their interpretation and application within each of the states, varies according to local conditions and necessities; that in no two of the States are the laws and decisions or rules and methods of application of the general principles the same; that the usufructuary rights permitted the citizens under the application of the general doctrine by each State, according to the local laws, conditions and necessities obtaining, are at all times within the control of the State and subject to the exercise of its police power; that the usufructuary rights of individuals may be taken away by the State through its superior power of eminent domain, as its future necessities may require; and that the general principles of prior appropriation are subject to be restricted and their operation limited in this case by state lines.

(2) That the rules and laws governing the usufructuary rights of the appropriator under the gen-

eral principles of prior appropriation are inapplicable to the sovereign rights of States; that the general principles of prior appropriation are incapable of application and administration for the regulation of diversions from interstate streams and their application would be inequitable and impracticable; that application of the general principles to interstate streams would be to impose exclusive and perpetual servitudes upon the territory and natural resources of one State, without consent, and to deny to that State and its inhabitants the use of a provision which nature has supplied entirely within its own territory, for the sole benefit of a neighboring State, and would violate the sovereign rights of States standing upon an equality as members of the Union; and that the general principles of prior appropriation cannot apply to interstate streams, without regard to state boundaries.

(3) That this case is to be controlled by the fundamental principles: that each State of the Union has the sovereign right to utilize and enjoy the natural resources and waters of the streams within its territory, according to its present and future conditions and necessities and those of its citizens and inhabitants, and has the sovereign right to grant to its citizens usufructuary rights to such natural resources, subject at all times to the superior rights of the State; that each State may utilize the natural resources and streams within its borders in such manner and to such degree as it may elect, and whenever the exercise of its sovereign powers shall be questioned by another State, this Court will not intervene unless, under all the facts and circumstances of the case, it shall appear that the one State is unreasonably injuring the other or interfering with the sovereign rights thereof; and that the exercise of its

sovereign rights by a State will not be disturbed unless the case be of serious magnitude, clearly and fully proved, and the principle to be applied be one which the Court is prepared deliberatly to maintain against all considerations on the other side and that, in such case, the dispute between the States shall be settled in such a way as will recognize the equal sovereign rights of both States and at the same time establish justice between them.

We respectfully urge that the State of Wyoming has failed to prove the allegations of her bill or that the diversion of which complaint is made will in any manner injure her or her citizens; that the State of Colorado, by the diversion of a portion of the waters of the branch of the Laramie River within her territory, is not exercising her sovereign powers in an unreasonable manner or in any manner interfering with Wyoming in the exercise of her sovereign rights; and, therefore, that the suit should be dismissed.

Respectfully submitted,

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IN EQUITY.

THE STATE OF WYOMING, COMPLAINANT,
vs.
THE STATE OF COLORADO, THE GREELEY-POUDRE IRRIGATION DISTRICT, AND THE LARAMIE-POUDRE RESERVOIRS & IRRIGATION COMPANY, DEFENDANTS.

BRIEF FOR DEFENDANTS.

VOLUME II.

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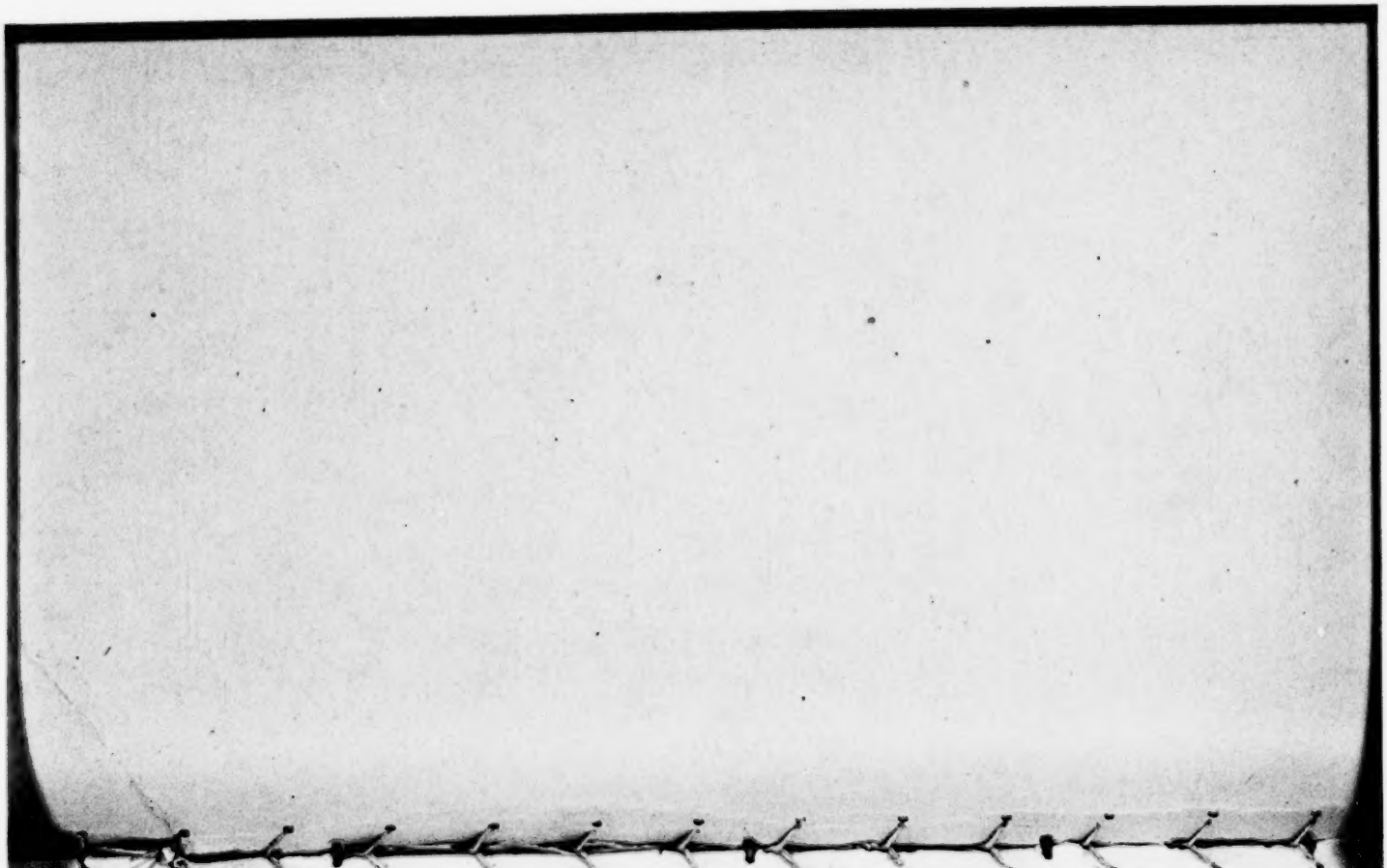

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In the Supreme Court of the United States.

OCTOBER TERM, 1916.

No. 7, Original.

THE STATE OF WYOMING, COMPLAINANT,
vs.
THE STATE OF COLORADO, ET AL., DEFENDANTS.

BRIEF FOR DEFENDANTS.

Volume II

PART I.

INTER-WATERSHED DIVERSIONS.

THIS GENERAL SUBJECT WILL BE TREATED AS FOLLOWS:

INTER-WATERSHED DIVERSIONS—

(1) FOREIGN COUNTRIES—

(a) *India*
(b) *France*
(c) *Ceylon*
(d) *Asia Minor*
(e) *Italy*
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(g) *Other diversions in Eastern Hemisphere*

(2) HAWAIIAN ISLANDS

(3) CANADA

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(5) SEVERAL STATES OF THE UNITED STATES

(a) *California*
(b) *Utah*
(c) *Montana*
(d) *Idaho*
(e) *Nevada*
(f) *Oregon*

(6) COLORADO AND WYOMING

(a) *Colorado*
(b) *Wyoming*

CAUSES OF INTER-WATERSHED DIVERSIONS

THE LAW OF INTER-WATERSHED DIVERSIONS. (See outline at beginning of discussion of law on this subject.)

INTER-WATERSHED DIVERSIONS.

This controversy involves the diversion of waters of the Big Laramie River, one of the tributaries of the north branch of the Platte River, through the intervening divide and into the

drainage area of the Cache la Poudre River, one of the tributaries of the south branch of the Platte River. (1445, 1479.) The water so diverted will be used for irrigation of lands in the Cache la Poudre Valley. The Big Laramie rises entirely within the State of Colorado and diversion and application are made within that State. No portion of the diversion works and no part of the lands to be served are situate within the State of Wyoming.

The diversion is absolutely inter-watershed in its character and no part of the water flowing through the tunnel connecting the two streams ever returns to the Laramie River. This diversion is the last and final inter-watershed diversion which can ever be made from the Laramie to the Cache la Poudre in Colorado, and all the remainder of the water of the Big Laramie must forever pass out of Colorado into Wyoming. (1763-7, 1395, 1624.)

In addressing ourselves to this phase of the case, we shall first of all consider diversions of this character from a historical standpoint, both in foreign countries and the United States, and later will discuss in particular the history of such diversions both in Colorado and Wyoming. The causes for such diversions and the law relating thereto will be separately treated.

This topic received exhaustive consideration by Prof. L. G. Carpenter, whose masterly presentation should be incorporated in full in the brief. His illuminating testimony tells the story of such diversions wherever irrigation has prevailed since antiquity, and should be read in full and considered with the many exhibits prepared and offered by defendants. (See marginal pages 1423-1610 inclusive, 3902-7 inclusive, Defendants' Exhibits 22-50 inclusive.) (See also testimony of John E. Field, 3597-3615, same subject.)

(1) FOREIGN COUNTRIES.

Diversion of water from one stream for irrigation of land situate within the drainage area of another stream is and has been universal in foreign countries wherever irrigation has prevailed. (1446, 3597.) It was practiced before the time of Christ (1467), and has since prevailed on the eastern hemisphere. (1445-1519, 3907-8.)

(a) *India.*

India furnishes the most notable example, largely because of the scale on which the work has been constructed and also from the fact that it is a country that has been densely populated for thousands of years and has been, in many respects, one of high civilization.

On the north are the Himalaya Mountains of very high elevation with large rain-fall, filled with glaciers and glacial lakes in many places. At the base, on the south, the peninsula is practically cut across by the river systems of the Indus and Ganges, the former flowing westward to the Indian Ocean and the latter eastward to the Bay of Bengal. These two streams catch all the run-off of the Himalaya Mountains and have many large tributaries, some running into the Ganges and the Indus, large tributaries, some running into the Ganges and the Indus. The divide in the central part of the continent is rather low, and there are mountains in the central parts of India and Hindustan south of these rivers. (1447.)

There have been inter-watershed diversions from these streams from a very early date. It was a country of intense population, great intellectual development and centralized authority. (1447.)

The Jumna is the western tributary of the Ganges and is almost on the border line. It rises in the Himalayas and flows eastward into the Ganges. A tributary of the Indus is situate a few miles to the west. A canal was built across the watershed from the Jumna to the tributary of the Indus as early as the twelfth century by a celebrated Indian ruler, Feroz. His name is still identified with some of the cities and other portions of that country. After having been used for a number of years, the canal seems to have fallen into disuse and so remained until reconstructed in 1568 by Akbar, another ruler of great energy. It was again allowed to fall into disrepair through local strife and lack of energy of the rulers, but was rebuilt about a century later under the ruler Shah-Jeham. When the British took charge of the country, they found this canal in bad repair. Warren Hastings took an active part in attempting its reconstruction and his activities in this regard were made matters of accusation. The canal was practically rebuilt in 1820 by the English and reconstructed on a still larger scale in 1870 and is now 84 miles long, supplies 555,000 acres and carries about 800 cubic feet per second, carrying water as far as 125 miles west of the Jumna to Sirea. The canal is known as the Western Jumna and practically all of the acreage served by it is outside of the watershed of the stream that supplies it. (1448.) The canal has repaid the entire expense to the English Government and $5,000,000 in addition, and also in addition to the taxes and returns received by the Government. (1449.) This canal, as well as the Eastern Jumna Canal, is designated on Sketch Map prepared by Prof. L. G. Carpenter, *Defendants' Exhibit 22.*

Near Bombay, a large reservoir, the Bhatode Tank, is an unfinished project of unknown date on the Meheree River, where water is carried from one watershed to another. (3907.)

A series of inter-watershed diversions are now under construction in the Indus valley. A number of old canals in that region run back to an unknown time, some of them built by private parties and some built by native rulers, as there are several native states that are not under British control.

The whole plain irrigated by the Western Jumna suffers at times through lack of sufficient water to obtain maximum production and the population is so great that in such cases there is famine and great loss of life. The English have planned to extend the diversion from tributaries of the Indus River. Each tributary is an enormous stream and has a large system of canals. These streams and the proposed canals to supplement the existing system are shown on *Defendants' Exhibit 23.* (1450.)

The English propose to build a canal starting from the Indus and running over to the Jhelum, a distance of approximately 60 miles. This water will then be available to supply the other ditches down the Jhelum and enable them to take out another ditch about 100 miles farther up the river that will carry water from the Jhelum over to the Chenab to supply other ditches on that stream and also to enable another ditch to be taken from the Chenab about 40 miles up stream and run a distance of about 100 miles to the Ravi, and then carried on beyond the Ravi to the lower Bari Doab canal. This is made possible by substitution of water through the canal for that diverted above. The taking of water from the Indus drainage, where the construction is now under way, is really intended to supplement the Bari Doab Canal, a distance of 50 miles or more, and to cross over the large streams by a system of exchange, but, in fact, carrying the water from the first stream across to the last. (1450-1.)

Defendants' Exhibit 24 portrays the canals on the upper portion of the Ganges River. It includes the Ganges, Jumna, Ramganga and others in the region covered by the Ganges canal. The enormous Ganges canal is about 600 miles long and carries water out of the Ganges basin over into the basin of the Indus and also over into the Jumna basin. In order to build the Western Jumna canal and to serve additional country west of the Jumna, a shortage of water would be occasioned to the Eastern Jumna canal and a plan has been considered of supplementing the supply of the latter canal from some of the other streams, probably by building the supply canal from the Sardah River, about 150 miles long and running over to the Ganges. The increased amount taken from the upper Ganges canal can be delivered to the Eastern Jumna canal by a branch about 20 miles long and thus decrease the demand on the Jumna River and increase the supply of the Western Jumna Canal which runs over on the other side of the divide. The result of this

proposed construction is to enable the water of the Sardah River to be used about 300 miles to the west and on the western slope of India while the Sardah is a tributary of the eastern slope. (1452-3.)

The Periyar project is in the Madras Presidency in southern India. Water from the Arabian Sea drainage is carried *through the continental divide by a tunnel* and delivered into the Vaigai River and carried in that stream a distance of about 60 miles to the land to be irrigated. The project includes a large reservoir at the upper end of the Periyar River on the Arabian Sea drainage and immediately adjacent to the 6,000 foot tunnel of the project. The water so diverted from the Arabian drainage is used to irrigate lands on the drainage of the Bay of Bengal. The project has been completed for a number of years and irrigates about 120,000 acres. This project is quite similar in many respects to the Greeley-Poudre project here in controversy. The reservoir is larger, but the tunnel is less than half as long as that of the Greeley-Poudre project. The two projects are also similar in that the stream in whose drainage the lands to be irrigated are situate is used as a carrier of the water for some 60 miles from the tunnel portal to the point of diversion or application. The similarity of the two projects will be further noted by consulting the sketch map prepared by Prof. Carpenter, *Defendants' Exhibit 25.* (1453-4.)

The Kurnool-Cuddapah canal, carrying 3,000 cubic feet of water per second, carries water between the drainages of the Krishna and Penner Rivers in the Madras Presidency in southern India. Two other projects, one above and one below the Kurnool are proposed, the upper or Krishna diverting water about 100 miles above the Kurnool and crossing several tributaries and the summit of the divide, watering land on both sides. The Krishna and Penner Rivers are independent streams, each flowing directly into the Bay of Bengal. Their watersheds are distinct from one another. The location of these canals is noted on the sketch map, *Defendants' Exhibit 26.* (1455-56.)

The projects mentioned are among the more notable of those in India. These diversions are from one stream to another that are not tributary to each other. There are many others on a lesser scale. (1456.) There are private ditches in India costing hundreds of millions of dollars that are not indicated in government reports and serving lands regardless of situation with relation to the principal streams from which the diversions are made.

No opposition has been offered to the construction of any of the immense canals of India by reason of their inter-watershed diversions. Such construction seems to be taken as a matter of course. (1457.)

(b) *France.*

In southern France irrigation is required. The rain-fall is light and water is available on the other side of the mountains from near Marseilles eastward along the Mediterranean. The same condition pertains to a large degree with the interior of the country along the Rhone for some distance from the coast, including that portion of the country settled by the Romans, whose ruins still remain. Adjacent to Marseilles, there are a number of canals brought from the Durance to the north. This stream is a tributary of the Rhone and drains a portion of the Alps, but is separated from the coast by mountains. On the south side of these mountains the rain-fall is very light and the country of beautiful climatic conditions, in the vicinity of Marseilles, Nice and Monaco. The land produces bounteously with the application of water, and, of consequence, diversions from other watersheds have been made from the earliest times. (1458.)

The Romans built canals of record length to supply a part of this country along the coast near Marseilles, and north of it is the plain known as the Crau, separated from the Durance by a divide of considerable elevation, and canals have supplied water to the plains from the Durance for some centuries. (1457.)

The Canal of Crapponne and the Canal del Alpine, both taking water from the Durance, convey it across the divide for irrigation on the plain. The Crapponne canal was built in 1650 by Adam de Crapponne. It covers the plains northwest of Marseilles and east of the old Roman city of Arles. A part of the water finally reaches the Rhone, but most of the land irrigated is not tributary to the Rhone but drains directly into the Mediterranean. *Defendants' Exhibit 32* is a photograph of a masonry aqueduct on this canal near the city of Arles. The Crapponne canal bears a strong resemblance to the Sky Line diversion of The Water Supply & Storage Company in Colorado, taking water from the Laramie River into the Poudre drainage and also the Grand River and Michigan River ditches of the same system, each of which will be hereafter more fully discussed.

The Alpine canal was built about 1772. It also diverts water from the Durance, crosses the same divide and serves much the same territory as that served by the Crapponne. These canals are noted on sketch map, *Defendants' Exhibit 27.* (1459.)

The Marseilles Canal diverts from the Durance, crosses the same range of mountains and serves land in the suburbs of Marseilles and also supplies the city with water. It was constructed between 1840 and 1850. It is a large canal with many aqueducts. (1459.)

The Verdon Canal diverts water from the Verdon River,

a branch of the Durance, and carries it over the mountain divide into the basin tributary to the city of Aix. It supplies the small town with water and irrigates the whole basin. It was commenced about 1863 and serves about 40,000 acres of land. Both the Verdon and Marseilles Canals are shown on *Defendants' Exhibit 27.*

The Carpentras Canal diverts water from the Durance at a point near the head-works of the Marseilles canal. It runs thence north, while the other French canals already mentioned extend south. This canal covers the territory between the Durance and the Aiges Rivers. It also crosses the historical stream Vaucluse and supplies territory near the city of Carpentras. This region has been irrigated from very early times. There is a charter for a ditch on file at Avignon dating back to 1101. The present Carpentras Canal is really an extension of ditches that were built at a remote period, so that the name properly applies to the extension. There are other concessions or charters of ditches dating back to the twelfth century, for instance, 1171. The present canal of Carpentras was projected in 1556, but the affair seems to have been suspended because of religious worries at that time, which resulted in the massacre of St. Bartholomew's Eve. The canal was taken up about a century later and encountered difficulty because of the financial panic due to John Law and his Louisiana scheme. Portions of it were constructed in 1780 and the present canal was completed in 1858.

In this case the water of the Durance is taken across a number of the tributaries of the Rhone and for a distance of something like 40 miles along the foot of the mountains. (1461-2, *Defendants' Exhibit 28*). An aqueduct of the canal as it crosses the Vaucluse is shown in *Defendants' Exhibits 33 and 34.*

The canal of the Gap is east of the Carpentras Canal and diverts water into the Durance watershed from the Isere watershed. The enterprise practically surrounds the Carpentras canal. It takes from the Isere, which empties into the Rhone 75 miles south of Avignon, and thence runs into the valley of the Gap, which is a part of the Durance watershed. It runs for some distance through an open channel and then through a tunnel nearly two miles long and then delivers into the valley of the Gap and distributes on both sides of the valley. While previous canals have taken water from the Durance, this canal brings water into the Durance watershed, reversing the operation, illustrating the general principle that where conditions require, these transfers occur as a matter of economic development. (1462-3, *Defendants' Exhibit 29.*)

The diversions in France differ from the diversions in India only in magnitude. The same general principle prevails.

If these French inter-watershed diversions had not been made, a probable loss of life in the vicinity of Marseilles would have followed and it would have meant the failure or suspension of population east of Arles on the great plains now supplied by this water and elsewhere in the vicinity of Avignon. The country would have been developed to but a very small extent had it not been for these inter-watershed diversions. Without irrigation, agriculture in southern France is on the verge of failure at all times and the irrigation has merely increased the productive capacity. (1463-5.)

The canal of Nimes, while not of the importance of those already mentioned, is nevertheless of historical importance. It illustrates the same general principles surrounding inter-watershed diversions. The city of Nimes was an old Roman city, like Arles, Avignon, Marseilles and Aix, and with slight rainfall in the summer. Water was needed for both irrigation and municipal supply. The city had a canal bringing water about 15 miles through tunnels and by means of celebrated aqueducts, of which the aqueduct known as Pont du Gard is one. This aqueduct is shown on the photograph, *Defendants' Exhibit 30*, taken in 1892 by Prof. L. G. Carpenter and shows the aqueduct at the lower end as it crosses the Gard. At about one-third its height is seen a series of arches attached to the side of the main aqueduct, built by the French in 1860 as an addition to the side of the aqueduct to support a road. The aqueduct itself was built a little before the time of Christ. The channel is above the uppermost series of arches and the structure is one of the most celebrated irrigation works in the world because of its beauty of proportions. In order to make this masonry conduit, there are three series of super-imposed arches carrying the tunnel. The water was taken to the city of Nimes and its vicinity. The aqueduct is now broken and in disrepair. By this aqueduct, the Roman baths, domestic requirements of the city, and irrigation of the lands were supplied. (1466-7.)

Defendants' Exhibit 31 gives a view through the tunnel a little below the end of this aqueduct shown on Exhibit 30. This tunnel was built by the Romans to carry water through the ridge.

(c) *Ceylon.*

The Abonganga series of works in the island of Ceylon involves the transfer of water from one watershed for use upon another. (3907.)

(d) *Asia Minor.*

Transfers between the Tigris and Euphrates Rivers are very ancient and extensive and of historical importance. They

have recently attracted more or less attention because of recent restoration. There are a number of ancient canals still in existence and a good many take water from one of these streams and carry it across the divide for use within the drainage area of the other stream. During the last few years, projects costing many millions of dollars have been in course of construction and are largely completed. These are not altogether the rebuilding of old canals, but are, in the main, near the lines of the old canals that have fallen into disuse. (3907-8.)

(e) *Italy.*

Professor Carpenter in his testimony (1469) says:

"In Italy, the conditions are somewhat analogous to India, but on a very much smaller scale. That is, there are a series of streams coming down from the Alps on the north which join and form the stream known as Po. These streams coming from glaciers of the Alps, are quite large and fairly continuous because many of them are held by glacial lakes or reservoirs like Lake Como and Lake Maggiore.

This is the greatest region of irrigation in Italy because of the extent of the Valley of the Po, its water supply and ease of irrigation; but does by no means comprise the entire irrigation of Italy. It is the one that is spoken of in speaking of Italian irrigation.

The irrigation in the valley of the Po goes back to a very early date and there were large canals built in the twelfth and thirteenth centuries especially near Milan, a town near Venice. There are two canals known as the Naviglia Grande near Milan, and the Muzza Canal also near Milan, one coming from the west and one from the east. The Canal Biana was another large canal built lower down the Po, and there were quite a good many of considerable importance built at an early date. The Biana was built still earlier than the twelfth century. There were canals dating back very much further, but those represented the same characteristics that have been spoken of in the development of irrigation in the United States; that is, they were simply canals built to supply small areas or built by individual land holders which in some cases were the old monasteries; one of the largest was built by a monastery out of Milan. Then there were those of smaller canals built from springs, etc.

When they found the increased value from irrigation and the search for water came, they went farther for water supply and tapped streams further away, bring-

ing them across intervening streams. Projects were proposed and considered by the local association, and sometimes by the Government, and out of them all, two might be especially mentioned, that have been built and under consideration for a long time and led to a variety of plans, but all essentially to the same purpose and not materially differing in character. These two canals are the Cavour Canal and the Villoresi, the first named after the Italian statesman who accomplished the unification of Italy, and the second for an engineer who had been responsible for one of the plans of the second canal.

These two canals supplement each other something as some of the canals described in India on the Jhelum and Ravi. The Cavour Canal takes part of its supply of water from the Po and traverses the province of Piedmont. It takes a large part of its supply, however, from a wide stream, the Dora Baltea. That canal is used to irrigate a portion of Piedmont north of the Po River directly, and by supplying a system of canals that are already in existence. The latter would be called a system of exchange, supplementing the supply. It supplements the supply as obtained by those canals from other sources. It ends at the Ticino river on the east border of Piedmont."

The Cavour Canal, with some other canals starting near the city of Turin, derives its supplemental supply from the Dora Baltea, crosses the Elvo, Carvo, Sesia and other streams, supplying the lands of their watersheds, and ends near the city of Novaro on the Ticino. It was constructed between 1860 and 1870. (Sketch map, *Defendants' Exhibit 35*, 1471.)

The Villoresi Canal takes water from the Ticino below Lake Maggiore and irrigates the region north of Milan and extends to the east. It is what might be termed a "high-line" canal and was built more especially to irrigate the province of Milan, while the Cavour canal was for the province of Piedmont. The Cavour canal could have been extended into the Province of Milan, but its elevation would have been so low that it would not serve much of the territory capable of irrigation, so that the Villoresi canal was started from the Ticino at a higher elevation but is essentially an extension of the idea of the Cavour canal. It was constructed in 1880. (Sketch map, *Defendants' Exhibit 36.*)

Both the Cavour and Villoresi canals are constructed and are very extensive systems. The water is used entirely for irrigation in both cases. The annual rainfall is about 36 inches and the irrigation is used to supplement the precipitation. The canals serve one of the most densely populated regions in the world.

The canal Emilinio is something of the same character. It has been under consideration by the Italian Government for twenty years and was planned before that and designed to irrigate the region near Bologna, Parma and Ferrara on the south side of the Po and on the Adriatic Sea. It is planned as a large canal at the foot of the hills and described in parts 14 and 15 of the Italian Government reports on the "Carta Idrografio D'Italia." (1472.)

Professor Carpenter, further speaking of inter-watershed diversions in Italy, says: (1472.)

> "There are no other instances of special note. There are some along the Apennines that are reported in these cases; but I have not made any particular attempt to trace these out. These are bound to be small; but would be in kind, illustrating the general principle shown by those already given, that they take water freely from any stream that may be available.
>
> I have failed to find any objections ever presented of any such manner of diversion and application of water in Italy. I have looked through the Government reports and other literature of all kinds, some, by the way, running back to the fifteenth and sixteenth centuries, in a series of authors on water in Italy, and in no case has any reference to objection on any such score been made that I have found."

Prof. Carpenter made personal inspection of the Italian canals in 1892 in company with Italian engineers and on one or two occasions with Hon. E. S. Nettleton, during which inspection photographs were taken, three of which were offered in evidence in this case, *Defendants' Exhibits 40, 41 and 42.*

Defendants' Exhibit 40 is a view of the headgate works of the Cavour Canal, two miles below Turin.

Exhibit 41 is a photograph of intake of same canal from Dora Baltea, one of the streams from which the canal derives its supply.

Exhibit 42 is a photograph of Naviglio Grande Canal in the outskirts of Milan. (1482.)

(f) *Spain.*

Irrigation in Spain runs back to an unknown period and for that reason discussions of irrigation enterprises are meagre. The country was thoroughly irrigated in the time of the Moors and portions of the southern part of Spain have been irrigated from the earliest date. Rainfall at Madrid is about the same

as at Denver, 15 inches, and has about the same latitude and prevailing weather but considerably hotter. All of the ancient cities that were occupied by the Romans used aqueducts of great extent and considerable length. The custom of irrigation was common because of the necessities.

Prof. Carpenter says: (1473.)

> "In some of the recent canals, the conditions are such that the canals take water across divides, but I have no maps, and very little descriptions except those like the Benares Canal and Isabella Canal. Both have been constructed for some years, and irrigate in the neighborhood of 70,000 to 75,000 acres each. The Tamante Canal was taken up some years ago, but I am not certain that it has been built. It was to irrigate nearly 600,000 acres. I am unable to present maps of those, and therefore cannot speak definitely as to the conditions; but along the Mediterranean Sea near Valencia there are some of the old canals dating to the time of the Moors, analogous to those on the India coast of Madras, where they take from one stream which flows into the Mediterranean and carry it over into another stream flowing also into the Mediterranean. Thus for instance, here is a canal from the Zucar and extending over into the Cataroja, and also canals from the Guadlaviar, extending likewise to the Cataroja, and also in the opposite direction one extending to the small stream of Rio Seco. These date back to a very early date.
>
> This particular map that I refer to is given in Volume 2 of Tassa's description of irrigation in Spain."

(g) *Other Diversions in the Eastern Hemisphere.*

There are inter-watershed diversions between China and Turkestan where conditions are favorable, from the head of the Chinese rivers to those running into Turkestan. There are a number of canals taking water from one stream to another. (1474-5.)

At the extreme end of the Blue Nile, the English government proposes the construction of a tunnel about two miles in length, diverting water into another branch, which would naturally flow into the Nile about 300 miles below the Blue Nile, but instead of carrying the water down this stream, take it out across the Blue Nile over into a country not at present irrigated. (1475.)

The instances enumerated are typical of diversions prevailing on the Eastern Hemisphere, where many other such di-

versions undoubtedly occur wherever irrigation prevails. (1476.)

(2) HAWAIIAN ISLANDS.

There are a number of illustrations of inter-watershed diversions in the Hawaiian Islands.

In the Island of Oahu, water is taken from streams on one side of the island and across the divide for irrigation of lands situated along streams on the other side.

In the Island of Kausi there are a number of similar diversions. The Kekaha ditch carries water across at least one stream and into an entirely different watershed. The Olokele ditch takes water from the river of the same name and carries the water across a number of independent streams, all of which empty into the Pacific by their own channels. There are a number of other canals on the same island whose diversions are of a similar nature. There are also a number of diversions of this character in the Islands of Maui and Hawaii. Some of these canals are quite old and some are recent. (3904-5.)

(3) CANADA.

There are a number of inter-watershed diversions in Canada.

Prof. Carpenter, who was a member of the Irrigation Commission of the Province of British Columbia (1432), describes the inter-watershed diversions in British Columbia as follows: (1477.)

> "In British Columbia, the conditions are there such that the streams are generally small and the valleys are narrow, and as a whole the conditions are not such where there would be any call for diversion. At the same time when acting as Commissioner for British Columbia and looking into the stream records, I found a number of instances where water was diverted across divides. There are other reasons also why they would not be expected to be present in any great number in British Columbia, because the country is very new in its irrigation development. There were, however, several instances that I recall where one stream came near enough to another with a feasible divide, so that water was brought from one shed to another.
>
> This was the case, for instance, on the branch of a stream northwest of Ashcroft in British Columbia, where it was carried across the divide on land toward Spence's Bridge and towards Ashcroft. It was also true in the

vicinity of Lake Okanogan, a region which has recently been developing rapidly as a fruit country, where water has been taken from Nelson Creek to irrigate lands to the south over towards Michigan Creek and Kelowna. These are small diversions as compared with the matters which we have had examples of elsewhere. This last enterprise was planned but not constructed, at least at that time. The question was one of funds. Near Penticton water was taken from Penticton Creek to the north, irrigating the valleys of other branches running into Okanogan Lake.

There was a more noticeable transfer across the divides at the head of the Columbia further east between Columbia and the Kootenay. It happens in this case that conditions are quite favorable. These two streams start close together with a fairly wide mountain valley, so that the water in one runs one way and the water in the other to the north, the Columbia running north at that place. The enterprise was under construction there, taking water from one into the other.

The general physical conditions in British Columbia were not very favorable for such changes; but wherever such conditions were favorable, it was being proposed and considered without objection.

There was still another, that I am not able to locate the name.

There were several smaller changes of that kind that I found, as where water was changed by permission of the Commissioner. They had a system of permits by what in the early days was called the Gold Commissioner and he had charge practically of everything pertaining to the government and all permits were issued by him. In a number of cases I found permits of this character that planned the diversion of water from one stream to another. The physical conditions seem to entirely control in these cases.

As a member of the Irrigation Commission I did not raise any objection whatever. In fact the laws as they were, permitted it, and the laws as passed did not forbid it. It was considered one of the essential conditions to the development in an irrigated country, so it was left entirely permissible.

In Alberta, conditions are similar to the conditions in British Columbia, in fact, there are streams and large plains so that development can be carried on on a large scale, and development there is in the central government instead of the local government. British Columbia, I may say, in passing, has been in about the same re-

lation to Canada as Texas has to the United States, that is, Canada owns none of the lands of British Columbia, any more than the United States does in Texas. In Alberta, on the other hand, all public lands belong to the Central Government—to the Dominion of Canada.

There are a number of streams that start from the Rocky Mountains in Alberta, running to the east mostly in the Saskatchewan drainage area. The surveys were made to some extent in the first place by the Canadian Government and an extensive series of surveys has been made by the Canadian Pacific Railway.

I have maps here of the Canadian surveys, which may be referred to by title. In 1884, is one showing a proposed method of diverting water from the Elbow into the North Fork of Fish Creek. In the report of 1897, they present a map showing the location of a canal for diverting water from White Mud River to Swift Current Creek. Also from the South Saskatchewan River to the Regina Districts. There is one in the report of 1894 from Red Deer River into the Rose Bud, and these are the official government surveys of reports showing what they contemplated under Government supervision.

In the British Province of Alberta, in the Dominion of Canada, the more recent construction has been along the Canadian Pacific Railroad from the Bow and Red Deer and connecting them together.

Practically all of the diversions in Alberta are from one tributary of the principal stream to another tributary of the same stream. They are all in the Saskatchewan drainage area.

In the case at bar, the diversion of water is from one tributary of the stream to another, all in the Platte River drainage area. The conditions here correspond so far as that situation is concerned, with those in Alberta."

Defendants' Exhibit 37, a sketch plan of the Canadian Irrigation Surveys showing the proposed location of a canal diverting water from the White Mud River to Swift Current Creek is an official map of the Dominion of Canada, taken from the report of the Canadian Irrigation Surveys of the Department of the Interior. (1480.)

This diversion is from a stream flowing into the Missouri watershed over into a stream of Hudson Bay drainage.

Defendants' Exhibit 38 is also a map made from the Canadian Irrigation Surveys, published by the Dominion of Canada showing proposed diversion of water from Elbow River into Fish Creek. (1480.)

Defendants' Exhibit 39 is another map from the same official report from the Irrigation Survey of the Dominion of Canada, showing the proposed method of diverting water from Red Deer River across the divide into Rose Bud River. (1481.)

Whether the projects shown upon the three sketch maps, Exhibits 37, 38 and 39 (from the official government publications) are constructed by the Government or some other parties they nevertheless are the work of and bear the sanction of the Government of the Dominion of Canada. (1481.)

In a letter from the Commissioner of Irrigation, Department of Interior of Alberta, to the State Engineer of Colorado, August 25, 1913, Hon. P. M. Sander, acting Commissioner of Irrigation, encloses a sketch map showing the various inter-watershed diversions of Alberta and mentions the following diversions in the following general classifications:

Continental Divide Diversions: Canadian Pacific Railway Company Irrigation scheme near Lethbridge, Alberta, to divert water from the St. Mary River, Hudson Bay drainage, and some of the waste water will run back into Pakowki lake drainage basin (no outlet) which lies in the Milk River drainage area, which is tributary to Missouri River and hence Mississippi River. With some extension of the above ditch, a considerable amount of water might go directly to Milk River drainage area. Under terms of International Waterways Treaty, U. S. Reclamation Service is diverting water directly from St. Mary River, Hudson Bay drainage into Milk River, Missouri River drainage.

Diversions from one main drainage to another: Canadian Pacific Railway Company, western section, near Calgary, Alberta, diverts from Bow River into drainage of Red Deer River; Canadian Pacific Railway Company, Lethbridge system, diverts from St. Mary River to Belley River; Southern Alberta Land Company near Medicine Hat, Alberta, diverts from Bow River into Belley River; Province of Alberta, near High River, Alberta, diverts from Highwood River, tributary to Bow River, into Little Bow River, tributary to Belley River.

Diversions from one tributary stream over the divide into watershed of another tributary stream of the same general drainage: Diversions from Battle Creek to Middle Creek, both flowing into Mile River.

Defendants' Exhibit 152 includes the above communication and the sketch accompanying the same. (3611.)

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(4) UNITED STATES RECLAMATION SERVICE.

The United States Government, through its Reclamation Service, has entered upon the construction of several inter-

watershed or trans-mountain diversions. No heed seems to have been given to watersheds or natural barriers by the United States in its efforts at reclamation of the arid lands.

The Strawberry Valley Project in Utah takes approximately 160,000 acre feet of water from the Strawberry River and tributaries of the Green River (Colorado River drainage), stores the same in a reservoir and carries the same through a tunnel 19,100 feet long, to the Spanish Fork River for use upon lands in that drainage. Strawberry River is of the Gulf of California drainage, while the Spanish Fork River is a stream in the great basin of Utah and ultimately discharges into the great Salt Lake, which has no outlet. (1483-4, 3603.)

Defendants' Exhibit 43 is a sketch map showing the Strawberry Valley Project and the general relation of the tunnel and diversion with respect to the Colorado River and also with respect to the interior basin of Utah. The Jordan River connects Utah Lake, shown on the sketch, with Great Salt Lake. Water diverted from the Strawberry River and the Gulf of California drainage into the Jordan River and the Salt Lake drainage will not go down Strawberry River and will not return to that stream, but must be finally evaporated in the interior basin. This case is more extreme in its nature than the diversion of water from one tributary to another tributary of the same stream. (1485.)

The Milk River project, a portion of which is called the St. Mary Project, also involves an inter-watershed diversion. It is located in northern Montana. The St. Mary is considered as a supplementary part of the Milk River Project. St. Mary River is a tributary of the Saskatchewan and is a part of the Hudson Bay drainage. The water from this stream is diverted into Milk River, which is a branch of the Missouri, hence the diversion is, in effect, one from the Hudson Bay drainage in Canada to the Gulf of Mexico drainage in the United States. It is almost opposite in character of diversion from that shown on Exhibit 37, but evidences the fact that both Canada and the United States are willing to transfer water across divides in the same way. Sketch map, *Defendants' Exhibit 44*, shows St. Mary or Milk River project and other facts concerning the proposed diversion. The diversion is another example of the same principle involved in the Strawberry River project. It is not only from one watershed to another, but from one ocean to another. (1485-6.)

The Truckee-Carson project diverts water from the Truckee River near Wadsworth, Nevada, and carries it to the Carson River drainage basin. The *entire flow of the Truckee River* has been diverted into the Carson River basin for irrigation, so that there is *no water* running into Pyramid Lake. (3604-15, 3905.)

The Uncompahgre project in Colorado diverts water through the divide between the Gunnison and Uncompahgre Rivers by means of a tunnel some six miles in length. The water is diverted from the former for application upon lands situate along the latter stream. (1487.)

(5) SEVERAL STATES OF THE UNITED STATES.

There are many notable examples of inter-watershed diversions in the several states of the arid region and particularly in California, Utah, Montana, Idaho, Nevada, Oregon and in both Colorado and Wyoming.

(a) *California.*

The Los Angeles aqueduct is the most notable example in California. It has been built under public auspices and carries water for a distance of 250 miles from the Great Basin across two watersheds and finally delivers on the Pacific coast drainage. It diverts water from Owen River on the east side of the Sierra Nevada Mountains and conveys the same across this range of mountains, across the head of the San Joaquin Valley and across a second range of mountains known as the Sierra Madre or Tehachape Mountains. This diversion from the Nevada or Great Basin drainage for use upon the Pacific Ocean drainage is authorized in connection with the City of Los Angeles, which required water for domestic, irrigation, power and other purposes. Like all other similar diversions, the obtaining of water from this remote source was a matter of necessity. They not only divert the water of Owen River, but intercept a number of intermediate streams, so that the final carrying capacity is about 900 cubic feet per second. The right of the City of Los Angeles to construct this enormous enterprise, costing in the neighborhood of $25,000,000, has not been questioned. (1488-9, 3614.) (See sketch map, *Defendants' Exhibit 45.*)

The Hetch-Hetchy Project is another California project in process of construction for supplying water to San Francisco. Although San Francisco has been using water from a foreign watershed for a number of years, under pressure of need, they have been compelled to go into the Sierra Nevadas and obtain water from the Yosemite basin. This they intercept and carry across the divide and down to San Francisco. (1489.)

The notable features of the two California inter-watershed diversions just mentioned are the cost and magnitude of the enterprises, and, also, that they are contrary to the accredited riparian custom of that state, showing that necessity has forced them to practice this method.

The Truckee-Carson project already mentioned also involves inter-watershed diversion by the United States Reclama-

tion Service of water arising in California. Lake Tahoe lies across the boundary between California and Nevada. Nearly all its watershed is in California, as is also the Truckee River, its outlet which flows into Nevada and terminates in Pyramid Lake. The Reclamation Service is diverting the entire flow into the Carson River for irrigation under the Truckee-Carson project, so that in 1913 no water was running into Pyramid Lake. (3615.)

(b) *Utah.*

There are numerous inter-watershed diversions in Utah. W. D. Beers, State Engineer, says:

> "Will state that it *is* permissible in this state to divert water from one main drainage area into another and also from the watershed of one stream into the watershed of another stream when both are tributary to the same drainage area. * * * We have no diversions across the Continental Divide in this state." (3600-1.)

In a later letter, the same authority states:

> "Regarding the diversions of water from tributary streams where water is carried into the watershed of other streams of the same general drainage area, will state that such diversions are quite numerous in this state."

According to the same authority, there are nine diversions from one main drainage area to another, as shown by the records in the State Engineer's office at Salt Lake City, Utah, either constructed, in process of construction, or proposed. (Beers, 3602-3.)

The Strawberry Valley project of the United States Reclamation Service has already been mentioned, diverting 160,000 acre feet from the Strawberry River of the Gulf of California drainage over to the Spanish Fork River in the Salt Lake drainage. This is probably the most notable of the Utah diversions. (3603.)

The Burt and Carkquish Project for the diversion of 60,000 acre feet of water from Weber River drainage area across the divide into the Provo River drainage is probably the next largest diversion from one main drainage to another in Utah. (Beers, 3603.)

According to State Engineer Beers (3603), there are also diversions of like character as follows: The Timpanogas Irrigation Company project diverting water from Shingle and

Beaver Creeks of the Weber River drainage across the divide into the Provo or Utah Lake drainage;

The Murdock diversion from Beaver Creek across the divide into the Utah Lake drainage;

The Johnson diversion from the Joes Valley branch of the Green River across the divide to Ephraim Creek of the Sevier River drainage;

The Cutler project, diverting water from Weber River drainage across the divide into the Provo River drainage.

Porter project diverting water from Swaine Creek of the Sevier River drainage (which stream terminates in the Sevier Lake in the Great basin) over the divide into Kenab Creek of the Colorado River drainage. (3603.)

(c) *Montana.*

The Milk River project of the United States Reclamation Service is probably the most notable Montana project involving diversion of water from one main drainage area across the divide for application upon lands in another drainage area. In this case, the diversion is from the Hudson Bay drainage into the Missouri River or Gulf of Mexico drainage. (1485-6.)

A portion of the water supply of Butte is pumped from Big Hole River, a tributary of the Missouri, across the Continental Divide to Butte, which is on the Pacific slope. (3614.)

There is also a diversion between Montana and Idaho. (1487.)

(d) *Idaho.*

F. P. King, State Engineer of Idaho, states as follows:

> "I cannot recall for purpose of identification, the numbers of permits involving a transfer of water from one shed to another, but know that such action has been taken *repeatedly without question.*" (3609.)

(e) *Nevada.*

Inter-watershed diversions are common in Nevada. The Continental Divide does not affect Nevada, hence there are no diversions of that class. (3604.)

The most notable diversion is the Truckee-Carson canal of the United States Reclamation Service, already referred to, carrying water from the Truckee River to the Carson River drainage basin. (3604, 3615.)

Other small inter-watershed diversions constructed years ago occur from the drainage basin of the Truckee River. The Carson and Tahoe Lumber & Fluming Company diverted water from the drainage basin directly to Lake Tahoe and discharged

it into the Carson River drainage basin. Lake Tahoe is the head of the Truckee River.

The Virginia City Water Company are now diverting water from Marlette Lake and its tributaries, within the Truckee drainage basin above Lake Tahoe, to Virginia City, discharging the surplus into the Carson River drainage basin.

There are old ditches diverting water from the Walker River drainage basin into the Churchill Valley, eventually discharging into the Carson River basin. (3604-5.)

(f) *Oregon.*

In Oregon there is a ditch which has been constructed for a number of years, taking water from the upper tributaries of Burnt River and carrying the same across the divide into Willow Creek, which is a tributary of Matheur River. (3902.)

Professor Carpenter, speaking of inter-watershed diversions in Oregon, says:

> "There are other projects on Rogue River in southern Oregon. * * * Rogue River runs from southern Oregon into the Pacific Ocean. Kalamath River starts in Oregon and runs into California. There is one case where a ditch has already been completed carrying water from Kalamath basin into the Rogue River valley and there have been one or two others that are projected, surveyed, permits granted and some steps taken towards construction. There are two or three of these projects which are of considerable size.
>
> There is another known as the Teel Irrigation District in Umatilla County, Oregon. In this case they propose to take water from tributaries of John Day River, carrying it across the divide into Butter Creek and then to irrigate land with this water near the Umatilla Government project in Oregon. This enterprise is projected. It is in a state of suspense waiting for funds, but the permissions have been granted and everything is ready to take up construction upon obtaining of funds. I have maps of all these projects, but unfortunately have mislaid them." (3902-3.)

(6) COLORADO AND WYOMING.

Colorado and Wyoming are similarly situate. Their mountain ranges form the Continental Divide and from their slopes waters flow into the two great oceans. (2992.) Both states are in the arid region and their plains originally constituted a portion of the Great American Desert. In both of them the

climate is dry, with very limited rain-fall occurring at irregular intervals. Agriculture must depend almost altogether upon irrigation (1381-7), and, as we shall hereafter observe, in each state, from the earliest times, the rule of riparian rights has been abolished and the rule of appropriation in its broadest sense has been adopted.

We shall further observe that each state has universally recognized and approved the right of its appropriators to apply the water diverted from the streams upon lands requiring its benefit wherever the same may be located, without reference to the stream of origin.

The map, *Defendants' Exhibit 46*, prepared by Professor Carpenter, shows the states of Colorado, Wyoming and Montana and some of the territory in adjacent states and the courses of the streams whose inter-watershed diversions we shall hereafter particularly mention, and especially the Powder and Tongue Rivers as they rise in Wyoming, cross into Montana and join the Yellowstone, and the Laramie and Poudre Rivers as they rise and flow to join the North and South branches of the Platte River, which unite in Nebraska.

(a) *Colorado.*

Irrigation has been practiced in Colorado for a considerable time. In the Cache la Poudre Valley, the first irrigation on an extensive scale in the United States was practiced. Its conditions are quite advanced. Inter-watershed diversions are, and from the very first have been, quite common in this state. Whenever there was an available saddle or pass at an elevation not too great, and where there were streams flowing enough water to justify the expense, these diversions have taken place. They have been as essential to the reclamation of the lands as have been the construction of reservoirs or the exchange of water on streams. (Carpenter, 1490-3.)

The need of water for irrigation has caused inter-watershed diversions within the State of Colorado. Waters were first taken from the streams near by and subsequently from any other source of supply without discrimination. The same causes brought about the construction of these canals as led to the construction of canals of this character in France and India. (Carpenter, 1497.)

The diversion at the head of St. Vrain Creek across the divide and into the drainage of Left Hand Creek was one of the first to be made in Colorado. St. Vrain Creek rises on the Eastern slope of the Rocky Mountains near the summit of the Continental Divide and is a tributary of the South Platte River. Left Hand Creek is finally a tributary of the St. Vrain from the south. James Creek, a still smaller stream, takes its

rise between the St. Vrain and Left Hand Creek and makes a junction with the latter before it emerges from the foot-hills. Left Hand Creek and James Creek do not have a good natural water supply, and do not furnish sufficient water to irrigate the agricultural lands along the borders of Left Hand Creek upon the plains. In the early sixties certain settlers upon the plains along the valley of Left Hand Creek made appropriations of water from the stream for the irrigation of lands occupied by them. There was not enough water in the natural stream to supply their wants. At a certain point in the mountains, James Creek and the south fork of the St. Vrain are but a short distance apart. Taking advantage of this proximity of the two streams and channels, a ditch was cut through the narrow strip of land separating them. Thus water from St. Vrain Creek was carried over into James Creek and thence down the channel of that stream to Left Hand Creek and thence down Left Hand Creek and out upon the plains to supply the settlers with water for irrigation. This artificial channel was first constructed in 1863. By means of this inter-watershed ditch, the volume of water running in the channel of Left Hand Creek was more than doubled. An enlargement of this ditch was made in 1870, whereby the flow of Left Hand Creek was increased to about ten times its original size.

Subsequent appropriators upon St. Vrain Creek required the same water for use upon their lands that was diverted by the owners of the Left Hand Ditch and seized the water and destroyed the dams. The matter was then taken into court, and, as we shall observe hereafter, the diversion was approved by the Supreme Court in two decisions and by two different presiding justices. (See statement of facts and quotation from opinions in Coffin vs. Left Hand Ditch Co., 6 Colo., 443, and Oppenlander vs. Left Hand Ditch Co., 18 Colo., 142.) (Carpenter, 1496.)

Subsequent to the construction of the Left Hand Ditch, numerous other inter-watershed ditches were constructed in Colorado. These will be taken up more with regard to their location than the date of their construction. This class of diversions, as we shall hereafter observe, has been universally approved both by the statutes of the state and by the uniform decisions of its courts. A number of them are as follows:

The Cimarron Ditch takes water from Cimarron River over into Cow Creek and then delivers it into the Uncompahgre, which stream in turn delivers the water in the vicinity of Montrose and in the same neighborhood as the Gunnison tunnel project of the United States Reclamation Service. (1493.)

The West Cimarron ditch diverts water from West Cimarron River to the Uncompahgre and is similar to the Cimarron ditch. (1495.)

The Pine Ridge ditch is an old canal diverting water from the La Plata River to the Las Animas watershed. The La Plata is a tributary of the San Juan of the Colorado River drainage. This diversion is a case of diversion like the one at bar, from one tributary of the stream to another tributary of the same stream as both streams finally flow into the Colorado. (1494.)

The Overland ditch diverts water from Muddy Creek to Laroux Creek and the High Line Ditch diverts water from Surface Creek to Laroux Creek. (1495.)

Another ditch diverts water from Laroux Creek to a dry creek watershed and is another instance of the application of the general principle that where the physical conditions are appropriate, water is taken across the divide. (1495.)

The Montezuma Valley enterprise diverts water from the Dolores River by means of a tunnel into the Montezuma Valley, tributary to the San Juan River. Here again is a case almost identical with the case at bar, as it is between tributaries of the same principal stream. That ditch and tunnel were built in 1887 and have since been in operation. (1495, 1561.)

The City of Colorado Springs takes water from the south drainage of Pike's Peak, carries it through the divide in a tunnel over 6,000 feet in length and through a secondary tunnel about 700 feet in length and delivers it to the east drainage of the same peak. The south drainage of the peak is tributary to Beaver Creek, which flows into the Arkansas River near Florence, while the east drainage is into Fountain Creek, which enters the same stream near Pueblo. Thus the water is diverted from Beaver Creek across into the Fountain Creek drainage, where it is used by Colorado Springs for municipal, power and irrigation purposes. This is another example of diversion of water from one tributary for application on the watershed of another tributary of the same general stream. (1496.)

The City of Cripple Creek takes water from a branch of Beaver Creek, across the divide into Four Mile Creek. Both Beaver Creek and Four Mile Creek are tributaries of the Arkansas River stream system and here again is a case of diversion of water from one tributary to another. (1496.)

The Boulder Pass Ditch and other canals at the head of Boulder Creek and Clear Creek, tributaries of the Platte River (Atlantic drainage), divert water from Williams Fork, a tributary of Grand River (Pacific drainage). (1493-4.)

There are also several diversions planned at the head of Boulder Creek and Clear Creek whereby water will be diverted from Williams Fork and Frasier River, tributaries of the Grand River. Among these are the tunnel of the Henrylyn Irrigation District project and the tunnel proposed by the Moffat Railroad and the City and County of Denver. The

Henrylyn project is in process of construction. It proposes the diversion of water from Williams Fork, a tributary of the Grand River, for application on lands near Denver on the South Platte drainage. The Moffat tunnel enterprise also proposes to bring the water from the Pacific to the Atlantic side of the watershed, the water to be used for municipal and irrigation purposes. (1493, 1497-8.)

There is a canal diverting water from the Pacific drainage over into the Atlantic drainage at the head of the Arkansas River. (1496.)

A ditch on the head of Mosca, diverting water from Sand Creek, Rio Grande River drainage, carries water across the divide into the Huerfano River, Arkansas River drainage. This canal has been constructed for more than twenty-five years. (1496.)

At the head of the Cache la Poudre River, a number of important inter-watershed diversions have taken place in years past. These include the system here in controversy and are: Grand River, Michigan and Skyline Ditches of The Water Supply & Storage Company; Michigan Ditch of The North Poudre Irrigation Company; Divide and Wilson Supply ditch system, and the diversion by the Greeley-Poudre Irrigation District system made possible through its tunnel, collection ditches and reservoirs situate on the Laramie River. None of these diversions are for irrigation of lands within the watershed from which the diversion is made and in each instance the diversion is made from one stream for irrigation of lands situate within the drainage of another stream, the Cache la Poudre River.

The Cache la Poudre River, North Fork of the Grand River and the North Fork of the Platte River, with its tributary, the Laramie River, all rise in the same vicinity in Colorado. (1388.) In this vicinity the several ditches mentioned cross their several divides and convey water from the Grand and the North Platte drainage over into the Cache la Poudre or South Platte drainage. A comprehensive discussion of this area and the location of these several ditches is given by State Engineer Field. (1388-1400.)

Owing to the general development on the Cache la Poudre River, a shortage of water began to be felt in the early 80's, especially for irrigation of late and more valuable crops, such as potatoes, cabbage, sugar-beets, etc. The dependable supply of the stream having been exhausted, irrigators were compelled to look elsewhere and entered upon the construction of the trans-mountain or inter-watershed diversions. (1403-5.)

State Engineer Field (1404) thus described this class of diversions:

"The most difficult and expensive development undertaken is probably in the class of trans-mountain diversions. Here it is necessary to build canals in regions remote from labor, materials, and markets, through comparatively unoccupied territory and over lines where a large part of the work is through rock and along steep hillsides, where the seasons suitable for construction of canals are short and labor hard to obtain, where the most substantial construction is necessary, and where the utmost care must be exercised in the selection of the route and in the performance of the work. The ice and snow conditions of winter must be provided for and guarded against and tunnels of greater or less extent are generally necessary."

Of the Water Supply & Storage Company:

The Grand River Ditch diverts water from the north fork of the Grand River (Colorado River and Pacific drainage) across the Continental Divide and into the South Fork of the Cache la Poudre (Platte River and Atlantic drainage). The canal is about 7½ miles long and was commenced in 1888. It is over 10,000 feet above sea level and used for irrigation of lands in the Cache la Poudre River drainage, situate under the Larimer County Canal, which forms the south boundary of The Greeley-Poudre Irrigation District. (1396, 1443, 1492, 1880, 2204.)

The canal from Michigan Creek diverts from a tributary of the North Fork of the Platte River in North Park, Colorado, over Cameron Pass of the Medicine Bow Range of mountains at an elevation of about 10,200 feet, and into the Cache la Poudre River, for irrigation of the same lands in the Cache la Poudre drainage; (1492, 2204-5.)

The Sky Line Ditch of the same company diverts water from the head-waters of the Laramie River in Colorado. This is the stream here in controversy and this diversion is the first and earliest trans-mountain diversion made from the Laramie River in Colorado. The canal was commenced in 1891 and was completed in 1893. It carries about 130 cubic feet per second (2209) of water across a low pass in the Green Mountains at the point of juncture with the Medicine Bow Range and discharges into the Cache la Poudre drainage at Chambers Lake. It has been in constant use since 1893 and the waters so diverted and carried over the mountains are used for the irrigation of the same lands served by the Grand River and Michigan River ditches; (1405, 2205-13).

Laramie Lake and Lost Lake diversion by the same company carries water, naturally draining from those lakes into

the Laramie River over into Cache la Poudre River by means of a short ditch uniting those lakes with Chambers Lake. Laramie Lake and Lost Lake are situate almost at the top of the Green Mountains. (1492.)

The cost of none of these Water Supply & Storage Company's diversions in any manner compares with that of the Greeley-Poudre system. (1492.) All have been used constantly since their construction under claim of right by priority of appropriation and without objection from Wyoming or her citizens.

The degree to which the arid lands have been reclaimed through the Larimer County Canal with waters obtained from these trans-mountain or inter-watershed diversions, is best illustrated by the photographs contained in album, *Defendants' Exhibit 119.*

Another canal diverting water from Michigan Creek (North Platte drainage) across the Medicine Bow Range and into the Cache la Poudre (South Platte drainage) was constructed by The Mountain Supply Ditch Company, subsequent to construction of the Michigan River ditch of The Water Supply & Storage Company and is now owned by The North Poudre Irrigation Company. This canal furnishes part of the supply of the North Poudre system lying north of the Larimer County canal and west of the lands comprising the Greeley-Poudre Irrigation District.

The Divide Canal and Wilson Supply Ditch, working in combination as one system, were constructed for diversion of water from the upper reaches of Deadman and Sand Creeks, tributaries of the Laramie River, over the divide and into Sheep Creek, a tributary of the Cache la Poudre. This water is used to irrigate lands under the Larimer & Weld Canal in the Cache la Poudre drainage. The agricultural development of the Larimer & Weld area is elaborately illustrated by album, *Defendants' Exhibit 120.*

The Greeley-Poudre Irrigation District enterprise was commenced August 25, 1902, for diversion of additional waters from the Laramie River by means of tunnel and system of collection ditches and reservoirs. (1395-1402, 1935, 2039, 3933.) The tunnel by which the combined waters carried by the collection ditches and reservoirs on the Laramie are conveyed to the Cache la Poudre drainage, located and completed at the point where the Cache la Poudre turns from its theretofore parallel course with the Laramie and runs directly away from the course of the latter stream, needs no further description.

(b) *Wyoming.*

Wyoming is geographically quite similar to Colorado. The water supply in both states is wholly inadequate to supply the

vast areas of arid lands otherwise capable of reclamation. Irrigation is necessary in both states and inter-mountain diversions are as prevalent in Wyoming as in Colorado.

Professor Carpenter makes the following general statement:

> "Inter-mountain and inter-watershed diversions prevail in Wyoming. Wyoming is an arid state where irrigation is practiced under irrigation conditions and is therefore subject to the same general modes of action as other states and other countries.
>
> With Wyoming, as with Colorado, Italy, India and France, wherever there has been a locality developing which needed water, they have obtained water either from adjacent streams or *from available foreign watersheds.*
>
> There are quite a number of instances of this kind in Wyoming.
>
> These diversions have been recognized by the State of Wyoming by permits given by the officials in charge of irrigation.
>
> They have also been recognized by the Board of Control in giving adjudicated rights. Those adjudicated rights are similar to what we call water rights in this country" (referring to Colorado) "They are given by the Board of Control.
>
> In Colorado they are fixed by the courts.
>
> They are identically the same.
>
> Wyoming has officially recognized all of these transfers and use of water from one shed into another." (1503-4.)

He further says:

> "It is a fact that the complaining parties in this suit are doing the very thing of which they complain." (1514.)

The right of the appropriator to obtain his supply from any source, riparian, natural or foreign, has never been questioned in Wyoming, but, on the contrary, has been universally recognized and confirmed, especially by the quasi-judicial tribunals, the State Engineer and the Board of Control, by and through whom all of the water rights in that state are initiated, and, after construction, confirmed and decreed. The custom is there as universally accepted, recognized and confirmed as it is in the State of Colorado.

Professor L. G. Carpenter concludes his most remarkable and comprehensive testimony upon the question of inter-watershed diversions the world over by an extended discussion of

several of these Wyoming inter-watershed diversions, and we can do no better than quote from his testimony *in extenso*.

"The most marked instance is in northern Wyoming in the vicinity of Sheridan, which might be mentioned in detail and is very marked for a double reason, for its development has been to a greater degree than anywhere else and the marked conditions there have developed more than anywhere else I know of in the state.

In the first place, the land is at a low elevation, comparatively speaking, and that means that agriculture is more of an agricultural than of a grazing character, the land justifies higher prices and more extensive development. That is the first condition.

For a second reason, there also happen to be physical conditions near there encouraging the diversion of water quite readily at one particular place.

This has led to an extensive series of diversions from one watershed to another." (1503.)

"There happens to be a very convenient place for diversion between the Powder and Tongue River watersheds. There is a ridge of rock or rampart between the two sheds; but at one particular place it is broken so that there is a gap very much lower than the summit of the ridge. At the same place a tributary of the Powder River comes very close to the opening, so it required very little work to divert water through that opening.

On the north side, that is, the Tongue River side, the watercourse, a branch of the Prairie Dog, descends very rapidly, so that the country on the north side of that gap is lower than on the south side.

This gap has been a noticeable landmark in a sense, and so much so that the early travelers and wagon trains went through the gap and made it a point of crossing through this ridge.

That gives the physical conditions for these diversions.

Then, in addition to that, we have the relative fall of the land to the north and the relative early development of that same region, making additional water desirable. *Hence, it was the most natural thing in the world and a consequence of that same general principle, that they made a diversion through this gap.*

In doing this, they took water from North Piney Creek, which is a branch near the gap; but as the North Piney is not as good a stream as the South Piney, which is more or less east and to the south, they then, in addi-

tion, constructed feeding canals from the South Piney to the North Piney and bring water from the North Piney through this gap into the Prairie Dog Creek on the north watershed.

Prairie Dog Creek is used to some extent as a carrier of this water. They use both ditches and the Prairie Dog Creek for this purpose.

Permits and decrees were given for these diversions by the State Engineer and the Board of Control.

These permits are given to the waters of Piney Creek and the lands are described as lands along the Prairie Dog or other streams to the north.

These streams are tributaries of the Tongue River, they are part of the Tongue River system. The Piney is a part of the Powder stream system." (1508-9.)

"This particular place is the pioneer, almost, in Wyoming, for the two reasons already given, and also for the reason that the vicinity of Buffalo and Sheridan was one of the first in the state to become an agricultural community, hence those conditions developed there more than anywhere else in the state. When I speak of agricultural, I am distinguishing between that and what I call pastoral. I refer to the condition where cultivation of crops prevails.

The elevation of Sheridan is 3,750 feet, while the elevation at Laramie is over 7,000 feet, thus it makes that northern border of Wyoming a portion of the best agricultural section of the state from an economic standpoint.

There is a very extensive series of transfers of water from one watershed to another on the various tributaries of the Powder River which are south of Sheridan.

The ones I refer to as the most marked are those where water is transferred from a branch of the Powder River over into a branch of the Tongue River. *These two streams are entirely independent, both in Wyoming and Montana*, except as they physically mingle their waters after they enter the Yellowstone River.

The Powder River and the Tongue River in Wyoming are very similar in their general situation to the North Fork and the South Fork of the Platte River. These two streams are entirely separate in what might be called the parent state. After passing out of the parent state into another state, they then both enter into another stream and finally join their waters there.

In this case, the Tongue and Powder Rivers join their waters in the Yellowstone.

In the case of the Laramie and the Poudre Rivers,

they join their waters by the junction of the North and South Platte Rivers in Nebraska. *Both the Laramie River and the Poudre River are Colorado streams and their waters intermingle in another state.*"

"*The diversions at Sheridan, Wyoming, are exactly parallel to the diversions from the Laramie River to the Poudre River in Colorado.* The diversion from the Powder into the Tongue is made in Wyoming, while the two streams pass through another state.

I will speak of the diversions within the Powder River watershed before speaking of its diversion into the Tongue River watershed.

The Powder River watershed is just south of the Tongue River. In its watershed is the town of Buffalo and the irrigated section adjacent. Lake DeSmet is in that watershed. On the west side are the high mountains which supply these streams, and these streams, as a whole, are more abundant in the Powder River watershed than they are north of that tributary to Sheridan. *In these streams coming down from the watershed of the Powder River, there have been a large number of diversions from one stream to another.* For instance, there is a diversion from Clear Creek into French Creek, and from French Creek into the Johnson Creek. These streams I mentioned are tributaries of the Powder River. * * * I am taking the transfer of water from the watershed of one branch to that of another branch of the Powder River system. There is also found a diversion that passes from French Creek across Johnson Creek. We likewise have a diversion from Piney Creek on the north to Shell Creek on the south, and also from Rock Creek over to Shell Creek. There is also a place in the mountains some ten or twelve miles west of there where the South Piney Creek and Rock Creek come close together. This offers a convenient opportunity to divert water from the South Piney over into Rock Creek.

Such diversions have been practiced for years and *that whole irrigated tract is interlaced with the use of water from one stream to another.*

The decrees or adjudicated rights have been made from one stream to another according to the original source of supply, irrespective of the location of the lands.

These diversions I have described are all within the general Powder River watershed, which is the more southerly of the two streams, the Powder and the Tongue.

Exhibit 47 is a sketch map showing the stream system in northern Wyoming, both of the Tongue and the Powder Rivers. It shows these various points where

water crosses from one stream to another, *and these particular points are marked with a cross.* The land which it supplies by water through transfer is marked by crossed lines. The extent of these cross lines does not indicate very accurately the land itself, but indicates its location in a general way. It also shows the principal ditches by simply taking the outside or typical ones that cross the divide. It does not extend beyond the Montana border. In the corner, there is a map on a small scale that shows its relation to Montana and the Yellowstone River, showing the general situation on a very much reduced scale.

Exhibit 47 shows the various diversions I have just testified about, that is, those taking water from one portion of the Powder watershed to another." (1504-7.)

"I next refer to the diversions from the Powder River over into the Tongue River watershed. The rights to this water are given in the State records of Wyoming as classed in with the appropriations from Piney Creek, and except by looking up the specific lands, it would not be revealed that the water is carried across the shed. In this particular case, the list of lands that have thus acquired rights have been platted on the topographical sheet and are shown in color.

Exhibit 48 is a map prepared on the Sheridan Quadrangle Sheet of the U. S. Geological Survey, with additional notations made under my direction, and which show in color the lands on the Tongue River watershed that are supplied by water from Piney Creek of the Powder River watershed.

These are the lands to which water has been decreed by the Board of Control of the State of Wyoming. That body consists of the State Engineer and the Division Superintendents and is the official body of the state to issue decrees to water.

In addition, the divide between the two streams is noted by broken line in this map in heavier ink, so as to indicate clearly where that watershed is. The ditches are not indicated in my notations. They are shown on the map by a blue line, corresponding to the stream. There are three or four colors used which indicate the course given of respective ditches through this gap. The coloring was done by me. There is a legend on the map showing what each color signifies.

There are some diversions in the same general vicinity in addition to the diversions I have noted on this map, that is, * * * there are quite a number of diversions within the Tongue River drainage itself, similar in

character to those referred to within the Powder River watershed.

It simply is a general practice there, and the conditions as mentioned are very favorable to such diversions, and consequently they have done there as everywhere else on the earth's surface, when the occasion justified it. *They have carried water from one stream to another as freely as if no sheds were there, and the only conditions to be considered were physical and economical.* These on the map, are represented in like manner as in case of the Powder River system, by cross at the point where the principal diversions are made across the sheds. It is not an exhaustive list. There are others in the extreme north and west of this map that are not shown here.

I was compelled to check the lands as fixed by the Board of Control decrees in order to ascertain which of these diversions from Piney Creek and the Powder River tributaries were inter-watershed in their character. The published list of adjudicated rights, published by the State, simply tells the name of the ditch, for instance, the Prairie Dog or Supply Company and puts it under Piney Creek, but gives no indication as to where the land is located, and this requires a list of lands in detail, which are not included in the published list." (1511.)

At a later time in his testimony, Professor Carpenter thus further referred to these Sheridan diversions:

"I spoke of such diversions being made within Wyoming in the vicinity of Sheridan. * * * It seems there are ditches in Montana on both of these streams below the Montana line, that is, there are ditches in Montana after these streams run from Wyoming into Montana and before either of them joins the Yellowstone. There are also ditches in Wyoming. I ascertained those facts from county officials in Montana counties." (3905.)

Professor Carpenter further says:

"There are several other instances of inter-watershed diversions in Wyoming that I know of and undoubtedly there are many that are arising, because wherever the conditions justify, such diversions are the natural consequence.

The diversion by the Wheatland project out of the Laramie River, known as the Wyoming Development Company's diversion, *is an inter-watershed diversion.*

Water is taken from the Laramie River by a tunnel into Blue Grass Creek, thereby taking Laramie River water over into the Sybille watershed, which, in turn, is a tributary finally of the Laramie. This is a diversion from the main stream across into the shed of tributaries.

The difference between the diversion of the Wyoming Development Company and the diversion between the headwaters of the Poudre is one of degree only. The two streams come close together *and the diversions would undoubtedly have been made just as freely if the Sybille had not entered the Laramie at all.* It does enter the Laramie River, but I have no doubt from my knowledge of the mind of the people who developed the enterprise and the people who farm and need water, that those people would have diverted water just as quickly and just as freely, believing that it was perfectly right and proper, * * * whether the Blue Grass had gone into the Sybille and then into the Laramie or whether it had gone in the other direction. *In other words, it is just as natural to take water when available there as it is for a hungry man to search for food.*

Had the Wheatland people not made the inter-watershed diversion by means of the tunnel, they could not have developed the Wheatland area, except to a limited extent. That diversion has rendered the whole Wheatland tract possible from an agricultural standpoint. The only difference between the diversion at issue in this case * * * and the diversion from the Laramie to the Blue Grass is one of degree, and that the streams come together again quicker in one case than in the other. Had the Wyoming Development Company's tunnel not been constructed, the water of the Laramie River would have gone on into the North Platte.

The diversion by the Wyoming Development Company is recognized in Wyoming. * * * The courts and officials have recognized it, permits have been granted, the Board of Control has adjudicated it, and it is in the general list which has been subject to appeal, so that I think the final decree has not been entered. I am not aware of any objection having been raised to this diversion on account of its being inter-watershed in character. I have never heard any suggestion." (1511-13.)

An examination of Plaintiff's Exhibit N will reveal the fact that the District Court of Wyoming has officially recognized and decreed this inter-watershed diversion for the Wheatland project.

Professor Carpenter further says:

"There is a diversion under construction in Wyoming where water is proposed to be *taken from the North Platte River and brought over into the Little Laramie River*, * * * by The Laramie Water Company, which system includes Lake Hattie Reservoir. * * * Water is taken from Douglas Creek, a part of the North Platte system, and brought into the Little Laramie * * * and thus taken from the North Platte River to supply the Laramie River. * * * It runs from the Little Laramie into Lake Hattie by means of a supply canal tapping the Little Laramie. If the waters of Douglas Creek were not intercepted and were allowed to flow as of nature, they would go into the North Platte River and into the Pathfinder Reservoir.

This is the same ditch concerning which Mr. Bishop as engineer for the Laramie Water Company testified. It is the same ditch sometimes known as Douglas Creek Ditch and testified to by other engineers who were witnesses for Wyoming and were employees of The Laramie Water Company. (1513-14.)

"I have found several references and plans of proposed diversions from one stream to another where maps have been presented and referred to in the State Engineer's reports.

Exhibit 49 is a reproduction of sketch maps in the reports of the State Engineer of Wyoming, showing proposed diversions from one stream to another. There are three of them. * * * These three sketch maps shown in Exhibit 49 are all from the 7th Biennial Report of the State Engineer of Wyoming.

The one taken from page 40 represents the Encampment Canal in the Platte River drainage basin, and its proposed route crosses several other tributaries of the Platte River System.

From page 39 of the same 7th report, is a proposed Basin Canal from the Grey Bull River and crosses the divide between the Grey Bull and the Big Horn, passing over the divide and dropping into the Dry Cottonwood and supplying some of the valley in the vicinity of Basin.

There are several other minor canals shown, noting proposed developments that are not interstream.

On page 44 of the same report is also shown a diversion proposed from the Shoshone River across the divide into the watershed of the Grey Bull and there are some ditches taken from the Shoshone River to the north, running into minor watersheds.

There are probably a large number of inter-watershed or interstream diversions varying only in quantity and degree throughout Wyoming. I have not looked up all these places where conditions are favorable, but where conditions so favor they are apt to be found." (1515-16.)

Complainant objects to Colorado taking water *from* the *Laramie* River for use upon lands in the Cache la Poudre watershed. It would be indeed remarkable if it were discovered that for many years Wyoming has been taking water *from* the *Cache la Poudre* over *into the Laramie River* drainage, and that her right so to do has been adjudged and decreed by quasi-judicial tribunals having jurisdiction so to do. Nevertheless, such is the fact, and while the diversion is comparatively small, it nevertheless serves to confirm the fact that such diversions are not only legal but universal in Wyoming as well as in Colorado and that they are sanctioned by the courts of one state to the same degree as they are by those of the other.

Professor Carpenter says:

"I have ascertained that the appropriators of Wyoming divert water from the Poudre River over into the Laramie River. There is a case where water is diverted just in the contrary direction to that proposed by the State of Colorado through the Greeley-Poudre system. Water is diverted from a tributary of the Poudre River by systems in Wyoming over into a tributary of the Laramie area or from the Poudre watershed into the Laramie watershed.

This diversion takes place in Wyoming under the sanction of the laws and regulations of Wyoming. *It is done in accordance with the permit of the State and by the rights which have been passed on and adjudicated by the official Board of Control.*

Defendants' Exhibit 50 is a *map prepared by the State Engineer's office of Wyoming*, of a portion of Tp. 12, North, Range 73 West, the southern boundary of this portion being the state line between Colorado and Wyoming. This is one of a series of maps prepared by the State Engineer's office of Wyoming, showing ditches and streams from which ditches have been taken in that state for the purpose of record in their office. They have a series of such maps covering most of the state where ditches have been built and rights have been recognized.

This, then, that I present, is the official map from their office, except that for clearness in this case I have marked over the streams and ditches in color to make

it more distinct. The streams are designated with red and the ditches with yellow. This was done to make them clearer, for, as this is a blue print, the lines are not very clear.

The Johnson ditch crosses the divide from Fish Creek, *which is a branch of Dale Creek in the Poudre River watershed and over into Willow Creek drainage area, which is a part of the Laramie watershed. The Hill Ditch* also apparently crosses the divide and is not so clearly marked.

These diversions are all of minor character, compared with the larger ones of which I have spoken. They are small as to the amount of acreage, *but they involve the same principle.*

Fish Creek is a small stream running into Colorado but having a good many diversions from it in Wyoming." (1516-18.)

"Fish Creek is one of the several tributaries of Dale Creek which is one of the tributaries of the Poudre River. It has no large drainage area, but there are a number of decrees from it in Wyoming. It is actually a tributary of Dale Creek." (1577.)

"The diversion of water from the head of Fish Creek over into the Laramie River drainage in small quantities * * * is an injury to the Poudre Valley. All the water of the Poudre River, especially on Fish Creek, Dale Creek and the North Poudre, is and has been needed for years. It is particularly needed during the summer season. * * *

The difference between this diversion and a larger diversion is entirely a question of degree. This Fish Creek diversion simply illustrates the natural tendency to obtain water where the land is situate, so that it can be used and to derive the water from any adjacent or available source." (1595-6.)

Reduced to final analysis, a denial of the right of Colorado and her citizens to divert the waters of the Laramie River for irrigation of lands in the drainage area of the Cache la Poudre will be to declare that similar diversions are unlawful in Wyoming. So to do, would necessarily involve not only the Wheatland area, within the Sybille drainage and largely dependent upon the inter-watershed diversion from the Laramie and its Wheatland Reservoir No. 2, as well as other minor inter-watershed diversions within that drainage, but also the Sheridan area, within the Tongue River drainage and reclaimed with waters from the Powder River, and many other of the most highly developed agricultural districts of Wyoming. The Lar-

amie and Cache la Poudre are both within the Platte River drainage and the Powder and Tongue Rivers are both within that of the Yellowstone, and diversions from one greater tributary to another differ only in degree from diversions between minor streams going to form either of the larger tributaries, and to confine the use of water to the particular drainage of origin, be it large or small, must needs impair or render wholly valueless a considerable portion of the agricultural areas of both Colorado and Wyoming.

We cannot concur in advocating so destructive and revolutionary a doctrine.

Professor Carpenter, speaking generally of inter-watershed diversions, says:

> "I have covered a number of examples of inter-watershed diversions on both hemispheres, situate in several countries and several states of the United States. As I have before stated, they are illustrations of the fact that when water is needed for agriculture, they are going to, or are inclined to divert that water for that purpose whether it be from a stream adjacent or from a greater distance, and by a direct diversion or the intermediate use of reservoirs; *but in all cases, the diversion is actuated by the need and the opportunities to use that water. The fact of passing watersheds seems, in no case to be any more than a question of physical difficulty.* That is done as freely from one stream or a neighboring stream if the physical conditions permit and justify it. It has been recognized by practice and custom as a necessary thing to do. In each instance the object is to obtain water for irrigation of land, and in some cases for domestic use. Practically all the cases I have given have been for irrigation, at least that has been a very important part of the purpose. *There is no essential difference between the use of open ditches or tunnels for the purpose of making these inter-watershed diversions.* They are both means adapted to local conditions and accomplish the same general purpose. The selection of either of these means is merely an engineering problem." (1519.)
>
> "The preservation of waters in their natural watershed for a period of years ranging from a few years to a thousand years or more for the purpose of future development has never seemed to enter the calculation. I have seen no case where they have seemed to give that any thought, except in the consideration as to where the greatest benefit might be." (1593.)

No attempt was made by the State of Wyoming to controvert or deny the facts and conditions described in the foregoing

testimony of Professor Carpenter, and it therefore stands as admitted by the plaintiff that the same rule of necessity and opportunity now and always has governed all diversions in Wyoming, regardless of natural watersheds, to the same degree and effect as at every other place and in every other country where arid lands require the artificial application of water in order that they may be rendered the more productive, and that the more productive those lands prove to be, the more marked has become the actual construction of inter-watershed diversions.

Unfortunately, throughout all the arid countries of the world, there seems to be more available land than water supply, and in Wyoming, as elsewhere, the economic and financial problems of overcoming the physical obstacles have been the only problems standing between the construction of these inter-watershed diversions for the reclamation of arid lands. In Wyoming as in Colorado, the state has elected to abandon absolutely the doctrine of riparian rights and has adopted the rule of rights to the use of water from the streams within her borders by priority of appropriation, preference being given exclusively in the order of priority of the initiation of such diversions, if followed with continuity and beneficial use is made within reasonable time under all the circumstances surrounding the appropriation, and without the slightest regard to the physical location of the point of diversion and the lands to be served. Furthermore, Wyoming has carried this doctrine to the extreme limit by already officially adjudging and decreeing to her citizens waters arising within her borders but flowing southerly and into the Poudre River in Colorado for irrigation of lands situate across the natural divide and within the drainage area of the Laramie River and thereby has officially decreed and sanctioned that which she, in this case, condemns as illegal if done by the defendants.

CAUSES OF INTER-WATERSHED DIVERSIONS.

Professor Carpenter, who gave this subject most exhaustive consideration, in part said:

> "I have had occasion to observe diversions of water from one watershed to places of use upon another watershed the world over. It is practically a universal custom." (1445.)
>
> "These diversions have been prompted through the *need of water* in one watershed with the other watershed providing the most feasible and practicable way of obtaining water. It simply is one step in supplying the need. In some other cases, it has been also governed

by some or other additional considerations, as, for instance, the place of greatest use.

If inter-watershed diversions had been prohibited in many instances I have observed, *it would have prevented the development of a great many communities and of millions of acres. It would have lessened the food production for quite a large number of the human race*, for, I think it is pretty well known, that practically *seven-eighths of the food of the human race is raised by irrigation.* This is not true of our Anglo-Saxon people, but of the people of the world as a whole it is true. So that immense areas would have remained idle and, as in India, the loss from death by famine would have been very much increased, in fact, some of these cases in India were forced for the prevention of famine.

The custom of using streams as natural carriers of water from one part of a system of works to another is as universal as the need. Whenever the stream is so situated and the land to be served is so situated that the stream is convenient for that purpose, it is done without limit. If the land is situated where the stream is not a convenient carrier, they bring it in another way." (1446.)

In speaking of this character of diversions in India, he concludes with the following remarks:

"These diversions are simply made whenever the conditions are favorable; if they have water they can get, they plan a diversion from it. * * *

In each of these cases I have specifically pointed out, had these inter-mountain or inter-watershed diversions been prohibited, it would have meant the loss of millions of lives by famine in India. In fact, many of these canals and diversions have been taken up as a result of a report of the Famine Commission of India about 1898, I think, that suggested some of them, but by no means all.

They are entirely a result of the natural growth and development of the region.

Decidedly larger areas are made productive by this method than would be otherwise. A great deal of the water would run to waste otherwise.

Necessity has produced the construction of most of these works.

I have looked through the government reports, * * * and I have never found any legal objection against these diversions because of their inter-watershed character. This class of diversions seems to be taken as

a matter of course, to which they seem to have no objection whatever. There seems to be no more objection presented to it than to taking from a stream within its own shed." (1457-8.)

Of the French diversions, he says:

"The general principles involved in the diversions in France are the same as the diversions in India to which I have referred. There is a difference in magnitude, but where the conditions call for the diversions they have done it. The diversions are the result of the same general conditions * * *.

If these diversions which I have mentioned had not been made in France, it would have made probable the loss of a great many lives at Marseilles, which has had in its past years a great loss of life from lack of water, and it would mean the failure or suspension of population east of Arles on those plains that now are very easily supported by this water, and so it is in the vicinity of Avignon." (1463.)

Of the canal of Nimes, he says:

"It is not a very large one in capacity, but still it illustrates the same facts, that they are inclined to build a canal under the pressure of need and without any thought where the water comes from as far as that is concerned or where it is applied." (1466.)

He further says:

"I have failed to find any objection ever presented in France to this manner of diversion and application of water in any of the descriptions of canals, projects, or in any literature on that subject that I have seen." (1472.)

In speaking of the Italian irrigation, he says:

"These illustrate the general principle shown by those already given, that they take water freely from any stream that may be available.

I have failed to find any objections ever presented to any such manner of diversion and application of water in Italy. I have looked through the government reports and other literature of all kinds, some, by the way, running back to the fifteenth and sixteenth centuries, in a series of authors on water in Italy, and in no case has any reference to objection on any such score been made that I have found." (1472.)

With regard to Spain, he says:

"I know of no objection having been raised to such diversions. I do not think there could have been any, because the practice has gone on so generally." (1474.)

Of diversions in Hindustan, he says:

"I know of no rule governing these inter-watershed diversions except the same rule that has been evidenced elsewhere, that where water is available and land was needing water, it was taken without any regard to divides or considering any more than the physical obstacles that needed to be overcome as to the water of the stream itself. It was a mere physical difficulty." (1475.)

In speaking of such diversions in British Columbia:

"In a number of cases I found permits of this character that planned the diversion of water from one stream to another. The physical conditions seem to entirely control in these cases.

As a member of the Irrigation Commission, I did not raise any objection whatever. In fact, the laws as they were, permitted it, and the laws as passed did not forbid it.

It was considered one of the essential conditions to the development in an irrigated country, so it was left entirely permissible." (1478.)

In speaking of the various states:

"There are many notable examples of inter-watershed diversions in the several states. There are numerous cases in Colorado and Wyoming. There is one between Montana and Idaho, and, in fact, in nearly all of these states wherever the conditions require it.

Whenever it becomes necessary and feasible to bring water across the divide, wherever they have land on one side and find water on the other side of the divide, then they make the diversion." (1487.)

"I have not made detailed investigations of many of the other states. As I have previously stated, the conditions under which such diversions take place indicate that there has a certain development taken place. It has reached such a point that the local supply of water, if not exhausted, is at least so that the conditions justify their going some distance for water. This is an economic condition. When a state is just developing, they cannot afford to go too far for water,

especially when they can get it near by. Extreme conditions warrant the expenditure of larger sums of money to accomplish the irrigation of larger acreages. This occurs as the country becomes developed." (1490.)

Toward the close of the testimony, he says:

"They are simply illustrative of the *same general rule* that I have been attempting to show to be *universally true*, which is, that whenever there is an occasion to use the water, *whenever there is a need of water, people are going to obtain it from the stream that is nearest to them* or the stream that is most accessible physically and financially and, *whether a divide stands in the way or not, does not cut any figure*, any more than it requires more capital. * * *

I have found cases of physical and possibly financial obstacles, but that has been all. There has been no difficulty or opposition from the fact that water was taken across the divide." (3901-2.)

Referring to the Hawaiian Islands, he says:

"It shows again that where water was needed and they have conditions that justify the expense, the construction is completed." (3904.)

Referring to the Truckee-Carson diversion of the United States Reclamation Service, he says:

"In fact in one of these transfers the water is taken from a stream that runs normally into one basin or sink, over into a stream or watershed which runs into another and entirely different basin or sink. That is done by authority of the U. S. Reclamation Service and in those, as in other cases, where divides have been matters that have come in connection with these enterprises, they have not been considered as a different condition and water has been carried across them as freely as across minor divides or ridges.

They have carried the water in this case just the same as they have in the case of the Strawberry project and the Gunnison project. * * *

In all those cases the water has been carried across the divide wherever the conditions justified it." (3894-5.)

Speaking further in regard to foreign countries, he says:

"In foreign countries there are a number of other

cases of inter-watershed diversions than those I noted. It is perfectly safe to assume that wherever conditions exist, such transfers of water will be found." (3906.)

"No doubt further search into the subject would develop information concerning large numbers of these inter-watershed diversions wherever proper conditions exist. Diversions of this kind will be found where water is needed on one side and where land is so valuable as to justify the expense.

Such diversions in such cases will be made just as naturally and just as much a matter of course as we know that a thirsty man will drink water." (3907.)

Inter-watershed diversions between tributaries of the same stream are in no essential manner different from those across continental divides. In discussing this phase of the case, Professor Carpenter says:

"This is done by the U. S. Reclamation Service and in those, as in other cases, where divides have been matters that have come in connection with these enterprises, they have not been considered as a different condition and water has been carried across them as freely as across minor divides or ridges." (3904.)

And again:

"From the standpoint of irrigation and development, *I see no difference*, unless it possibly be in degree, *between diversions from the watershed of drainage of one ocean into the watershed of drainage of another ocean*, or of a stream having no outlet, *and between tributaries of the same stream.* It is a condition that comes from a state of development and a state of need, and local conditions which either make it possible or impossible. Thus, at the head of the Big Thompson, diversion could only be made at great cost and so high up there would not be enough water obtained to justify the expense. At the head of Boulder Creek diversion could be made at a lower elevation and water caught and the expense justified, and the same in Wyoming where diversions can be made when conditions justify it." (1498.)

Mr. John E. Field, State Engineer of Colorado and for years an expert in irrigation matters for both the State of Colorado and the United States Government, says:

"In irrigated regions the custom is to go and get water where you can get it, whether it is from the same

watershed in which the land is situated or whether it is from some other watershed.

Inter-watershed diversions are made where necessity arises that will justify construction. As a rule, they are decidedly more expensive than intra-watershed diversions. As a rule the only obstacle is that of expense. Wherever there begins to be a water shortage, the irrigators or those desiring to build ditches or desiring to increase efficiency of their systems, look for other water supplies, and this search for additional water carries them into other watersheds, and, if not too expensive, these diversions are made.

The future needs of the district from which the water is taken are never considered. Projectors of inter-watershed diversions simply ascertain whether there is any water there sufficient for them. *Their necessities have come earlier than those in the drainage area itself and are supplied first, and they take their water in order of priority, regardless of whether it is to be used in the same watershed or in a different watershed."* (3596.)

As illustrative of the principle which the record in this case bears out, it might be permissible to refer for the moment to Prescott's "History of the Conquest of Peru," Volume 1, pages 131-2, where the author thus describes irrigation of the ancient Peruvians:

"Much of the country along the sea-coast suffered from want of water, as little or no rain fell there, and the few streams, in their short and hurried course from the mountains, exerted only a very limited influence on the wide extent of territory. The soil, it is true, was, for the most part, sandy and sterile; but many places were capable of being reclaimed, and, indeed, needed only to be properly irrigated to be susceptible of extraordinary production. To these spots water was conveyed by means of canals and subterraneous aqueducts, executed on a noble scale. They consisted of large slabs of freestone nicely fitted together without cement, and discharged a volume of water sufficient, by means of latent ducts or sluices, to moisten the lands in the lower level, through which they passed. *Some of these aqueducts were of great length. One that traversed the district of Condesuyu measured between four and five hundred miles.* They were brought from some elevated lake or natural reservoir in the heart of the mountains, and were fed at intervals by other basins which lay in their route along the slopes of the Sierra. In this descent, *a passage was sometimes to be opened through rocks,—*

and this without the aid of iron tools; *impracticable mountains were to be turned; rivers and marshes to be crossed;* in short, the same obstacles were to be encountered as in the construction of their mighty roads. But the Peruvians seemed to take pleasure in wrestling with the difficulties of nature. * * *

Most of these beneficent works of the Incas were suffered to go to decay by their Spanish conquerors. In some spots, the waters are still left to flow in their silent, subterraneous channels, whose windings and whose sources have been alike unexplored. Others, though partially dilapidated, and closed up with rubbish and the rank vegetation of the soil, still betray their courses by occasional patches of fertility. Such are the remains in the valley of Nasca, a fruitful spot that lies between long tracts of desert; *where the ancient water-courses of the Incas,* measuring four or five feet in depth by three in width, and formed of large blocks of uncemented masonry, *are conducted from an unknown distance.*"

At page 134:

"With such patient toil did the Peruvians combat the formidable obstacles presented by the face of their country! Without the use of the tools or the machinery familiar to the European, each individual could have done little; but acting in large masses, and under a common direction, they were enabled by indefatigable perseverance to achieve results, to have attempted which might have filled even the European with dismay."

On page 137:

"Such were the expedients adopted by the Incas for the improvement of their territory; and, although imperfect, they must be allowed to show an acquaintance with the principles of agricultural science, that gives them some claim to the rank of a civilized people. Under their patient and discriminating culture, every inch of good soil was tasked to its greatest power of production; while the most unpromising spots were compelled to contribute something to the subsistence of the people. Everywhere the land teemed with evidence of agricultural wealth, from the smiling valleys along the coast to the terraced steeps of the Sierra, which, rising into pyramids of verdure, glowed with all the splendors of tropical vegetation."

And on page 364, he further describes irrigation works of the Incas:

> "The soil, though rarely watered by the rains of heaven, was naturally rich, and wherever it was refreshed with moisture, as on the margins of the streams, it was enamelled with the brightest verdure. The industry of the inhabitants, moreover, had turned these streams to the best account, and canals and aqueducts were seen crossing the low lands in all directions, and spreading over the country, like a vast network, diffusing fertility and beauty around them. The air was scented with the sweet odors of flowers, and everywhere the eye was refreshed by the sight of orchards laden with unknown fruits, and of fields waving with yellow grain and rich in luscious vegetables of every description that teem in the sunny clime of the equator. The Spaniards were among a people who had carried the refinements of husbandry to a greater extent than any yet found on the American continent; and, as they journeyed through this paradise of plenty, their condition formed a pleasing contrast to what they had before endured in the dreary wilderness of the mangroves."

That this description by the eminent historian was conservative, we need but refer to the learned article and especially the photo illustrations accompanying the same, recently prepared by O. F. Cook, Botanist of the National Geographic Society, and published in May, 1916 number (Vol. XXIX, No. 5, p. 474, et seq.) of The National Geographic Magazine under title of "Staircase Farms of the Ancients," wherein he says in part:

> "At a time when our ancestors in northern Europe were still utter savages, clothed only with skins, and living by hunting and fishing, settled agricultural communities must have existed in the Peruvian region. * * * Evèn irrigation agriculture appears to us as a new and very specialized branch of the art, and we think ourselves very enterprising to have undertaken the reclamation of our so-called deserts in the Western States. * * * The native agriculture of Peru reached the stage of reclamation projects long before America was discovered by Europeans. *Our undertakings sink into insignificance in the face of what this 'vanished' race accomplished.*"

The late Clesson S. Kinney, in his recent (1912) treatise on the law of "Irrigation and Water Rights" and the arid

region doctrine of appropriation of waters, Volume 1, gives the history of ancient and modern irrigation in a most elaborate and comprehensive manner on pages 101 to 127 inclusive. For illustration, of ancient irrigation in the arid west and the extremity to which *necessity* drove the ancient builders, he says:

> "One of the most marvelous engineering accomplishments of ancient or modern times is shown in discoveries which were made during the years of 1899 and 1900 in the lava beds of New Mexico. Hundreds of years ago, the geologists and archaeologists tell us, a system of irrigation reservoirs and ditches was operated in this Territory, which is not paralleled by anything of this nature in the United States today. The builders of these works, a people older than the Pueblo race, the native occupants of this section of the country, cultivated thousands of acres of now arid territory. Ditches wound in and out at the base of the mountain ranges, following the sinuosities of the larger canals in such a manner as to catch all the storm water before it was absorbed by the loose sand at the mountain's base. Reservoirs constructed at convenient places stored the water, from which it was led in cemented ditches across loose soil to the various points where it was required for irrigation. * * *
>
> That they were highly developed, however, in agriculture, which is the mother of civilization, is shown by the evidences which they have left.
>
> Their canals wind in and around for miles, showing a superior engineering knowledge in securing an exact and uniform fall; remarkable viaducts were used in crossing canyons, while a network of distributing ditches brought every available acre into use for tillage. Here was no irrigation by wandering tribes, or individual owners, or diverters of water; but a great system covering large areas, and by a people who were permanently settled in that region, carefully thought out and operated by a central head for the greatest good of the many and the utilization of the greatest possible acreage."
>
> Kinney on Irrigation (2nd Ed.), Vol. 1, p. 121.

And thus we find that *necessity* has universally caused inter-watershed diversions and that wherever agriculture, the "mother of civilization," has prevailed upon the face of this earth, it has been the universal custom through all the ages to supply the *needs* of thirsty land with water from any available source whether within or without the drainage area of the stream from which the diversion was made, and that natural

barriers have interposed no obstacles, other than physical, to such diversions, which have been made across the divides as freely and as naturally as within the watersheds. And we also find that both Colorado and Wyoming have been no exception to this general rule; that inter-watershed diversions have been made as freely, naturally and beneficially there as elsewhere; and that the only limitation *within* each state upon all diversions (intra- and inter-watershed) has been that he who is first in time shall forever be first in right as against all who shall claim from the same source *within his respective sovereign jurisdiction.*

THE LAW OF INTER-WATERSHED DIVERSIONS.

Will be treated as follows:

(a) *Riparian Rights.*
(b) *Arid Region Doctrine of Appropriation.*
(c) *Essential Differences Between Common Law and Appropriation Doctrines, Including Right to Make Inter-watershed Diversions.*
  (1) Colorado Constitution, Statutes and Decisions.
  (2) Wyoming Constitution, Statutes and Decisions.
  (3) Other Decisions and Authorities.
    (3-a) Hoge v. Eaton, Overruled.
(d) *Plaintiff's Brief.*
(e) *Conclusion.*

THE LAW OF INTER-WATERSHED DIVERSIONS.

In Volume I of this brief, we have discussed at length the law relative to the right of each sovereign state to regulate diversion and distribution of waters within her own borders in such manner as she may elect, including the right to change her doctrines or rules in such manner and as frequently as she may desire.

Kansas vs. Colorado, 206 U. S., 46-94; 27 Sup. Ct., 655; 51 L. Ed., 956.
United States vs. Rio Grande Irri. Co., 174 U. S., 690, 702-6; 19 Sup. Ct., 770; 43 L. Ed., 1136.
Clark vs. Nash, 198 U. S., 361, 370; 25 Sup. Ct., 676; 49 L. Ed., 1085.
Boquillas Cattle Co. vs. Curtis, 213 U. S., 339, 345; 29 Sup. Ct., 493; 53 L. Ed., 822.
Kinney on Irrigation (2 Ed.) Vol. 1, p. 1025-29, 1088.

A preliminary discussion of the rights of appropriators in the arid regions of the United States, to divert the waters of one stream for carriage across the divide of the watershed and for application within the drainage area of another and foreign stream requires a brief consideration of the common law doctrine of riparian rights in order that we may distinguish the rights of water users under that doctrine from those claiming under the doctrine of appropriation, and for the further purpose of interpreting decisions of courts of certain of the states which have adopted the common law rule in its strict or modified sense. We shall frequently italicize for better emphasis.

(a) Riparian Rights.

In Great Britain and the humid states of the United States, where the climate is moist, the natural rain-fall abundant and the land supplied by numerous springs and flowing streams, irrigation is not required. There the concern of the farmer is how he may dispose of surplus water, already so abundantly supplied by nature, rather than how he may supply his crops with sufficient moisture to start the seed and promote their growth.

> "The problem there to be solved is how best to drain the water off the land and yet get rid of it, not how to save it to be conducted upon the land in aid of the husbandman."

In this humid region, *every proprietor of land* on the *banks* of natural streams has *equal rights* to have the water of the stream to flow "as it was wont to run" without diminution in quantity or deterioration of quality save as necessarily depleted by reasonable use thereof by himself and other riparian proprietors.

Long on Irrigation (2 Ed.) Sec. 31, page 66, and cases cited.

The common law doctrine of riparian rights is thus stated by Chancellor Kent:

> "*Every* proprietor of lands on the banks of a river has naturally an *equal* right to the use of the water which flows in the stream adjacent to his lands, as it was wont to run (*'currere solebat'*), without diminution or alteration. No proprietor has a right to use the water to the prejudice of other proprietors, above or below him, unless he has a prior right to divert it, or a title to some exclusive enjoyment. He has no property in the water itself, but a simple usufruct while it passes along. *'Aqua currit et debet currere ut currere solebat'* is the language

of the law. Though he may use the water while it runs over his land *as an incident to the land*, he cannot unreasonably detain it, or give it another direction, *and he must return it* to its original channel when it leaves his estate.

Without the consent of the adjoining proprietors, he cannot divert or diminish the quantity of water which would otherwise descend to the proprietors below. * * * This is the clear and settled doctrine on the subject, and all the difficulty that arises consists in the application. The owner must so use and apply the water as to work no material injury or annoyance to his neighbor below him, who has an *equal* right to the subsequent use of the same water; * * * All that the law requires of the party by or over whose land a stream passes is that he should use the water in a reasonable manner, and so as not to destroy, render useless or materially diminish or affect the application of the water by proprietors above or below on the stream."

Chancellor Kent, 3 Kent Com., 439.

Common law rights of riparian proprietors are such as grow out of or are connected with their ownership of the *banks* of streams and rivers, or other bodies of water. These rights are distinct from those of the rest of the public, by reason of the fact that the land of the riparian owner touches the water. They are termed natural rights and arise *ex jure naturae*, and are the natural advantages of the owner which spring from the natural situation of the land upon the water. The riparian owner has a right to make reasonable use of the water of the stream as it flows by his land, but his usufructuary right is *equal* with and no less nor greater than all that of *every other* riparian owner upon the same stream. Use by one riparian owner must be of such a character as not to destroy, render useless or materially diminish or affect every other proprietor on the stream in his equal right to the use of the same water. These property rights are part of the freehold of which no riparian owner can be disseized but by due process of law and upon a just compensation.

Kinney on Irrigation & Water Rights (2d Ed.), Vol. 1, pages 759-73, and cases cited.

Professor Long, in his very recent work, says:

"The right of a riparian proprietor to the use of the flow of the water of the stream is an inherent incident of his ownership of the riparian land; it is annexed to the soil, not as an easement or appurtenance, but as a

part and parcel of the land itself. As a part and parcel of the land it passes with the land upon the sale thereof although not specifically mentioned in the conveyance. * * * *It follows from the nature of the right that it is in no way dependent upon user. Use does not create the right and disuse cannot destroy or suspend it.* If the riparian proprietor does not care or need to use the water, he still has the right to have it flow in its accustomed channel, except as its volume may have been decreased by its reasonable use by upper proprietors. His right can be lost only by grant, condemnation or prescription."

Long on Irrigation (2d Ed.), pages 70-1, and cases cited.

Mr. Kinney is also authority to the effect that:

The land, to be riparian, must be under a common ownership. If the use for which the water is claimed, consumes the water, the extent of the land must be reasonable with reference to the lands of other proprietors whose lands are also riparian to the same stream, and

Under the rule of riparian rights so obtaining in humid regions (including, as we shall hereafter observe, the largely humid region on the Pacific coast), the lands must lie within the watershed of the stream in order to be riparian. He says:

"If lands * * * bordering upon a certain stream are divided by Nature, so that a portion of them are cut off and lie in another watershed, such lands are *not* riparian to such stream. They belong to the lands of the other watershed, and, in turn, may or may not be riparian to the stream which drains such watershed, depending, of course, as to whether or not they touch upon such stream. In such a case Nature has interposed a dividing line and has cut off such lands from the lands actually riparian to the stream by the ridge dividing the two watersheds. *This is just as effectual as though the common owner had cut off such lands* by conveying them to another person."

Kinney on Irrigation (2d Ed.), Vol. 1, pp. 782-3.

Under the riparian doctrine, the riparian owner

"May use the water while it runs over his land, as an incident to the land * * * and he must return it to its ordinary channel when it leaves his estate."

in order that *other riparian owners* (not appropriators), either

above or below him upon the stream, may not be deprived of an *equal right* to the use of the same water.

> "The principal reasons for the rule *confining riparian rights to that part of the lands bordering on the stream* which are within the watershed are that, where the water is used on such land it will, after such use, return to the stream."
>
> Long on Irrigation (2d Ed.), p. 95, and cases cited.

Mr. Wiel, in his recent work, devoted largely to advocacy of the California common-law doctrine of riparian rights, assigns the same reason for prohibiting use beyond the watershed in common-law states, viz.: That the water must return to the stream to supply the equal rights of other *riparian* land owners.

Thus it appears that in some jurisdictions under the common-law doctrine, the riparian owner is limited to the natural watershed of the stream in the use of its waters for the reasons: (1) That lands segregated by the divide are not riparian, and (2), that water carried beyond the divide cannot be returned to the stream for other riparian owners, each and all of whom have an *equal* right to the use of the water as it flows in the stream past their riparian lands.

It generally appears that, under the riparian doctrine, the use of water is limited and confined to riparian lands or lands which border upon the stream; that *all riparian* owners have the *same* natural and *equal right* to the use of the water of the stream, regardless of location on the stream or the dates of acquisition of title; the right is a part and parcel of the land and passes with the land upon sale; *use does not create and disuse cannot suspend or destroy the right;* the riparian owner is only entitled to the use of water as it passes along and the *equal rights of all* other riparian owners *prohibit exclusive use by any one* thereof; and each riparian owner must return the water to its ordinary channel when it leaves his estate in order that all other riparian proprietors may enjoy their equal right to the use thereof, and this, in turn, probably prohibits a diversion of any of the waters beyond their natural watershed, for, by so doing, the owner would be using the water upon non-riparian lands and could not return it to the stream.

The arid states have abrogated the common-law riparian doctrine in its entirety and have adopted the law of appropriation in lieu thereof. The doctrine of appropriation is in direct contrast with the common-law doctrine and differs, *inter alia*, in the following particulars:

Under the doctrine of appropriation, all rights are *necessarily unequal rather than equal*, and he who is first in time is

first in right, even to the extent of converting to his own and *exclusive beneficial use* the *entire flow* of the stream, if his necessities so require;

Beneficial use is the foundation of the right. It may be forfeited by non-user, and the physical situation of the land with relation to the stream bears no relation to the right, so vested, limited and perpetuated upon beneficial use;

The waters of the stream are the property of the public, the state, subject to appropriation in order of priority and beneficial use, and are not an incident to and part of the soil or the lands which, by accident, touch the stream;

The appropriator may change *both* the point of diversion and place of application, and *he has a property right in the water*, lawfully diverted to beneficial *use*, which he may sell and dispose of separate and apart from the land upon which the right ripened;

> Kinney on Irrigation (2d Ed.), Vol. 2, Secs. 768-9, pp. 1326-32.

He is under no obligation to return the water to the stream, and in the enjoyment of his *exclusive* (as contrasted with equal) right, his use is not limited to lands which are riparian to the stream, but he may apply the same on non-riparian lands within the drainage of the stream or "whithersoever necessity may require," including lands in other and foreign watersheds; and

His beneficial use to the extent of the necessities of his land, wherever situated, coupled with the time (priority) of such beneficial use, defines the extent and order of his right.

> Oppenlander vs. Left Hand Ditch Co., 18 Colo., 142, 148-9; 31 Pac., 854.

The common-law doctrine of riparian rights prevails in all the humid states and is the foundation of the so-called "California System" or doctrine which has generally been followed and adopted by Kansas, Montana, Nebraska, North Dakota, Oklahoma, Oregon, South Dakota, Texas and Washington.

> Long on Irrigation (2d Ed.), pp. 19-21.
> Kinney on Irrigation (2d Ed.), Vol. 2, p. 1103.

The doctrine of appropriation has been adopted and the common-law doctrine of riparian rights *abolished* in Colorado, Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming. The doctrine of appropriation, in abrogation of and direct conflict with the common-law doctrine, as adopted in these states, is commonly known as the "Colorado doctrine," as distinguished

from the aforementioned "California doctrine," so founded upon the common-law theories.

Kinney on Irrigation (2d Ed.), Vol. 2, pages 1098-1124.

Long on Irrigation (2d Ed.), pages 19-63.

(b) Arid Region Doctrine of Appropriation.

We have already noted that in the states of the arid region, including Colorado and Wyoming, the common-law doctrine of riparian rights has been abolished and in lieu thereof these states have uniformly adopted the doctrine of acquisition of title to water by priority of appropriation for beneficial uses.

"The imperative and growing necessities" of the conditions prevailing in these arid states compelled the recognition and adoption of the law of prior appropriation, and each of the states, in the exercise of her sovereign right so to do, adopted the new doctrine and abrogated the old as unsuitable and wholly inapplicable to the conditions prevailing throughout the arid region.

Schodde vs. Twin Falls Water Co., 224 U. S., 107.

Boquillas Land & Cattle Co. vs. Curtis, 213 U. S., 339; 29 Sup. Ct., 493; 53 L. Ed., 822.

Kansas vs. Colorado, 206 U. S., 46, 94; 27 Sup. Ct., 655; 51 L. Ed., 956.

Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62, 65.

Clark vs. Nash, 198 U. S., 361, 370; 25 Sup. Ct., 676; 49 L. Ed., 1085.

Gutierres vs. Albuquerque Land & Irr. Co., 188 U. S., 545, 552-4; 23 Sup. Ct., 338; 47 L. Ed., 588.

United States vs. Rio Grande Irr. Co., 174 U. S., 690, 702-6; 19 Sup. Ct., 770; 43 L. Ed., 1136.

Coffin vs. Left Hand Ditch Co., 6 Colo., 443, 446-7.

Oppenlander vs. Left Hand Ditch Co., 18 Colo., 142; 31 Pac., 148-9.

Willey vs. Decker, 11 Wyo., 498, 529.

Farm Inv. Co. vs. Carpenter, 9 Wyo., 110; 61 Pac., 258.

Moyer vs. Preston, 6 Wyo., 308, 318.

Clough vs. Wing, 2 Ariz., 371, 381-2.

Reno Smelter M. & R. Co. vs. Stephenson, 20 Nev., 269; 21 Pac., 317.

United States vs. Rio Grande Dam & Irr. Co., 9 N. M., 292, 302-3.

Drake vs. Earhart, 2 Ida., 716; 23 Pac., 541.

Stowell vs. Johnson, 7 Utah, 215; 26 Pac., 290.
Kinney on Irrigation (2d Ed.), chap. 31, and cases cited.

Detailed consideration of the foregoing and the many other authorities in point would unnecessarily consume time of court and counsel, and the reason for the doctrine may be obtained by quoting from a few of the many available authorities.

The reasons announced in Clough vs. Wing, by the Supreme Court of Arizona are approved by this court in Boquillas Cattle Co. vs. Curtis, 213 U. S., 339, 347. In that case, Justice Barnes, after describing the antiquity of the irrigation works in Arizona and having shown that the riparian law which:

> "Had its origin in the Island of Great Britain, under conditions of climate peculiar to its position"

is unknown to conditions in Arizona, says:

> "Thus we see that this is the oldest method of skilled husbandry, and probably a large number of the human race have ever depended upon artificial irrigation for their food products. The riparian rights of the common law could not exist under such systems; and a higher antiquity, a better reason, and more beneficent results have flowed from the doctrine that all right in water in non-navigable streams must be subservient to its use in tilling the soil. * * * The common-law had been unknown; and that law has never been, and is not now, suited to conditions that exist here, so far as the same applies to the uses of water."
>
> Clough vs. Wing, 2 Ariz., 371, 381; 17 Pac., 453.

In Clark vs. Nash, Mr. Justice Peckham said:

> "The rights of a riparian owner in and to the use of waters flowing by his land are not the same in the arid region and mountainous States in the West that they are in States of the East. These rights have been altered by many of the Western States, by their constitutions and laws, because of the totally different circumstances in which their inhabitants are placed, from those that exist in the States of the East, and such alterations have been made for the very purpose of thereby contributing to the growth and prosperity of those States arising from mining and the cultivation of an otherwise valueless soil by means of irrigation. *This court must recognize the difference of climate and soil, which render necessary these different laws in the States so situated.*"
>
> Clark vs. Nash, 198 U. S., 361, 370.

"From these authorities we assume that the applicability of the common-law rule to the physical characteristics of the state should be considered. Its inapplicability * * * applies forcibly to the State of Nevada. Here the soil is arid, and unfit for cultivation unless irrigated by the waters of running streams. The general surface of the state is table land, traversed by parallel mountain ranges. The great plains of the state afford natural advantages for conducting water, and lands otherwise waste and valueless become productive by artificial irrigation. The condition of the country, and the necessities of the situation, impelled settlers upon the public lands to resort to the diversion and use of waters. This fact of itself is a striking illustration, and conclusive evidence of the inapplicability of the common-law rule."

Reno Smelting M. & R. Works vs. Stevenson, 20 Nev., 269, 21 Pac., 317.

"The Rio Grande, as we have said, flows through a region dependent upon irrigation. It is part of what is known as the arid region of this country. * * * Here the paramount interest is * * * the cultivation of the soil by means of irrigation. * * * The use of the waters of all these streams for irrigation is a matter of the highest necessity to the people inhabiting this region. * * * Prior to that time" (1866) "it had become established that the common law doctrine of riparian rights was unfitted to the conditions in the far West, and new rules had grown up, under local legislation and customs. * * * The doctrine of prior appropriation has been the settled law of this territory by legislation, custom and judicial decision. Indeed, it is no figure of speech to say that agriculture and mining life of the whole country depends upon the use of the waters for irrigation, and, if rights can be acquired in waters not navigable, none can have greater antiquity and equity in their favor than those which have been acquired in the Rio Grande valley in New Mexico."

United States vs. Rio Grande Dam & Irr. Co., 9 N. M., 292, 302-6.

After declaring that the maxim "first in time, first in right" should be the settled law in Idaho, the Supreme Court of that state says:

"Whether or not it is a beneficial rule, it is the lineal

descendant of the law of necessity. When, from among the most energetic and enterprising classes of the east, that enormous tide of emigration poured into the west, this was found an arid land, which could be utilized as an agricultural country, or made valuable for its gold, only by the use of its streams of water. The new inhabitants were without law, but they quickly recognized that each man should not be a law unto himself. Accustomed, as they had been, to obedience to the laws they had helped make, as the settlements increased to such numbers as justified organization, they established their local customs and rules for their government in the use of water and land. They found a new condition of things. The use of water to which they had been accustomed, and the laws concerning it, had no application here. *The demand for water they found greater than the supply, as is the unfortunate fact still all over this arid region.* Instead of attempting to divide it among all, thus making it unprofitable to any, or instead of applying the common law riparian doctrine, to which they had been accustomed, they disregarded the traditions of the past, and established as the *only rule suitable to their situation that of prior appropriation.* This did not mean that the first appropriator could take all he pleased, but what he actually needed, and could properly use without waste. Thus was established the local custom, which pervaded the entire west, and became the basis of the laws we have today on that subject."

Drake vs. Earhart, 2 Idaho, 750, 753; 23 Pac., 541.

Of the appropriation doctrine in Utah, the Supreme Court says:

"Riparian rights have never been recognized in this Territory, or in any State or Territory where irrigation is necessary; for the appropriation of water for the purpose of irrigation is entirely and unavoidably in conflict with the common law doctrine of riparian proprietorship. If that had been recognized and applied in this territory it would still be a desert; for a man owning ten acres of land on a stream of water capable of irrigating a thousand acres of land or more, near its mouth, could prevent the settlement of all the land above him. For at *common law* the riparian proprietor is entitled to have the water flow in quantity and quality past his land as it was wont to do when he acquired title thereto, and this right is *utterly irreconcilable* with the use of water for irrigation. The legislature of this Territory has

always ignored this claim of riparian proprietors, and the practice and usages of the inhabitants have never considered it applicable, and have never regarded it."

Stowell vs. Johnson, 7 Utah, 215, 225; 26 Pac., 290.

Many of the leading authorities upon this subject have been announced by the Supreme Courts of the States of Colorado and Wyoming. Some of these decisions will be quoted at length in treating of the matter of inter-watershed diversions under the doctrine of appropriation.

The Supreme Court of Colorado, in part says:

"The *common-law doctrine* giving the riparian owner a right to the flow of water in its natural channel upon and over his lands, even though he makes no beneficial use thereof, *is inapplicable to Colorado. Imperative necessity*, unknown to the countries which gave it birth, *compels the recognition of another doctrine in conflict therewith.* And we hold that, in the absence of express statutes to the contrary, the first appropriator of water from a natural stream for a beneficial purpose has, with the qualifications contained in the constitution, a prior right thereto, to the extent of such appropriation."

Coffin vs. Left Hand Ditch Co., 6 Colo., 443, 447.

"By the constitution and laws of Colorado, state and territorial, from the earliest times, rights to the beneficial use of water from natural streams have been acquired by diversion through prior appropriation rather than by grant."

Platte Water Co. vs. Southern Colorado Irr. Co., 12 Colo., 525, 531; 21 Pac., 711.

"The law of necessity rendered the common law doctrine of riparian rights wholly inapplicable in this jurisdiction, and as has frequently been stated, required its abrogation; so that * * * it has never been recognized as controlling in the matter of water rights. * * * Priority of appropriation for a beneficial purpose is the test by which this right is measured, as against others taking water from the same natural source."

Crippen vs. White, 28 Colo., 298, 302; 64 Pac., 184.

"The doctrine of this state *that the common law rule* of continuous flow of natural streams is *abolished*, is so

firmly established by our constitution, the statutes of the territory and the state, and by many decisions of this court, that we decline to reopen or reconsider it."

Sternberger vs. Seaton Co., 45 Colo., 401, 404; 102 Pac., 168.

While sitting as a judge of the Circuit Court of Appeals, Mr. Justice Van Devanter said:

"The *common-law doctrine* in respect to the rights of riparian proprietors in the waters of natural streams *never has obtained in Colorado.* From the earliest times in that jurisdiction the local customs, laws, and decisions of courts have united in rejecting that doctrine and in adopting a different one which regards the waters of all natural streams as subject to appropriation and diversion for beneficial uses and it treats priority of appropriation and continued beneficial use as giving the prior and superior right. * * * In so choosing between these inconsistent doctrines, Colorado acted within the limits of her authority, first as a territory and then as a state, and her choice was recognized and sanctioned by Congress, so far as the public lands of the United States were concerned."

Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62, 65.

The Colorado doctrine of appropriation, to the exclusion and abrogation of the common-law rights, has always been recognized in Wyoming.

"The common law doctrine relating to the rights of a riparian proprietor in the water of a natural stream, and the use thereof, is unsuited to our requirements and necessities, and *never obtained* in Wyoming. So much only of the common law as may be applicable has been adopted in this jurisdiction. The doctrine invoked is inapplicable. A different principle better adapted to the material conditions of this region has been recognized. That principle, briefly stated, is that the right to the use of water for beneficial purposes depends upon a prior appropriation. Our statutes have repeatedly recognized this right, and the constitution of the State declares it. We incline strongly to the view expressed by the Supreme Court of Colorado, to the effect that such right and the obligation to protect it existed anterior to any legislation upon the subject. (Coffin v. Left Hand Ditch Co., 6 Col., 443.)

We esteem it unnecessary, if it would not indeed be superfluous, at this late day to enter into any elaborate discussion of the reasons which gave birth to this doctrine. It is the natural outgrowth of the conditions existing in this section of the country. The climate is dry; the soil is arid and largely unproductive in the absence of irrigation, but when water is applied by that means it becomes capable of successful cultivation. The benefits accruing to land upon the banks of a stream without any physical application of the water to the land are few; and while the land contiguous to water, and so favorably located as to naturally derive any sort of advantage therefrom, is comparatively small in area, the remainder, which comprises by far the greater proportion of our land otherwise susceptible of cultivation, must forever remain in their wild and unproductive condition unless they are reclaimed by irrigation. Irrigation and such reclamation can not be accomplished with any degree of success or permanency without the right to divert and appropriate water of natural streams for that purpose and a security accorded to that right. Thus, the *imperative* and growing *necessities* of our conditions in this respect alone, to say nothing of the other beneficial uses, also important, to which water has been and may be applied, has compelled the recognition rather than the adoption of the law of prior appropriation."

Moyer vs. Preston, 6 Wyo., 308, 318-19.

"Under the doctrine of prior appropriation, it would seem essential that the property in waters affected by that doctrine should reside in the public, rather than constitute an incident to the ownership of the adjacent lands. Such waters are, we think, generally regarded as public in character.

* * * In the arid region of this country another public use has been recognized by custom and laws and sanctioned by the courts. * * * This use, and the doctrine supporting it, is founded upon the *necessities* growing out of natural conditions, and is absolutely essential to the development of the material resources of the country. Any other rule would offer an effectual obstacle to the settlement and growth of this region, and render the lands incapable of continued successful cultivation. The waters for the reclamation of the desert lands must be obtained, in a very large measure, from the natural streams and other natural bodies of water.

The common law doctrine of riparian rights re-

lating to the use of the water of natural streams and other natural bodies of water not prevailing, but the opposite thereof, and one inconsistent therewith, having been affirmed and asserted by custom, laws, and decisions of courts, and the rule adopted permitting the acquisition of rights by appropriation, the waters affected thereby become perforce *publici juris.*"

Farm Inv. Co. vs. Carpenter, 9 Wyo., 110, 136; 61 Pac., 258.

In the case of Willey vs. Decker, the court reviews a great many of the leading decisions of the states of the arid west upon this subject and adopts the general rule already announced.

The court says in part as follows:

"In this State, on the other hand, the common law doctrine concerning the rights of a riparian owner in the water of a natural stream has been held to be unsuited to our conditions; and this court has declared that *the rule never obtained in this jurisdiction.*"

The court then quotes at length from that portion of the case of Moyer vs. Preston already cited, and after adopting the rule laid down in the case of Coffin vs. Left Hand Ditch Company, and the decisions of the Supreme Courts of other arid states, says:

"It will be observed that the doctrine of prior appropriation is established as a rule of imperative necessity, and the outgrowth of the custom of the earlier settlers upon the public lands for the purpose of mining or rendering the soil available for cultivation."

Willey vs. Decker, 11 Wyo., 496, 515, 519; 73 Pac., 210.

From the foregoing authorities, as well as those which we shall next consider, it would seem that the "imperative necessities" of the arid region compelled the rejection of the common-law doctrine of riparian rights and the adoption of the new appropriation doctrine, in direct conflict with the common-law rule, in each of the states of the region for regulation of the use of the waters flowing in the streams *within* the borders of each thereof.

The doctrine of appropriation has nothing in common with that of riparian rights, and their underlying principles are to be contrasted rather than compared. This is particularly true as regards geographical location of the lands which may be served,

where the common law limitations of use within the watershed have been abolished.

While an analytical discussion of each of the essential differences between the two doctrines, arranged in order of importance and under proper sub-titles, might be profitable, a general discussion of these essential differences by quotations from a number of leading authorities will sufficiently aid the court in arriving at a true interpretation of the right of the defendants to divert the waters of the Laramie River for irrigation of lands situate wholly within the foreign drainage area of the Cache la Poudre River.

(c) *Essential Differences Between Common-Law and Appropriation Doctrines, Including Right to Make Inter-watershed Diversions.*

We have previously noted that under the common-law doctrine, all owners of lands bordering and touching upon the stream have an *equal right* to the use of its waters as it flows from its source to the sea; that this right attaches as a part of the estate of the land-owner; that each of the owners of the lands bordering on the stream is entitled to make but a reasonable use of its waters, so that he will not infringe upon the like right of each of the other riparian land-owners to a similar use of the same water; that the right is not dependent upon use and is not forfeited by non-use; that no appropriator can obtain an exclusive right to the use of any portion of the waters as they flow and can only make reasonable use thereof upon his riparian lands and that he must return the water to the stream before it leaves his estate and accordingly cannot convey the water to lands in a foreign drainage from whence it cannot be returned to the stream of origin.

We have also observed that the common-law doctrine has been *entirely* rejected as unsuitable to the physical conditions and necessities of the arid region for *intra-state* diversions.

In rejecting the common-law doctrine in its entirety, each of the states of the arid region has, at the same time, rejected each of the fundamental principles upon which the doctrine is founded, including that which requires the water to be returned to the stream and prohibits its use upon lands in a foreign drainage, and we shall observe that under the doctrine of appropriation, the first appropriator may not only apply the water within a foreign drainage by reason of abrogation of the duty of return of water to supply the *equal* rights of all other riparian owners, but may also acquire the *exclusive* right to divert all of the water of the original stream if beneficial use so requires.

We will limit our discussion to the Constitution, statutes

and decisions of the courts of (1) Colorado, (2) Wyoming and (3) the decisions of the courts of other states and other authorities.

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(1) Colorado Constitution, Statutes and Decisions.

Colorado has adopted the doctrine of appropriation and abolished the common-law rule of riparian rights in its entirety. The Constitution of the State provides:

> "The water of every natural stream, not heretofore appropriated, within the State of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the *use of the people of the state,* subject to appropriation as hereinafter provided."
>
> "The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."
>
> Article XVI, Sections 5 and 6, Constitution of Colorado.

Inter-watershed diversions are recognized by statute:

> "That whenever any person or company shall divert water from one public stream *and turn it into another public stream,* such person or company *may take out the same amount of water again,* less a reasonable deduction for seepage and evaporation, to be determined by the state engineer."
>
> "Any person or company *transferring water from one public stream to another* shall be required to construct and maintain under the direction of the state engineer measuring flumes or weirs and self-registering devices at the point *where the water leaves its natural watershed and is turned into another,* and also at the point where it is finally diverted for use from the public stream.
>
> Laws 1897, page 176, sections 1 and 2.
>
> Sections 3748-9 Mills' Annotated Statutes. (Rev. Ed.)
>
> Sections 3222-3, Revised Statutes Colorado, 1908.

"Whenever the owner or owners of any irrigation ditch, canal or reservoir *transferring water from one public stream to another* * * * in order that the same may be diverted therefrom for irrigation or any other purposes, shall fail and neglect to construct suitable and proper measuring flumes or weirs for the proper and accurate determination of the amount and volume of water turned into, carried through and diverted out of said public stream, then the state engineer or superintendent of irrigation shall * * * refuse to allow to be taken and diverted therefrom, any water whatever on account of delivery of water thereto, for such time and until such owner or owners shall cause to be erected or repaired such flumes or weirs at the point of delivery to and taking from said public stream so used as a conduit."

Laws 1901, page 194, section 2.
3 Mills' Annotated Statutes, Sec. 2286 b.
Revised Statutes of Colorado, 1908, Sec. 3249.

The section quoted from the law of 1901 was amended and re-enacted by the Legislature in 1911.

Laws 1911, page 464, Section 2.
Mills' Annotated Statutes (Rev. Ed.), Sec. 3773.

The Supreme Court of Colorado, at an early date, passed upon the above mentioned constitutional provisions and generally upon the abrogation of the common-law doctrine and the adoption of the appropriation doctrine. We have already quoted at some length from these decisions.

In 1882 the whole subject came before the court in a case involving the right of an appropriator to divert water for application within a drainage area foreign to the original stream. The decision by the late and learned Justice Helm is the leading authority in the United States upon the subject of inter-watershed diversions, and, as we shall later observe, is generally approved, not only by the Supreme Court of Wyoming, but as well by the state and federal courts in the arid region, and the United States. The controversy involved the diversion of water from the South Fork of St. Vrain Creek, across the divide to James Creek and thence along the bed of that stream to Left Hand Creek, which latter water-course was and since hitherto has been used as a ditch for distribution of these waters from the foreign stream by means of various smaller lateral ditches heading upon Left Hand Creek. The farmers

owning the land along Left Hand Creek thus served by waters from the St. Vrain Creek, claimed as appropriators, and the defendants proceeded to destroy the diversion dam and to take the water under claim of riparian ownership along the St. Vrain.

The opinion of the court reads in part as follows:

> "It is contended by counsel for appellants that the common law principles of riparian proprietorship prevailed in Colorado until 1876, and that the doctrine of priority of right to water by priority of appropriation thereof was first recognized and adopted in the constitution. But we think the latter doctrine has existed from the date of the earliest appropriations of water within the boundaries of the state. The climate is dry, and the soil, when moistened only by the usual rainfall, is arid and unproductive; except in a few favored sections, artificial irrigation for agriculture is an absolute necessity. Water in the various streams thus acquires a value unknown in moister climates. Instead of being a mere incident to the soil, it rises, when appropriated, to the dignity of a distinct usufructuary estate, or right of property. It has always been the policy of the national, as well as the territorial and state governments, to encourage the diversion and use of water in this country for agriculture; and vast expenditures of time and money have been made in reclaiming and fertilizing by irrigation portions of our unproductive territory. Houses have been built, and permanent improvements made; the soil has been cultivated, and thousands of acres have been rendered immensely valuable, with the understanding that appropriations of water would be protected. *Deny the doctrine of priority or superiority of right by priority of appropriation, and a great part of the value of all this property is at once destroyed.*
>
> The right to water in this country, by priority of appropriation thereof, we think it is, and has always been, the duty of the national and state governments to protect. The right itself, and the obligation to protect it, existed prior to legislation on the subject of irrigation. It is entitled to protection as well after patent to a third party of the land over which the natural stream flows, as when such land is a part of the public domain; and it is immaterial whether or not it be mentioned in the patent and expressly excluded from the grant.
>
> The act of congress protecting in patents such right

in water appropriated, when recognized by local customs and laws, 'was rather a voluntary recognition of a pre-existing right of possession, constituting a valid claim to its continued use, than the establishment of a new one.' *Broder v. Notoma* W. & M. Co., 11 Otto., 274.

We conclude, then, that the *common law doctrine* giving the riparian owner a right to the flow of water in its natural channel upon and over his lands, even though he makes no beneficial use thereof, is *inapplicable to Colorado. Imperative necessity*, unknown to the countries which gave it birth, compels the recognition of another doctrine in conflict therewith. And we hold that, in the absence of express statutes to the contrary, the first appropriator of water from a natural stream for a beneficial purpose has, with the qualifications contained in the constitution, a prior right thereto, to the extent of such appropriation. See *Schilling v. Rominger*, 4 Colo., 103." * * *

"It is urged, however, that even if the doctrine of priority or superiority of right by priority of appropriation be conceded, appellee in this case is not benefited thereby. Appellants claim that they have a better right to the water because their lands lie along the margin and in the neighborhood of the St. Vrain. *They assert that, as against them, appellee's diversion of said water to irrigate lands adjacent to Left Hand Creek, though prior in time, is unlawful.*

In the absence of legislation to the contrary, *we think that the right to water acquired by priority of appropriation thereof is not in any way dependent upon the locus of its application to the beneficial use designed.* And the disastrous consequences of our adoption of the rule contended for, forbid our giving such a construction to the statutes as will concede the same, if they will properly bear a more reasonable and equitable one.

The doctrine of priority of right by priority of appropriation for agriculture is evoked, as we have seen, by the *imperative necessity for artificial irrigation of the soil. And it would be an ungenerous and inequitable rule that would deprive one of its benefit simply because he has, by large expenditure of time and money, carried the water from one stream over an intervening watershed and cultivated land in the valley of another.* It might be utterly impossible, owing to the topography of the country, to get water upon his farm from the adjacent stream; or if possible, it might be impracticable on

account of the distance from the point where the diversion must take place and the attendant expense; or the quantity of water in such stream might be entirely insufficient to supply his wants. It sometimes happens that the most fertile soil is found along the margin or in the neighborhood of the small rivulet, and sandy and barren land beside the larger stream. To apply the rule contended for would prevent the useful and profitable cultivation of the productive soil, and sanction the waste of water upon the more sterile lands. It would have enabled a party to locate upon a stream in 1875, and destroy the value of thousands of acres, and the improvements thereon, in adjoining valleys, possessed and cultivated for the preceding decade. *Under the principle contended for, a party owning land ten miles from the stream, but in the valley thereof, might deprive a prior appropriator of the water diverted therefrom whose lands are within a thousand yards, but just beyond an intervening divide.*

We cannot believe that any legislative body within the territory or State of Colorado ever intended these consequences to flow from a statute enacted."

Coffin vs. Left Hand Ditch Co., 6 Colo., 443, 446-7, 449-50.

The doctrine announced in Coffin v. Left Hand D. Co., was affirmed by the Supreme Court of Colorado in Thomas v. Guiraud (6 Colo. 530-2), Justice Helm writing the opinion, in which the following language was used:

"We have recently held that the doctrine of priority of right to water by priority of appropriation thereof for a beneficial purpose, with the modifications declared in the constitution, is and always has been in force in this state. We have also decided that the *locus* of its application does not in any way affect the doctrine; and that a prior appropriator of water is entitled to it as against a subsequent settler upon the stream from which it is taken, although he carries it over an intervening divide and uses it to cultivate lands adjacent to another stream. *Coffin v. Left Hand Ditch Co.* (ante, p. 442.)"

The Court, in the same opinion, announces the right of the first appropriator to take all of the water in any stream, in the following language:

"Had there remained water in the stream after such diversion and use by Guiraud, plaintiff in error would

have had the undoubted right to appropriate the same. But since Guiraud diverted the usual flow of water to the full extent thereof, plaintiff in error could acquire no absolute right to any part of such usual or ordinary flow, when required by defendants in error; he might divert and use the same at such times as Guiraud and those who held under him were not in need thereof; and when there was an excess over the ordinary flow he might legally appropriate water to the extent of such excess; but when there was not enough for both, the diversion of plaintiff in error must give way to the prior right of defendants in error to the extent of Guiraud's original appropriations."

Justice Helm then announces the doctrine of appropriation of water in Colorado, in the following language:

> "*The true test of appropriation of water is the successful application thereof to the beneficial use designed; and the method of diverting or carrying the same, or making such application, is immaterial.*"
>
> *Thomas v. Guiraud*, 6 Colo., 530, 533.

The opinion in Coffin v. Left Hand Ditch Co. was thus affirmed by the Supreme Court in 1888:

> "Since the commencement of this action the questions presented have been passed upon by this court in *Coffin v. Ditch Co.*, 6 Colo. 443. In that case it was held that the common-law doctrine giving the riparian owner a right to the flow of water in its natural channel upon and over his lands, even though he makes no beneficial use of it, is inapplicable to Colorado; and that the first appropriator of water from a natural stream for a beneficial purpose has, in the absence of express statutes to the contrary, with the qualifications contained in the constitution, a prior right thereto, to the extent of such appropriation; and that this right is entitled to protection as well after patent to a third party of the land over which the natural stream flows as when such land is a part of the public domain; and it was further held that *the right to water acquired by prior appropriation is not in any way dependent upon the locus of its application to the beneficial use designed.* The questions determined in *Coffin v. Ditch Co.* are identical with the questions raised on this appeal, and such determination is in accord with the ruling on the demurrer. We do not feel called upon to enter into a discussion of these questions upon the merits."

Hammond v. Rose, 11 Colo. 524, 526; 19 Pac. 446; 7 Am. St. Rep. 258.

The facts involved in the controversy before the Court in the case of Coffin v. Left Hand Ditch Co., are set out more in detail in the opinion by Justice Elliott in Oppenlander v. Left Hand Ditch Co., rendered in 1892. The controversy involved the same diversion before the court in the former case. Justice Elliott describes the character of the diversion as follows:

> "St. Vrain creek takes its rise on the eastern slope of the Rocky Mountains near the summit of the continental divide. Thus it has a good supply of water from the regions of perpetual snow. The general course of the stream is eastward through the mountainous regions of Boulder county, and thence across the plains, until it becomes a tributary of the South Platte River.
>
> Left Hand creek is a tributary of the St. Vrain from the south; its general course is, also, eastward, until it forms a junction with the former stream some miles out upon the plains.
>
> James creek, a still smaller stream, takes its rise between the St. Vrain and Left Hand creek, and makes a junction with the latter stream before it emerges from the foothills. Neither Left Hand creek nor James creek has as good natural water supply as the St. Vrain, their sources, respectively, not being so far up the mountain slope; and as a consequence the natural water supply of Left Hand creek is not sufficient to irrigate the agricultural lands lying along its borders upon the plains.
>
> Early in the '60's certain settlers upon the plains, along the valley of Left Hand creek, made appropriations of water from said stream for the irrigation of the lands occupied by them respectively; but as there was not enough water in the natural stream to supply their wants, they undertook to increase the supply by artificial means. At a certain point in the mountains, James creek and the south fork of the St. Vrain are but a short distance apart. Taking advantage of this proximity of the two streams, a channel or ditch was cut through the narrow strip of land separating them. Thus water from the St. Vrain was carried into James creek, thence down the channel of the James to Left Hand creek, thence down Left Hand creek and out upon the plains to supply the settlers with water for irrigation.
>
> The artificial channel thus uniting the St. Vrain with James creek was first constructed in 1863, and since

that time said channel, including the natural channels of the James and the Left Hand below the junction, has been called the Left Hand ditch. This will not appear so strange when it is understood that the volume of water following in the channel of Left Hand ditch was more than doubled by the original construction of the artificial channel, and that by an enlargement thereof in 1870 the stream was increased to about ten times its original size."

Oppenlander v. Left Hand Ditch Co., 18 Colo. 142, 143-4; 31 Pac. 854.

The Court again affirms its decision in Coffin v. Left Hand D. Co., in the following language:

"*The right to divert and convey the water of a natural stream across an intervening 'divide' to be used for the irrigation of lands in the valley of another natural stream*, and for that purpose to utilize the channel of the second stream as a ditch to convey and distribute the water diverted from the first stream, *has been recognized by this court*. The diversion from the St. Vrain to the James and Left Hand creeks, as above stated, was upheld in Coffin v. Left Hand Ditch Co., 6 Colo. 449." Ib. 144.

Justice Elliott distinguishes the common law riparian rights from the Colorado law of appropriation, as follows:

"At common law the riparian owner is vested with certain rights in the water of a natural stream flowing through his land, and such rights pass by a conveyance of the land to his grantee, unless specially reserved. It is seriously claimed that this familiar principle of the common law in reference to natural streams applies also to artificial streams designed for purposes of irrigation.

Let us see what legal basis there is for such a claim. Upon examination we find few points of analogy and many points of difference between water rights at common law and water rights under the constitution of this state. For illustration, note the following:

At common law the water of a natural stream is an incident of the soil through which it flows; under the constitution the unappropriated water of every natural stream is the property of the public. At common law the riparian owner is, for certain purposes, entitled to the exclusive use of the water *as it flows through his land;* under the constitution the use of the water is

dedicated to the people of the state subject to appropriation. *The riparian owner's right* to the use of water *does not depend upon user* and is not forfeited by nonuser; *the appropriator* has no superior right or privilege in respect to the use of water on the ground that he is a riparian owner; his *right of use depends solely upon appropriation and user;* and he may forfeit such right by abandonment or by nonuser for such length of time as that abandonment may be implied. A riparian proprietor owning both sides of a running stream may divert the water therefrom, provided he returns the same to the natural stream before it leaves his own land so that it may reach the riparian proprietor below without material diminution in quantity, quality or force; *the appropriator, though he may not own the land on either bank of a running stream, may divert the water therefrom, and carry the same whithersoever necessity may require for beneficial use, without returning it or any of it to the natural stream in any manner.*

The appropriator may, under certain circumstances, change the point of diversion as well as the place of application of the water; *he has a property right in the water*, lawfully diverted to beneficial use, and *may dispose of the same separate and apart from the land* in connection with which the right ripened to anyone who will continue such use without injury to the rights of others.

Thus it appears that the constitution has, to a large extent, obliterated the common law doctrine of riparian rights and substituted in lieu thereof the doctrine of appropriation. *Sieber v. Frink*, 7 Colo. 148; *Fuller v. The Swan River Mining Co.*, 12 Colo. 12; *Strickler v. Colo. Springs*, 16 Colo. 61; *Combs v. Agricultural Ditch Co.*, 17 Colo. 146. See, also, opinions in *Farmers' High Line Co. v. Southworth*, 13 Colo. 111, and cases there cited."

Subsequent to the foregoing opinion, many inter-watershed diversions were made in Colorado which have since been used to bring large portions of its theretofore arid lands into a state of high productivity. These diversions were described by Professor Carpenter, whose testimony appears in another portion of this brief.

No further question of the legal right of the appropriator to divert the water of any Colorado stream "whithersoever necessity may require for beneficial use, without returning it or any part of it to the natural stream in any manner," seems to have been presented to the Colorado courts until the year 1908,

when it was again settled in accord with the former views of the court as above expressed. Justice Gabbert says:

> "The contention of counsel for defendants that water cannot be diverted from a stream for domestic use * * * by one not a riparian owner is not tenable. *The right to water appropriated for domestic purposes does not depend upon the locus of its use for those purposes.* Coffin v. Left Hand Ditch Co., 6 Colo., 444."
>
> Town of Sterling vs. Pawnee D. & E. Co., 42 Colo., 421, 427.

The above decisions announce the established law of Colorado, frequently confirmed in the many opinions of her courts as well as by the many statutes enacted for settling the rights of appropriators within her borders and for policing and administration of diversions from her streams. The general doctrine there announced does not seem to have been again questioned until 1908, when certain land owners sought to claim a preferred right to the use of the stream by virtue of the fact that their lands were riparian to South Clear Creek. Justice Campbell thus disposed of the contention:

> "We are entirely satisfied that the sole question argued and submitted to the trial court by counsel on both sides, was whether the common-law doctrine of continuous flow, under the facts disclosed by this record, exists in Colorado. At this late day it would seem to us, as it evidently did to the trial court, idle to make such contention in this state. The matter has long ago been set at rest. The authorities relied upon by plaintiffs are those which sustain the so-called California doctrine, first clearly and definitely announced by the supreme court of California in *Lux v. Haggin*, 69 Cal. 255, in which, *inter alia*, it was held that the common law, as to riparian ownership, was not abolished by any law of that state, but still existed there, side by side with the doctrine of appropriation. The states whose courts accept, and those whose tribunals reject, the California doctrine, and adhere to the so-called Colorado rule, are enumerated, and the various decisions collated, in Water Rights in the Western States, by Weil, at sections 16 and 17. *The Supreme Court of the United States in several cases, has approved and indicated its satisfaction with the decisions of the state courts which hold that the common-law doctrine has been abolished, and has said that each state, without interference by the federal courts, may for itself, and as between rival individual*

claimants, determine which doctrine shall be therein enforced. Atchison v. Peterson, 20 Wall. 507; Basey v. *Gallagher*, 20 Wall. 670; *U. S. v. Rio Grande*, etc., Co., 174 U. S. 690; *Clark v. Nash*, 198 U. S. 361, 370; *Kansas v. Colo.*, 206 U. S., 46-94.

* * * * * * * * * * * * * *

The doctrine in this state that the common-law rule of continuous flow of natural streams is abolished, is so firmly established by our constitution, the statutes of the territory and the state, and by many decisions of this court, that we decline to reopen or reconsider it, however interesting discussion thereof might otherwise be, and notwithstanding its importance. Perhaps the leading case in this state is *Coffin v. Left Hand Ditch Co.*, 6 Colo. 443. Others to like effect are: *Thomas v. Guiraud*, 6 Colo. 530; *Crippen v. White et al.*, 28 Colo. 298. A recent case, *Willey v. Decker*, 11 Wyo. 496, is in harmony with the Colorado doctrine, and therein Potter, Justice, in an able and exhaustive opinion, reviews the important cases from the various states and territories."

Sternberger vs. Seaton Co., 45 Colo., 401, 403-4.

The Federal Courts for the District of Colorado and the Circuit Court of Appeals have uniformly upheld the general doctrine announced in the opinion of Justice Helms in the case of Coffin vs. Left Hand Ditch Co., *supra*, and the other Colorado decisions above quoted.

To avoid unnecessary repetition, we will quote at length from the opinion in those cases decided by the United States Courts in a later portion of this brief, wherein we discuss the decision of Justice Hallett in the case of Hoge vs. Eaton, 135 Fed., 411; Snyder vs. Gold Dredging Co. (Circuit Court of Appeals), 181 Fed., 62; Cascade Town Co. vs. Empire W. & P. Co. (Circuit Court D. Colo.), 181 Fed., 1011, and Empire W. & P. Co. vs. Cascade Town Co., 205 Fed., 123.

A very interesting opinion by Judge Riner of Cheyenne, Wyoming, while sitting for the United States Circuit Court for the District of Colorado, was entered July 14, 1898, in a case involving the question whether the doctrine of riparian rights or the doctrine of appropriation prevails upon the Sangre de Cristo Mexican Land Grant, including within its boundaries the entire watershed of the Culebra River in Colorado. We fail to find the case reported in other than "I Legal Adviser," a publication of the Mills Publishing Company of Denver, and will therefore quote more at length than were the opinion to be found in the Federal Reporter:

"The demurrer presents the question whether the plaintiff can claim the right to use the water of the Culebra River as riparian proprietor, the river having its source and flowing its entire length through the land of the plaintiff. There is no allegation in the bill that the plaintiff has ever applied any of this water to a beneficial use, and no claim is made based upon its right as a prior appropriator. Its claim is made upon the sole ground that the stream has its source and flows its entire length through the lands of the plaintiff, and that the grant, the treaty and the act of congress secure to it the rights of a riparian owner.

Without discussing the question at length, I am inclined to the view that the riparian rights of such a riparian proprietor do not differ in any respect from those held by any other riparian proprietor who derives his title immediately, or mediately, from the United States, and that the *power to prescribe the rules which define and regulate the water rights of private riparian proprietors upon unnavigable streams belongs exclusively to the legislature of the state.*

Colorado was admitted into the Union upon an equal footing with the original states. Whatever the limitation upon her powers as a government may have been, while in a territorial condition, it ceased to have any operative force, except as voluntarily adopted by her after she became a state of the Union. On her admission she at once became entitled to and possessed of all the rights of dominion and sovereignty which belonged to the original states.

The stipulations of the treaty with Mexico referred to, operated upon and protected the titles of those private proprietors who held tracts of land within the territory ceded to the United States under grants from the Mexican government. These stipulations simply provide that the actual and bona fide grantees from the Mexican government shall continue to be the owners of their respective lands, although the territory has passed into the domain of the United States, and that their right of ownership shall be respected by this government. The legislation of congress operated solely upon the titles by declaring, establishing and confirming the private ownership of the grantees as derived from the Mexican government.

The treaty with Mexico, while it secured to private owners the title and ownership of the tracts of land

which had been granted them by Mexico, did not attempt to provide that this ownership should be governed by rules of law different from those which govern and control all private ownership of lands within the territorial jurisdiction of the United States or of any particular state. And the source of the plaintiff's title can, I think, make no difference as to the rights of property which accompany and flow from its ownership.

The constitution of the State of Colorado provides that the water of every natural stream not heretofore appropriated within the State of Colorado, is hereby declared to be the property of the public and the same is dedicated to the use of the people of the state subject to appropriation as hereinafter provided. It further provides that the right to divert unappropriated waters of any natural stream for beneficial uses shall never be denied, and that priority of appropriation shall give the better right as between those using the water for the same purpose (Art. 16, §§ 5-6).

It was early held in Colorado that the common-law doctrine as to the riparian rights by which the riparian proprietor is entitled to the flow of water in its natural channel upon and over his lands, whether he makes any beneficial use of it or not, is inapplicable to Colorado. (Coffin vs. Left Hand Ditch Company, 6 Colo., 447). *This doctrine is sustained in most, if not all, of the states (except California) within what is known as the arid region.*

The common-law doctrine relating to the rights of a riparian proprietor in the water of a natural stream, and the use thereof, is unsuited to our requirements and necessities and never did obtain in this region of country. A different principle, viz., that the right to use water for beneficial purposes depends upon a prior appropriation, is much better adapted to the material conditions existing in this and adjoining states.

The Supreme Court of Wyoming in the case of Moyer vs. Preston (44 Pac. Rep., 847), after speaking approvingly for the doctrine announced in the case of Coffin vs. The Ditch Company, says:

'We esteem it unnecessary, if indeed it would not be superfluous, at this late day, to enter into any elaborate discussion of the reasons which gave birth to this doctrine. It is the natural outgrowth of the conditions existing in this section of the country. The climate is dry. The soil is arid, and largely unproductive in the

absence of irrigation, but, when water is applied by that means it becomes capable of successful cultivation. The benefits accruing to land upon the banks of a stream without any physical application of the water to the land are few; and while the land contiguous to water, and so favorably located as to naturally derive any sort of advantage therefrom, is comparatively small in area, the remainder, which comprises by far the greater proportion of our lands otherwise susceptible of cultivation, must forever remain in their wild and unproductive condition, unless they are reclaimed by irrigation. Irrigation and such reclamation cannot be accomplished with any degree of success or permanency without the right to divert and appropriate water of natural streams for that purpose, and a security accorded to that right. Thus the imperative and growing necessities of our conditions in this respect alone, to say nothing of the other beneficial uses, also important, to which water has been and may be applied, have compelled the recognition, rather than the adoption, of the law of prior appropriation.'

The Supreme Court of the United States in the case of Broder vs. The Water Company (101 U. S., 274, 276 [1879]), said:

'It is the established doctrine of the court that rights of miners, who had taken possession of mines, and worked and developed them, and the rights of persons who had constructed canals and ditches to be used in mining operations and for purposes of agricultural irrigation in the region where such artificial use of the water was an absolute necessity, are rights which the government had by its conduct recognized and encouraged and was bound to protect before the passage of the act of 1866. We are of the opinion that the section of the act which we have quoted was rather a voluntary recognition of a pre-existing right of possession constituting a valid claim to its continued use than the establishment of a new one.'

The Supreme Court of this State, in the case of Coffin vs. The Ditch Company, *supra*, held to the doctrine that it has always been the duty of the state and national governments to protect the right of water in this country by priority of appropriation, and proceeds to say that the right itself and the obligation to protect it existed prior to legislation on the subject of irrigation. *That the state has the power to regulate the use of water*

within its boundaries I have no doubt. And to the legislature of the state the authority is most properly confided, to authorize the use of water and to impose such regulations and limitations upon its use as will best reconcile and accommodate the interests of all concerned.

Ample provision is made by the laws of the State of Colorado for the determination and protection of the rights of its citizens who use the waters of the state by providing a tribunal wherein the rights of all parties interested may be determined according to the priority of their application thereof to a beneficial use. The irrigation of arid lands is a public purpose, and the water thus used is put to a public use; and a statute providing for such irrigation is a valid exercise of legislative power. Under the proceedings provided by the legislature of Colorado, due process of law is furnished and equal protection of the law given. These statutes provide for a hearing, upon notice to the parties interested, before a tribunal created for the purpose of determining whether the parties have complied with the statutory provisions by appropriating the water, that is to say, by applying it to a beneficial use. In all respects these statutes furnish due process of law. (14th Amend., § 1.)

There being no allegation in the case that the plaintiff has made an appropriation of the water of this stream, or any portion of it, by applying it to a beneficial use, and that such appropriation was prior in time to the appropriation of the defendants, it is not entitled to the relief prayed for.

As this disposes of the case it is unnecessary to discuss other questions suggested in the argument. The demurrer will be sustained and the bill dismissed."

United States Freehold Land & Emigration Co. vs. Gallegos et al. (No 2545 U. S. Cir. Ct. D. of Colo.); 1 Legal Adviser, 412, 415-18.

The above case was reversed by the Circuit Court of Appeals (U. S. Freehold L. & E. Co. vs. Gallegos, 89 Fed., 769, 771) on a technical ground, but in the opinion the court refrains from passing upon the questions decided by Judge Riner in the following language:

"The question is of serious import and the effects of its decision must be grave and far-reaching. * * * Accordingly, we deem it our duty to refrain from consid-

ering or expressing our opinion upon it, and nothing that is said in this opinion is intended to express or intimate our views concerning it."

The correctness of Judge Riner's conclusions, upon which the Circuit Court of Appeals refused to pass, is supported by ample authority.

Boquillas Cattle Co. vs. Curtis, 213 U. S., 339, 342.
Kansas vs. Colorado, 206 U. S., 46.
Gutierres vs. Albuquerque Land & Cattle Co., 188 U. S., 545, 550.
United States vs. Rio Grande Irr. Co., 174 U. S., 690.
Kinney on Irrigation (2 Ed.), Sec. 583, pages 998-1003 and cases cited.

While further citation of authorities might be profitable and interesting, the foregoing sufficiently announce the doctrine of appropriation as it obtains in Colorado including the right of the appropriator to *convey* the water from any stream and use it "whithersoever necessity may require" including lands upon foreign watersheds "without returning it or any of it to the natural stream."

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(2) Wyoming Constitution, Statutes and Decisions.

Wyoming has adopted the Colorado doctrine of appropriation in its entirety, save for some more recent changes of procedure for initiation and adjudication of the various water rights. This is admitted by counsel for plaintiff (Brief, pages 85-7).

The Constitution of Wyoming, Article VIII, Sections 1 and 3, provides:

"Section 1. The water of all natural streams, lakes or other collections of still water, within the boundaries of the state, are hereby declared to be the property of the state."

"Section 3. *Priority of appropriation for beneficial uses shall give the better right.* No appropriation shall be denied except when such denial is demanded by the public interests."

The statutes of Wyoming more explicitly declare the doctrine of appropriation and provide a code of procedure for carrying it into effect. We will refer only to certain sections of

immediate interest, which were read into the record, pages 3910-18, but were not extended in the abstract. They are in part as follows:

> "A water right is a right to use the water of the state, when such use has been acquired by the beneficial application of water under the laws of the state relating thereto, and in conformity with the rules and regulations dependent thereon. *Beneficial use shall be the basis, the measure and limit of the right to use water at all times*, not exceeding in any case, the statutory limit of volume. Water being always the property of the state, rights to its use shall attach to the land for irrigation, or to such other purpose or object for which acquired in accordance with the beneficial use made and for which the right receives public recognition, under the law and the administration provided thereby. Water rights cannot be detached from the lands, place or purpose for which they are acquired, without loss of priority."
>
> Laws 1909, Chapter 68, Section 1.
> Wyoming Compiled Statutes, 1910, Sec. 724, p. 247.

The above section was evidently enacted subsequent to the decision in the case of Johnson vs. Irrigation Co., 13 Wyo., 208, which we shall hereinafter consider.

> "Any person, association or corporation hereafter intending to acquire the right to the beneficial use of the public water of the state of Wyoming shall, before commencing the construction, enlargement or extension of any ditch, canal or other distributing works, or performing any work in connection with said construction, or proposed appropriation, make an application to the state engineer for a permit to make such appropriation. * * *"
>
> Laws Wyoming, 1895, Ch. 45, Sec. 1.
> Wyoming Compiled Statutes, 1910, Section 727.

> "All applications which shall comply with the provisions of this chapter, and with the regulations of the engineer's office, shall be recorded in a suitable book kept for that purpose; *and it shall be the duty of the state engineer to approve all applications* made in proper form, which contemplate the application of the water to a *beneficial use* and *where the proposed use does not tend to impair the value of existing rights, or be otherwise detrimental to the public welfare.* But where there is no unappropriated water in the proposed source of supply, or where the proposed use conflicts *with existing*

rights, or threatens to prove detrimental to the public interest, it shall be the duty of the state engineer to reject such application and refuse to issue the permit asked for."

Laws 1895, Chapter 45, Sec. 1.
Wyoming Compiled Statutes (1910), Sec. 729.

"The refusal or approval of an application shall be endorsed thereon and a record made of such endorsement in the state engineer's office. The application so endorsed shall be returned to the applicant. If approved, the applicant shall be authorized on receipt thereof, to proceed with the construction of the necessary works, and to take all steps required to apply the water to a beneficial use, and to perfect the proposed appropriation. If the application is refused, the applicant shall take no steps toward the prosecution of the proposed work, or the diversion and use of the public water so long as such refusal shall continue in force."

Wyoming Compiled Statutes 1910, Sec. 730.

"Upon it being made to appear to the satisfaction of the Board of Control, that any appropriation has been perfected in accordance with such application, and the endorsement thereof of the state engineer, it shall be the duty of the Board of Control * * * to send to the county clerk a certificate of the same character as that described in Section 778, which certificate shall be recorded in the office of the county clerk as recorded in said section."

Revised Statutes Wyoming, 1899, Sec. 928.
Wyoming Compiled Statutes, 1910, Sec. 738.

"The priority of such appropriation shall date from the filing of such application in the state engineer's office."

Revised Statutes 1899, Sec. 929.
Wyoming Compiled Statutes, 1910, Sec. 739.

"*Rights to the use of water shall be limited and restricted to so much thereof as may be necessarily used for irrigation or other beneficial purposes as aforesaid;* irrespective of the carrying capacity of the ditch, and *all the balance of the water* not so appropriated shall be allowed to run in the natural stream from which such ditch draws its supply of water, and shall not be considered as having been appropriated thereby; and in case the owner or owners of any such ditch, canal or reservoir shall fail to use the water therefrom for irrigation

or other beneficial purposes during any five successive years, they shall be considered as having abandoned the same, and shall forfeit all water rights, easements and privileges, appurtenant thereto, and water formerly appropriated by them may be again appropriated for irrigation and other beneficial purposes, the same as if such ditch, canal or reservoir had never been constructed; neither shall the owner or owners of such ditch, canal or reservoir have any right to receive from others any royalty for the use of water carried thereby, but every such owner or owners having a surplus of water and furnishing the same to others from any ditch, canal or reservoir as herein provided, shall be considered common carriers and shall be subjected to the same laws that govern common carriers."

Revised Statutes 1899, Sec. 895.
Wyoming Compiled Statutes, 1910, Sec. 741.

"The final orders or decrees of the State Board of Control, in proceedings provided by law for the adjudication and determination of rights to the use of public waters of the state, *shall be conclusive* as to all prior appropriations, and the rights of all existing claimants upon the stream or other body of water lawfully embraced in the adjudication, subject, however, to the provisions of law for re-hearings in such proceedings and for the re-opening of the orders and decrees therein and for appeals from such orders or decrees."

Laws 1901, Chapter 67, Sec. 1.
Wyoming Compiled Statutes, 1910, Sec. 793.

The comparatively few decisions which have been announced by the Supreme Court of Wyoming, are, nevertheless, voluminous and exhaustive. The principles of these decisions uphold and adopt the strict doctrine of appropriation as announced in Colorado.

Moyer vs. Preston, 6 Wyo., 308.
Farm Investment Co. vs. Carpenter, 9 Wyo., 110; 61 Pac., 258.
Willey vs. Decker, 11 Wyo., 498; 73 Pac., 210.
Johnston vs. Irrigation Co., 13 Wyo., 228; 79 Pac. 22.

We have already quoted at length from Moyer vs. Preston (6 Wyo., 308), also from Farm Investment Co. vs. Carpenter (9 Wyo., 110).

The following excerpts from the opinions may be of additional value:

In discussing Section 1, Article VIII of the Constitution, which declared that the "waters of all natural streams * * * within the boundaries of the State are hereby declared to be the property of the State," Chief Justice Potter construes the language as synonymous with the declaration of the Colorado Constitution declaring that the unappropriated waters of the stream are the property of the public. He says:

> "The effect of such a declaration has been determined by the courts of Colorado, whose constitution declares that the unappropriated waters of the streams within the State are the property of the public. In the case of Wheeler v. Northern Colo. I. Co., 10 Colo., 582, Mr. Justice Helm, in delivering the opinion of the court, said, 'Our constitution dedicates all unappropriated water in the natural streams of the State to the use of the people, the ownership thereof being vested in the public. We shall presently see that after appropriation, the title to this water, save perhaps as to the limited quantity that may be actually flowing in the consumer's ditch or lateral, remains in the general public, while the paramount right to its use, unless forfeited, continues in the appropriator.'
>
> Again, in Fort Morgan L. & C. Co. v. So. Platte Ditch Co., 18 Colo., 1, in the opinion delivered by Mr. Chief Justice Hayt, it is said, 'Under our constitution, the water of every natural stream in this State is deemed to be the property of the public. Private ownership of water in the natural streams is not recognized. The right to divert water therefrom and apply the same to beneficial uses is, however, expressly guaranteed. By such diversion and use a priority of right to the use of water may be acquired.'
>
> There is to be observed no appreciable distinction, *under the doctrine of prior appropriation, between a declaration that the water is the property of the public, and that it is the property of the State.*
>
> It is said in McCready v. Virginia, 94 U. S., 391, in discussing the subject of tide waters: 'In like manner the States own the tide waters themselves. * * * For this purpose, the State represents its people, and the ownership is that of the people in their united sovereignty.' See also Martin v. Waddell, 16 Pet., 410; Gould on Waters, Sec. 32; Kinney on Irrigation, Secs. 51, 53; Bell v. Gough, 23 N. J. L., 624. 'The Sovereign is trustee for the public.' 3 Kent's Com., 427; Miller v. Mendenhall (Minn.), 8 L. R. A., 89.
>
> The ownership of the State is for the benefit of the public or the people. By either phrase, 'property of the

public' or 'property of the State,' *the State, as representative of the public or the people, is vested with jurisdiction and control in its sovereign capacity.*"

The court then continues with a lengthy discussion of the right of the state to administer the distribution of the waters within its borders by adjudication and fixing of priorities by the Board of Control and by subsequent enforcement of their "certificates" or decrees by the water officials.

Farm Investment Co. vs. Carpenter, 9 Wyo., 110, 138-9.

While considering the case of Coffin vs. Left Hand D. Co., supra, Justice Potter said:

"It was held that it did not prevent the diversion of the water of one stream to irrigate lands lying adjacent to or in the locality of another. * * * We are perfectly content, however, therewith. It is in accord with our own views."

Moyer vs. Preston, 6 Wyo., 308, 321.

In Willey vs. Decker, Justice Potter makes an exhaustive review of the leading authorities of the arid west relating to the appropriation of water, including those of Colorado, and adopts the arid region or Colorado doctrine as the law of Wyoming. While quotation of the entire opinion would be very profitable, we shall, nevertheless, content ourselves with a few excerpts therefrom. After an exhaustive and favorable review of the decisions of the leading authorities in the arid west, including the case of Coffin vs. Left Hand Ditch Co., 6 Colo., 443, as well as of the decisions of the courts in the states of Montana and Nebraska where the common law doctrine in large measure prevails, he says:

"From our somewhat extended review of the origin of *the doctrine of prior appropriation* of the waters of natural streams, *it is quite clear that neither the custom or necessity that gave birth to the doctrine was confined to riparian lands.* With respect to irrigation, the *same necessity* existed in the case of *all* lands, whether bordering on a stream or otherwise. Indeed, if there was any difference, the *necessity was greater in the case of non-riparian lands.* They constituted, and continue to constitute, the far greater body of lands whose cultivation is desirable, and upon the productiveness of which the welfare of the country in a large measure depends. And *it is an undoubted fact* that from an early date, if not from the very beginning, the custom of the *settlers* in

the diversion of running water for purposes of irrigation *disregarded the location of the lands*, except in so far as irrigation was at first confined to lands upon which water could be the more easily and inexpensively conducted.

It is hardly necessary, therefore, to cite authority upon the proposition that, *under the doctrine of prior appropriation, it is not now and never has been essential to a water right, that the appropriator should apply the water upon land commonly or legally known as riparian.*"

* * * * * * * * * * *

"The act of Congress of 1866 granting rights of way for ditches over the public lands recognized a custom to conduct water to lands other than those situated on the margin of streams. Mr. Kinney asserts that a *valid appropriation may be made for the irrigation of lands*, or for any other beneficial use, *not situated upon or near the stream.* (Kinney on Irr., 156.) *And we think this proposition is conceded in every jurisdiction where the doctrine is to any extent enforced.*

In the Colorado case of Coffin v. Left Hand Ditch Co., *supra*, the appellee claimed to have appropriated certain water from St. Vrain Creek, through its diversion by means of a ditch which conducted the water to the James Creek, thence along the bed of the same to Left Hand Creek, where it was again diverted by lateral ditches, and used to irrigate lands adjacent to the last named stream. It was contended that such appropriation was unlawful. But the court upheld it, and said: 'In the absence of legislation to the contrary, we think that the right of water acquired by priority of appropriation thereof is not in any way dependent upon the *locus* of its application to the beneficial use designed. And the disastrous consequences of an adoption of the rule contended for forbid our giving such a construction to the statutes as will concede the same, if they will properly bear a more reasonable and equitable one. The doctrine of priority of right by priority of appropriation for agriculture is evoked; as we have seen, by the imperative necessity for artificial irrigation of the soil. And it would be an ungenerous and inequitable rule that would deprive one of its benefit simply because he has, by large expenditure of time and money carried the water from one stream over an intervening watershed and cultivated land in the valley of another. It might be utterly impossible, owing to the topography of the country, to get water upon his farm from the adjacent stream; or, if possible, it might be impracticable on account of the distance from the point where the diver-

sion must take place and the attendant expense; or the quantity of water in such stream might be entirely insufficient to support his wants.'

The Supreme Court of the State of Washington say that, 'The right of appropriation, as defined by the best authorities, is not controlled by the location of the stream with reference to the premises which are irrigated.' (Offield vs. Ish, 21 Wash., 277; 57 Pac., 809. See also Long on Irr., 50; Thomas v. Guiraud, 6 Colo., 530; Hammond v. Rose, 11 Colo., 524; 19 Pac., 466; Oppenlander v. Left Hand Ditch Co., 18 Colo., 142; 31 Pac., 854.) The court say in the case last cited: 'The appropriator, though he may not own the land on either bank of a running stream, may divert the water therefrom, and carry the same whithersoever necessity may require for beneficial use, without returning it, or any of it, to the natural stream, in any manner.'"

Willey vs. Decker, 11 Wyo., 496, 529-31.

While the conclusions of the court to the effect that the Wyoming Courts have the right to decree and settle rights to the use of water in Montana is not in accord with the better authority as announced in Kansas vs. Colorado, *supra;* Lamson vs. Vailes, 27 Colo., 201; Stockman vs. Leddy, 55 Colo., 24; Turley vs. Furman, 16 N. M., 253; and particularly to the doctrines announced by the same learned justice in Grover Irr. Co. vs. Lovella Ditch Co., 21 Wyo., 204, the court nevertheless adopts, without question, the general law of appropriation, including the right to divert water from one stream for application and use upon lands in no sense riparian and situate at a remote distance from the stream and from which no return of water can be expected as required by the common law doctrine.

The principles announced in the above case of Willey vs. Decker seem to have been adopted without further question, and we find no subsequent reported cases dealing with this phase of the appropriation doctrine. It is interesting, however, to note that these appropriations have been universally recognized, approved and decreed by the Board of Control, possessing full power to hear, determine, grant and adjudicate all water rights in that state.

The judicial determinations of the Board of Control are as conclusive in their nature as are those of the District Courts in Colorado, and are to be taken as equivalent to the financial and conclusive decree of a judicial tribunal, save for rights of appeal provided by statute.

Constitution of Wyoming, Art. VIII, Sec. 2.

Wyoming Compiled Statutes, 1910, Secs. 778 and 793.
Farm Inv. Co. vs. Carpenter, 9 Wyo., 110; 61 Pac., 258.
Parshall vs. Cowper, 22 Wyo., 385.

Section 2 of Article VIII of the Constitution provides:

> "There shall be constituted a Board of Control, to be composed of the state engineer and superintendents of water divisions; which shall, under such regulations as may be prescribed by law, have supervision of the waters of the state and of their appropriation, distribution and diversion and of the various officers connected therewith. Its decisions to be subject to review by the courts of the state."

Section 778 of the Wyoming Compiled Statutes, 1910, provides in part as follows:

> "As soon as practical after the determination of the priorities of appropriation of the use of waters in any stream, it shall be the duty of the secretary to issue to each person, association or corporation, represented in such determination, a certificate to be signed by the state engineer as president of the Board of Control, and attested under seal by the secretary of said board, setting forth the name and postoffice address of the appropriator; *the priority date and number of each such appropriation; the amount of water appropriated.* * * *"

Section 793, *supra*, provides that the final orders and decrees of the State Board of Control shall be conclusive as to all prior appropriations and the rights of all existing claimants upon the stream.

In the case of Farm Investment Co. vs. Carpenter, *supra*, the Supreme Court defined the powers of the Board of Control as quasi-judicial in their nature. The same court, in a decision announced in April, 1914, says:

> "In determining the rights and priorities of the several claimants the Board of Control was required to ascertain and determine the carrying capacity of ditches and the amount of land then irrigated or susceptible of irrigation by means of each ditch and the amount of water appropriated to each ditch or canal. * * * Neither the State Engineer nor his subordinates had the right to change, modify or annul that *adjudication* or to prevent plaintiff from the use of that amount of water,

except to prevent waste. The duty of the officers authorized and required to distribute the waters of a stream is to divide the water according to the rights of the appropriators as determined by the Board of Control. That is their authority for the distribution, and without it they cannot lawfully make such distribution. * * *

The adjudication by the Board of Control as to the quantity of water to which an appropriator is entitled is as *conclusive upon the water distributors as its determination of priorities*, with the exception that he may regulate a headgate so as to prevent waste. For the purpose of governing those officers in the discharge of their duties in dividing waters between appropriators, *the adjudication of the Board of Control is as conclusive as though an appeal had been taken from its decision and a decree entered by the court.*"

Parshall vs. Cowper, 22 Wyo., 385, 393-4.

The granting of permits by the state engineer has the same quasi-judicial effect. By Section 727, Wyoming Compiled Statutes, 1910, above quoted, all parties intending to commence the construction of any diversion system must first make application for permit so to do. By Section 729, it is the duty of the State Engineer to approve these applications, if in due form, unless he shall, in his quasi-judicial capacity, find that there is no unappropriated water in the proposed source of supply or that the proposed use conflicts with existing rights or threatens to prove detrimental to public interest, in either of which latter instances it is his duty to refuse to grant the permit, whereupon, the appropriator is precluded from commencing the construction of his enterprise. If the permit is granted and the works are completed, the appropriator has the right to make diversion in accordance with the terms and conditions of the permit, and by Section 738 of the statutes, a proper showing to the satisfaction of the Board of Control that the appropriation has been perfected in accordance with the application, a certificate of final decree of the same character as that described in Section 778 shall be awarded the appropriator.

The State Engineer's permit and its judicial effect were ably construed by Chief Justice Potter in the case of Whalon vs. North Platte Canal etc. Co. A clear understanding of the legal effect of this decision can best be obtained by reading the opinion. He said in part:

"Under our present statutory system, the inceptive point or date of a water right is not the commencement of construction, or even the commencement of survey. It is the filing of the application for a permit. Survey

must, of course, be made, and it generally, no doubt, antedates the application. There must be construction, and if there has been none an abandonment may be the result. Formerly any person could, without permission of any one, inaugurate and complete an appropriation of water. And many appropriations now existing, made before the adoption of the present statutes, have been established, and others will be established, in respect to priorities, upon evidence as to time of commencing work or making surveys.

Since the enactment into our laws of the system now in force, a water right is not inaugurated by constructing a ditch. The law provides that before beginning construction an application for permit shall be filed; and upon its approval the applicant is authorized to proceed with construction. * * * A ditch that is built without authority, the building of which confers no right upon the owner to divert water, is not such a ditch as the statute mentions."

And further on in the same opinion, the court says:

"The water to be appropriated by defendant under the permit to their grantors has been duly conveyed to the defendant. The title to the water right has duly passed to it from the original applicants or appropriators.

Plaintiff can acquire an interest only in the use of unappropriated waters. The water remains public, but the right to its use appropriated under the permit to defendant's grantors, until the same may be abandoned or forfeited, is no longer in the State to grant."

Whalon vs. North Platte Canal etc. Co., 11 Wyo., 313, 344, 351; 71 Pac., 995.

The record shows, without contradiction, that a considerable portion of the most valuable agricultural lands in Wyoming are now and for long years have been irrigated with waters obtained by means of inter-watershed diversions, and that these diversions have been approved, adjudicated and decreed by the Board of Control and District Courts of the State of Wyoming. This particularly applies to the Sheridan and Wheatland districts.

It also shows that the State Engineer has granted permits authorizing the construction of many new systems for the purpose of diverting water from one stream for application upon lands in a foreign drainage area, even to the extent of authorizing a small inter-watershed diversion from Cache la Poudre waters for irrigation of lands lying in the foreign drainage of the Laramie River.

These inter-watershed diversions have already been described in detail in a former portion of this brief and repetition is here unnecessary (see subdivision "Wyoming" under general title "Inter-watershed Diversions").

There are doubtless other reported cases in the same degree bearing upon the general doctrine of appropriation and inter-watershed diversions, as adopted, considered and applied in Wyoming, but we believe the foregoing are conclusive of the fact that the Colorado system and the arid region doctrine of appropriation, in all its fundamental principles, prevails in Wyoming; that the doctrine of riparian rights is there entirely abrogated and the new doctrine of appropriation adopted as better suited to the new conditions and necessities of the country, and that in abrogating the common-law doctrine, the inhibition against inter-watershed diversions on account of use of water on non-riparian lands from which such water cannot be returned to the stream of origin, has been likewise abolished and the rule announced in Colorado, that the appropriator may divert the water from any stream "and carry the same whithersoever necessity may require, for beneficial use, without returning it or any of it to the natural stream" obtains with like effect in Wyoming.

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(3) Other Decisions and Authorities.

The United States has approved and ratified the arid region doctrine of appropriation, as distinguished from the common-law doctrine of riparian rights, by the following Acts of Congress:

> "Whenever, by priority of possession, rights to the use of water for mining, agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and decisions of Courts, the possessors and owners of such vested rights shall be maintained and protected in the same; and the right of way for the construction of ditches and canals for the purposes herein specified is acknowledged and confirmed; but whenever any person, in the construction of any ditch or canal, injures or damages the possession of any settler on the public domain, the party committing such injury shall be liable to the party injured for such injury or damage."
>
> Act of Congress, July 26, 1866.
> 7 Fed. Stats. Ann., 1905, p. 1090.
> Rev. Stats. of U. S., 1878, sec. 2339.
> 14 Stat. L., 523.

"All patents granted, or pre-emptions or homesteads allowed, shall be subject to any vested and accrued water rights, or rights to ditches and reservoirs used in connection with such water rights, as may have been acquired under or recognized by the preceding section."

Act of Congress of July 9, 1870.
7 Fed. Stat. Ann., 1905, p. 1096.
U. S. Rev. Stats., 1878, sec. 2340.
16 Stat. L., 218.

"*Provided, however*, That the right to the use of water by the persons so conducting the same on or to any tract of desert land of six hundred and forty acres shall depend upon *bona fide* prior appropriation; and such right shall not exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation; and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights."

Act of Congress, March 3rd, 1877.
19 Stat. L., 377.

"That the right of way through the public lands and reservations of the United States is hereby granted to any canal or ditch company formed for the purpose of irrigation and duly organized under the laws of any State or Territory which shall have filed, or may hereafter file, with the Secretary of the Interior a copy of its articles of incorporation, and due proofs of its organization under the same, to the extent of the ground occupied by the water of the reservoir and of the canal and its laterals, and fifty feet on each side of the marginal limits thereof; also the right to take, from the public lands adjacent to the line of the canal or ditch, material, earth and stone necessary for the construction of such canal or ditch: *Provided*, That no such right of way shall be so located as to interfere with the proper occupation by the Government of any such reservation, and all maps of location shall be subject to the approval of the department of the Government having jurisdiction of such reservation, and the privilege herein granted shall not be construed to interfere with the control of water for irrigation and other purposes under authority of the respective States or Territories."

Act of Congress of March 3, 1891.
26 Stat. L., 1096, 1097.

"That nothing in this act shall be construed as affecting or intending to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this act, shall proceed in conformity with such laws, and nothing herein shall in any way affect any right of any State or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof; *Provided*, That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right."

National Reclamation Act, July 17, 1902.
7 Fed. Stat. Ann., 1905, p. 1098.
32 Stat. L., 388.

These acts have been repeatedly construed by this court, and particular reference is made to them in the following cases:

Atchison vs. Peterson, 20 Wall., 507.
Jennison vs. Kirk, 98 U. S., 453, 456.
Broder vs. Natoma Water Co., 101 U. S., 274; 25 L. Ed., 790.
United States vs. Rio Grande Irr. Co., 174 U. S., 690, 705-6.
Gutierres vs. Albuquerque Land & Irr. Co., 188 U. S., 545, 552-5.
Clark vs. Nash, 198 U. S., 361, 370.
Kansas vs. Colorado, 206 U. S., 46, 94; 51 L. Ed., 956.
Boquillas Land & Cattle Co. vs. Curtis, 213 U. S., 339, 344-5; 53 L. Ed., 822.

The construction placed upon them by this court has been universally adopted throughout the arid region, including Colorado and Wyoming.

Union Mill & Mining Co. vs. Dangberg, 81 Fed., 73, 95.
Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62, 65; 104 C. C. A., 136.
Cascade Town Co. vs. Empire Water & Power Co., 181 Fed., 1011, 1014-15.

Empire Water & Power Co. vs. Cascade Town Co., 205 Fed., 123, 127.
Coffin v. Left Hand Ditch Co., 6 Colo., 443, 447, 449.
Willey vs. Decker, 11 Wyo., 496, 519-22; 73 Pac., 210.

In construing the above statutes, this court and the federal and state courts of the arid west have universally held that Congress has recognized and approved the adoption of the doctrine of appropriation and the rejection of the common law riparian doctrine by each of the states of the arid west in the exercise of its sovereign control of the waters of the streams *within* its borders.

Kinney on Irrigation (2 Ed.), V. 1, Chap. 32, pages 1027-97.

In Jennison vs. Kirk, Mr. Justice Field said:

"The first appropriator of water to be conveyed to such localities for mining or other beneficial uses, was recognized as having, to the extent of actual use, the better right.

The doctrines of the common law respecting the rights of riparian owners were not considered as applicable, or only in a very limited degree, to the conditions of the miners in the mountains. The waters of rivers and lakes were consequently carried *great distances* in ditches and flumes, constructed with vast labor and enormous expenditures of money, along the sides of mountains and through canons and ravines, to supply communities engaged in mining as well as for agriculturalists and ordinary consumption."

Jennison vs. Kirk, 98 U. S. (Otto.), 453, 458.

In Broder vs. Natoma Water Co., Mr. Justice Miller said:

"It is the established doctrine of the court that the rights of the miners, who had taken possession of mines and worked and developed them, and the rights of persons who had constructed canals and ditches to be used in mining operations *and for purposes of agricultural irrigation*, in the region where such artificial use of the water was an *absolute necessity*, are rights which the Government had by its conduct recognized and encouraged and was bound to protect before the passage of the Act of 1866. We are of opinion that the section of the act which we have quoted was rather a voluntary *recognition of a pre-existing right of possession*, constituting a valid

claim to its continued use than the establishment of a new one. This subject has so recently received our attention and the grounds on which this construction rests are so well set forth in the following cases, that they will be relied on without further argument: Atchison v. Peterson, 20 Wall., 507; Basey v. Gallagher, Id., 670; Forbes vs. Gracey, 94 U. S., 762; Jennison v. Kirk, 98 U. S., 453."

Broder vs. Natoma Water Co., 101 U. S., 274, 276.

In the case of United States vs. Rio Grande Irr. Co., Mr. Justice Brewer, after affirming the construction of the act of 1866 in Broder vs. Water Co., supra, thus construes the acts of 1877 and 1891:

"Obviously, by these acts, so far as they extended, Congress recognized and assented to the appropriation of water in *contravention* of the common-law rule as to continuous flow. * * * And in reference to all those cases of purely local interest, the obvious purpose of Congress was to give its assent, so far as the public lands were concerned, to any system, *although in contravention to the common-law rule*, which permitted the appropriation of those waters for legitimate industries."

After having quoted the definition of common-law riparian rights as given by Chancellor Kent (3 Kent Com., Sec. 439) he said:

"While this is undoubted, and the rule obtains in those States in the Union which have simply adopted the common-law, it is also true that *as to every stream within its dominion, a State may change its common-law rule and permit the appropriation of the flowing waters for such purposes as it deems wise.*"

U. S. vs. Rio Grande Irr. Co., 174 U. S., 690, 706, 702.

In Gutierres vs. Albuquerque Land Co., Mr. Justice White said:

"As stated in the opinion just referred to" (U. S. vs. Rio Grande Irr. Co.) "by the Act of July 26, 1866, * * * Congress recognized, as respects the public domain, 'so far as the United States are concerned, the validity of the local customs, law and decisions of courts in respect to the appropriation of water' by the Act of March 3, 1877 * * * the right to appropriate such an amount of water as might be necessarily used for the

purpose of irrigation and reclamation of desert land, part of the public domain, was granted, and it was further provided that 'all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply, upon the public lands and not navigable, shall remain and be held free, for the appropriation and use of the public for irrigation, mining and manufacturing purposes, subject to existing rights.'

That the purpose of Congress was to recognize as well the legislation of a territory as of a state with respect to the regulation of the use of public waters, is evidenced by the act of March 3, 1891 * * *. It may be observed that the purport of the previous acts is reflexively illustrated by the act of June 17, 1902." (Here quoting Section 8 of the National Reclamation Act, supra.)

Gutierres vs. Albuquerque Land & Irr. Co., 188 U. S., 545, 553-4.

In Kansas vs. Colorado, Section 8 of the Reclamation Act of June 17, 1902, above quoted, was before the court upon petition of the United States as intervenor. It was there urged that the Reclamation Act superseded the state laws and gave national control of the streams to the United States. In concluding the discussion and in approving the above quoted language of Mr. Justice White in Gutierres vs. Albuquerque Land & Cattle Co., Mr. Justice Brewer said:

"We do not mean that its legislation can override state laws in respect to the general subject of reclamation. While arid lands are to be found, mainly if not only in the Western and newer States, yet the powers of the National Government within the limits of those States are the same (no greater and no less) than those within the limits of the original thirteen, and it would be strange if, in the absence of a definite grant of power, the National Government could enter the territory of the States along the Atlantic and legislate in respect to improving by irrigation or otherwise the lands within their borders.

* * * * * * * *

But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that *each State has full jurisdiction* over the lands within its borders, including the beds of streams and other waters.

* * * * * * * *

It may determine for itself whether the common law rule in respect to riparian rights or that doctrine which

obtains in the arid regions of the West of the appropriation of waters for the purposes of irrigation shall control. Congress cannot enforce either rule upon any State."

In another portion of the opinion, it is said:

"One cardinal rule, underlying all the relations of the States to each other, is that of equality of right. Each State stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none."

Kansas vs. Colorado, 206 U. S., 46, 92, 94, 97.

The doctrine first announced in the case of Coffin vs. Left Hand Ditch Co., 6 Colo., 443, that the common-law limitation against inter-watershed diversions had been abolished along with the rest of the riparian rules in the arid states, which was later approved and sanctioned in the case of Willey vs. Decker, 11 Wyo., 496, 529-31, is approved by Mr. Justice White in the following language:

"It is conceded on behalf of appellant, that, by the laws of Mexico in force when the Territory of New Mexico was ceded to the United States, the use of the waters of both navigable and unnavigable streams was not limited to riparian lands, but extended as well to lands which did not lie upon the banks of the rivers, and that such use was subject to be regulated and controlled by the public authorities."

Gutierres vs. Albuquerque Land & Irr. Co., supra, 556.

This construction of the doctrine of appropriation was affirmed and approved by Mr. Justice Holmes in the following language:

"*The right to use water is not confined to riparian proprietors.* Gutierres vs. Albuquerque Land & Irrigation Co., 188 U. S., 545, 556; Coffin vs. Left Hand Ditch Co., 6 Colo., 443, 449, 450; Willey vs. Decker, 73 Pac. Rep., 210, 220.

Such a limitation would substitute accident for a rule based upon economic considerations, and an effort, adequate or not, to get the greatest use from all available land."

Boquillas Cattle Co. vs. Curtis, 213 U. S., 339, 347.

The doctrine that waters may be used on non-riparian lands, including those in foreign watersheds, under the rule of appro-

priation, as first announced in Coffin vs. Left Hand Ditch Company, is approved by Judge Hawley, of the Federal Court for the District of Nevada, who was first Chief Justice of the Supreme Court of that state, in a lengthy and exhaustive opinion wherein he likewise assigns the fundamental reasons which led to the abrogation of the common-law doctrine and the adoption of the rule of prior appropriation in the arid states and particularly in Nevada where the principles of prior appropriation had been accepted as applicable to the existing conditions of the soil and climate, in the cases of Jones vs. Adams, 19 Nev., 78; 6 Pac., 442; Reduction Works vs. Stevenson, 20 Nev., 269; 21 Pac., 317. The opinion embodies so complete a summary of the underlying principles of the law of appropriation that we take the liberty of quoting at considerable length.

> "This change is the natural outgrowth of the conditions existing in this state. The climate is dry. The soil is arid. The land is unproductive, without irrigation. When water can be used thereon, it becomes capable of successful cultivation. There are but few streams of water. The benefits accruing to land along the banks of these streams by the mere flow of water in the channel is very slight. *The bottom lands that can be irrigated by a diversion of the water, so that it can be turned back into the stream, are of limited extent.* A large proportion of the area of land suitable for cultivation would have to remain in its wild and unproductive state, covered only by the natural growth of sagebrush and greasewood, unless the right to appropriate and divert the water of the streams *away* from the channel for the purpose of irrigating such lands is recognized and secured. The same conditions exist with reference to the necessity of the use of the water for mining, milling, mechanical, manufacturing, municipal, and other beneficial purposes.
>
> *These conditions and the growing wants and necessities of the people imperatively demanded that such a change should be made.* Riparian rights are founded upon the ancient doctrine of the common law. If the law is a progressive science, courts should keep pace with the progress and advancement of the age, and constantly bear in mind the wants and necessities of the people, and the peculiar conditions and surroundings of the country in which they live. In this connection it has been said to be one of the excellencies of the common law that it admits of perpetual improvement, by accommodating itself to the circumstances of every age, and applies to all changes in the modes and habits of society, and that in this respect it will never be outgrown by any refinements,

and never out of fashion, while the ideality of human nature exists.

* * * * * * * * * * * *

The truth is that under the principles of the common law in relation to riparian rights, if applicable to our circumstances and conditions, there must be allowed to all, of that which is common, a reasonable use. But, if prior appropriation is to prevail, *then different rules must be applied.*

Under the principles of prior appropriation, the law is well settled that the right to water flowing in the public streams may be acquired by an actual appropriation of the water for a beneficial use; that, if it is used for irrigation, the appropriator is only entitled to the amount of water that is necessary to irrigate his land, by making a reasonable use of the water; that the object had in view at the time of the appropriation and diversion of the water is to be considered in connection with the extent and right of appropriation; that, if the capacity of the flume, ditch, canal, or other aqueduct, by means of which the water is conducted, is of greater capacity than is necessary to irrigate the lands of the appropriator, he will be restricted to the quantity of water needed for the purposes of irrigation, for watering his stock, and for domestic use; that the same rule applies to an appropriation made for any other beneficial use or purpose; that no person can, by virtue of his appropriation, acquire a right to any more water than is necessary for the purpose of his appropriation; that, if the water is used for the purpose of irrigating lands owned by the appropriator, the right is not confined to the amount of water used at the time the appropriation is made; that the appropriator is entitled, not only to his needs and necessities at that time, but to such other and further amount of water, within the capacity of his ditch, as would be required for the future improvement and extended cultivation of his lands, if the right is otherwise kept up; that the intention of the appropriator, his object and purpose in making the appropriation, his acts and conduct in regard thereto, the quantity and character of land owned by him, his necessities, ability, and surroundings, must be considered by the courts, in connection with the extent of his actual appropriation and use, in determining and defining his rights; that the mere act of commencing the construction of a ditch with the avowed intention of appropriating a given quantity of water from a stream gives no right to the water unless this purpose and intention are carried out by the reasonable, diligent,

and effectual prosecution of the work to the final completion of the ditch, and diversion of the water to some beneficial use; that the *rights acquired* by the appropriator *must* be exercised with reference to the general condition of the country and the necessities of the community, and measured in its extent by the actual needs of the particular purpose for which the appropriation is made, and not for the purpose of obtaining a monopoly of the water, so as to prevent its use for a beneficial purpose by other persons; that the diversion of the water ripens into a valid appropriation only where it is utilized by the appropriator for a beneficial use; that the surplus or waste water of a stream may be appropriated, subject to the rights of prior appropriators, *and such an appropriator is entitled to use all such waters;* that, in controversies between prior and subsequent appropriators of water, the question generally is whether the use and enjoyment of the water for the purposes to which the water is applied by the prior appropriator have been in any manner impaired by the acts of the subsequent appropriator.

These general principles are of universal application throughout the states and territories of the Pacific coast. They have, in one form or another, been declared, upheld, and maintained by a uniform current of decisions in this state." (Citing the leading decisions from all the arid states, including the citation of Coffin vs. Left Hand Ditch Co., 6 Colo., 443; Hammond vs. Rose, 11 Colo., 524; Atchison vs. Peterson, *supra,* and Broder vs. Water Co., *supra*).

" * * * A person appropriating a water right on a stream already partly appropriated acquires a right to the surplus or residuum he appropriates. * * *

"Under the law of riparian proprietorship, an upper riparian proprietor is entitled to make a reasonable use of a portion of the water of a river to irrigate his riparian land, but he does not have any right to take the water away from the river to irrigate other lands, that are not riparian. * * *

Under the rules of riparian proprietorship, the right to the use of the water in its natural flow is not a mere easement or appurtenance, but is inseparably annexed to the soil itself. It does not depend upon appropriation, or presumed grant from long acquiescence on the part of the other riparian proprietors above and below, but exists, jure naturae, as parcel of the land. It is not suspended or destroyed by mere nonuser, although it may be extinguished by the long-continued, adverse enjoy-

ment of others. It is not affected by the use to which the water has been or may be applied. Use does not necessarily create the right, and disuse cannot destroy or suspend it. * * *

The right to water acquired by prior appropriation is not dependent upon the place where the water is used. A party having obtained the prior right to the use of a given quantity of water, is not restricted in such right to the use or place to which it was first applied. It is well settled that a person entitled to a given quantity of the water of a stream may take the same at any point on the stream, and may change the point of diversion at pleasure, and may also change the character of its use, if the rights of others be not affected thereby." (Citing Colorado and other authorities.)

Union Mill & Mining Co. vs. Dangberg, 81 Fed., 73, 92-5, 106, 115.

It would seem unnecessary to further quote from the federal authorities at this time. As we shall hereafter observe, the general doctrine in its several phases, as announced in the foregoing decisions, is accepted and approved in the following Federal cases from the District of Colorado:

Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62, 69; 10 C. C. A., 136.

Empire W. & P. Co. vs. Cascade Town Co. (C. C. A., 1913), 205 Fed., 123, 127.

Cascade Town Co. vs. Empire W. & P. Co., 181 Fed., 1011, 1013-16.

An inter-watershed diversion for use of water from Stemilt Creek upon lands in the foreign watershed of Squillchuck Creek was treated as permissible by the Supreme Court of Washington. In the opinion the court recognizes the fundamental principles of appropriation as follows:

"The law of appropriation is a creature of necessity. It is a growth peculiar to conditions unknown to the common law."

Miller vs. Wheeler, 54 Wash., 429, 436; 103 Pac., 641.

The same court, in an early decision, made the following announcement:

"The right of appropriation, as defined by the best authorities, is *not* controlled by the location of the stream with reference to the premises which are irrigated."

Offield vs. Ish, 21 Wash., 277; 57 Pac., 809.

Prof. Joseph R. Long, in his very recent (1916) work on irrigation, says:

> "In our examination of the doctrine of riparian rights, we found that the riparian proprietor may use the water of a stream for irrigation only on riparian lands. In this respect there is a wide difference between the right of the appropriator and that of the riparian owner. The right to water acquired by priority of appropriation is *not* in any way dependent on the *locus* of its application to the beneficial use designed.
>
> The water may be used either in the valley of the stream from which it is taken or it may be carried over an intervening ridge to land lying in the valley of another stream, and there used. The water may be diverted to the exclusion of a riparian owner, as will be necessary where the lands to be irrigated therewith are not located on the banks, or in the neighborhood of the stream."
>
> Long on Irrigation (2nd Ed.), page 217; (1st Ed.), p. 92.

The late and learned Clesson S. Kinney, in the last edition of his work on "Irrigation and Water Rights," thus defines the arid region doctrine of appropriation:

> "The Arid Region Doctrine of appropriation may be defined as that doctrine or rule of law which has grown up in this Western portion of our country, governing the use of the water of the natural streams and other bodies, by its appropriation for any useful or beneficial purpose, based upon the physical necessities of the case; and, whereby for the purpose of applying the water to some beneficial use, the water must be diverted from its natural channels, and, *in contradistinction to the strict construction of the common law of riparian rights, the place of use may be on either riparian or non-riparian lands, and the right based upon priority.*"
>
> Kinney on Irrigation (2nd Ed.), Vol. 1, Sec. 587, pp. 1009-10.

In a later chapter, he says:

> *"There is no question now* as to the right of an appropriator to divert the water from a stream flowing in *one watershed* and by any means conduct it for the irrigation of *lands in another watershed.* Yet in an early

case in Colorado the validity of the appropriation and use of the water by this method was questioned, but the Court upheld the right. Under a similar state of facts to those in the Colorado case, the Supreme Court of Washington in a very recent case also upheld the right. Both cases also involved the question of mingling the waters of one watershed with the waters of the stream of another and the right to redivert the water from the latter stream and use the water for irrigation, and the right to do this was upheld.

The *general rule* is that *under the law of appropriation, as contrary to the law of irrigation as a riparian right, the water may be used in any locality, however remote from the stream from which it is taken, or it may be carried over or through the intervening ridge to land lying in another watershed, and there used,* provided that the *vested* rights of others are not injured thereby."

Kinney on Irrigation (2nd Ed.), Vol. 2, Sec. 866, pp. 1521-2.

Under the common-law doctrine, a riparian proprietor cannot divert all of the water of the stream. The rule is thus announced in an early Massachusetts case:

"This rule, that no riparian proprietor can wholly abstract or divert a water-course, by which it would cease to be a running stream, or use it unreasonably in its passage, and thereby deprive a lower appropriator of a *quality of his property,* deemed in law incidental and beneficial, necessarily flows from the principle, that the right to the reasonable and beneficial use of a running stream, *is common to all the riparian proprietors,* and so, each is bound so to use his common right, as not essentially to prevent or interfere with an *equally* beneficial enjoyment of the common right by all the proprietors."

Elliott vs. Fitchburg R. R. Co., 10 Cush., 191, 195.

Under the rule of priority, the contrary obtains, and the first appropriator is entitled to divert such water as may be necessary for the beneficial use for which the same was appropriated, regardless of junior appropriations, and even though it require the entire flow of the stream to supply his prior wants.

This rule was early announced by Justice Helm in a Colorado case in the following language:

"Had there remained water in the stream after such diversion and use by Guiraud, plaintiff in error would

have had the undoubted right to appropriate the same. *But since Guiraud diverted the usual flow of water to the full extent thereof,* plaintiff in error could acquire no absolute right to any part of such usual or ordinary flow, when required by defendants in error; he might divert and use the same at such times as Guiraud and those who held under him were not in need thereof; and when there was an excess over the ordinary flow he might legally appropriate water to the extent of such excess; but when there was not enough for both, the diversion of plaintiff in error must give way to the prior right of defendants in error to the extent of Guiraud's original appropriations."

Thomas vs. Guiraud, 6 Colo., 530, 532.

In the quotation from the opinion of Judge Hawley of the Federal Court of Nevada, the same rule is approved in the following language:

"That the surplus or waste water of a stream may be appropriated, subject to the rights of prior appropriators, *and such an appropriator is entitled to use all such waters.*"

Union Mill & Mining Co. vs. Dangberg, 81 Fed., 73, 95.

The rule is thus announced by Professor Long in his recent (1916) work:

"We have seen that the rights of an appropriator depend solely upon the fact of prior appropriation, and that an irrigator may use all the water, not already appropriated by others, that may be reasonably necessary for the irrigation of his land. Except as against prior appropriators, the rights of an appropriator, unlike those depending upon the fact of riparian ownership, are measured solely by his own needs and actual appropriation, and he is not concerned with the effect of the satisfaction of his own wants on other persons. It follows from these principles that *a prior appropriator may use the entire flow of a stream* for irrigation, provided this is necessary, for the proper irrigation of his land."

Long on Irrigation (2 Ed.), Sec. 132, page 232, and cases cited.

See also Drake vs. Earhart, 2 Ida., 750; 23 Pac., 541.

Mr. Kinney devotes several pages of his recent and

exhaustive treatise on the arid region doctrine of appropriation to this particular topic, and after observing that the doctrine of appropriation was adopted largely on account of the fact that the very limited supply of water in the streams of the arid region was wholly inadequate to supply the almost unlimited acreage of land, says:

> "The rule of priority of right was adopted, in order that the few who were first might live and live well rather than that the many should starve or eke out a miserable existence."

And concludes by saying:

> "Under this principle, the general doctrine is settled by a long line of authorities, * * * that the *prior appropriator* of the waters of a certain stream or other source of water supply, is entitled to the *exclusive use* of the water up to the amount embraced in his appropriation, *even if it cuts off the rights of valid subsequent appropriators.*"
>
> Kinney on Irrigation (2 Ed.), Vol. 2, Sec. 780, 781-4, pages 1355-69.

(3-a) Hoge vs. Eaton Overruled.

The disposition and regulation of the use of waters is a matter of local law with each state and the rules adopted by the constitution, laws and decisions of the courts of each state will be followed by the courts of the United States.

> Kinney on Irrigation (2d Ed.), Vol. 1, p. 1027;
> United States vs. Rio Grande Irr. Co., 174 U. S., 690;
> Gutierres vs. Albuquerque Land & Irr. Co., 188 U. S., 546;
> Clark vs. Nash, 198 U. S., 361;
> Kansas vs. Colorado, 206 U. S., 46;
> Boquillas Cattle Co. vs. Curtis, 213 U. S., 339;
> Schodde vs. Twin Falls Water Co., 224 U. S., 107.

Notwithstanding that the State of Colorado, by constitution, statutes and a uniform line of judicial decisions, has abrogated the common law rule of riparian rights and has adopted the doctrine of appropriation as governing the use of the water of the streams within its borders, and has early declared, in Coffin vs. Left Hand Ditch Co., 6 Colo., 443 and other cases which we have cited, that the appropriator might take the water whithersoever his necessities require and may apply the same upon lands within a drainage area wholly

foreign to the stream of origin, the late Judge Hallett of the Federal District Court of Colorado, shortly before he retired, while considering an inter-watershed diversion from Sand Creek to Sheep Creek involved in the case of Hoge vs. Eaton, used the following language:

> "Water is essential to human life in the same degree as light and air, *and no bounds can be set to its use for supplying the natural wants of man other than the mighty barriers which the Creator has made on the face of the earth.*"

This opinion was rendered February 27, 1905, previous to decision of this court (on May 13, 1907) in the case of Kansas vs. Colorado. While the above quotation may be interpreted as referring alone to the physical inability of the appropriator to overcome natural obstacles, it is naturally interpreted as announcing a riparian doctrine contrary to the uniform rule theretofore adopted and since hitherto followed in the State of Colorado, and is frequently cited as Colorado authority against inter-watershed diversions, and, therefore merits our careful consideration. The manifest error of this language of Judge Hallett is revealed by our many quotations from the constitution, statutes and decisions of the courts of Colorado, already appearing, and we will not unduly prolong this brief with further consideration thereof.

The same judge seems to have committed a similar error in the case of Schwab vs. Beam, 86 Fed., 41, in which he held that Article XVI, Section 6 of the Colorado Constitution does not apply to diversions for manufacturing, mining and mechanical uses, but that as to such the common law rule prevails and also that one who locates a placer claim upon a stream thereby, by implication, makes an appropriation of water, saying:

> "A placer location *ex vi termini* imports an appropriation of all waters covered by it in so far as such waters are necessary for working the claim."

A reading of the decision reveals the fact that Judge Hallett was laboring under the same fundamental error of interpretation of the doctrine of appropriation in both that case and Hoge vs. Eaton.

The case of Hoge vs. Eaton was reviewed by the Circuit Court of Appeals and reversed upon another point (Eaton vs. Hoge, 141 Fed., 64), the appellate court confining its discussion to technical matters and failing to express any opinion upon the erroneous doctrine so announced. The case was subse-

quently dismissed without affording further opportunity of consideration or review by any of the federal courts.

The same erroneous doctrine, announced in the case of Hoge vs. Eaton, was later considered and overruled by the Circuit Court of Appeals in the case of Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62; 104 C. C. A., 136. The reasons there assigned by Mr. Justice Van Devanter are so conclusive of what the opinion of that court would doubtless have been upon further consideration of the case of Hoge vs. Eaton that the language of the court may be taken as overruling that case.

The case of Snyder vs. Colorado Gold Dredging Co. involved an appeal from the Circuit Court of the United States for the District of Colorado, and it was there contended, under authority of the case of Schwab vs. Beam, *supra*, that the location of a placer claim was in and of itself an appropriation of all the waters of the stream upon which the same was located, and that, although no diversion was made for said claim, a right to use the water of the stream attached to it as an incident to and part of the estate included within the patent from the United States. In other words, it was asserted that the common-law rule of riparian rights obtained with relation to patented mining claims situate along a stream by virtue of the fact that the patent carries, by implication, the right to the use of any waters of any stream bordering and traversing the claim.

The court said:

> "The argument is plausible but not tenable. It is in conflict with the established doctrine of appropriation in Colorado and with its recognition and sanction by Colorado as respects the public lands. That doctrine regards the waters of natural streams as entirely distinct from the lands through which they flow, and regards rights to the use of such waters as dependent upon actual appropriation. In these respects *it makes no distinction* between public lands and private lands, *between owners of riparian lands and owners of other lands, between places of use which are adjacent to a stream and those which are remote therefrom,* or between individuals who desire to apply the waters to placer mining and those who desire to apply them to other beneficial uses. Nor does it recognize a merely constructive appropriation or one which rests only on intention. On the contrary its requirements are satisfied only when by union of intent and act the waters actually are subjected to a beneficial use."

The court then quotes with approval the definition of the true test of an appropriation, heretofore quoted from Thomas vs. Guiraud, 6 Colo., 530, 533, and from other decisions of the Supreme Court of Colorado, and continues as follows:

> "True, gold placer claims cannot be worked without water, *but this applies to non-riparian claims* quite as much as to those which are riparian, and water usually is applied to both in substantially the same way; that is, by a ditch which diverts it at a point beyond the limits of the claim and then carries it to the place of use. *Rarely can a riparian claim be worked successfully by the aid of the waters of the contiguous stream* unless they be diverted some distance above the claim, and even then *the volume of water is often so inadequate that it must be supplemented by drawing upon another stream.* Nor are gold placer claims alone in requiring the use of water to render them productive or of value. In Colorado other claims to public lands, such as homestead claims and desert claims, have a like need of water. Indeed, the desert land law (Act March 3, 1877, c. 107, 19 Stat., 377; as amended by Act March 3, 1891, c. 561, sec. 2, 26 Stat., 1096 [U. S. Comp. St. 1901, p. 1549]) conditions the right to make the preliminary entry upon the making of a declaration under oath of an intention to reclaim the land by conducting water upon the same, and conditions the right to make final entry upon the making of satisfactory proof of reclamation by that means; and yet a preliminary desert entry, even if it be of riparian lands, never is regarded as in itself an appropriation of water, any more than is a preliminary homestead entry of non-riparian lands. * * * Considerations such as these point very persuasively to the absence of any good reason for excepting riparian gold placer claims from the doctrine prevailing in Colorado that the waters of all natural streams are subject to appropriation, and that actual application to a beneficial use is the test of appropriation. But it suffices to know that in that state the local customs, laws and decisions of courts make no such exception.

In Schwab vs. Beam (C. C.), 86 Fed., 41, a different conclusion was announced, *but that decision stands alone, is not in accord with the decisions of the Supreme Court of Colorado* respecting the application of the doctrine of appropriation as there prevailing to the use of water for purposes other than irrigation, *and is not sustained by what seems to be the better reasoning.* The

several congressional enactments, whereby the local customs, laws, and decisions of courts relating to rights to the use of water have been recognized and sanctioned, disclose a settled purpose to make the subject one of local law, as respects the public lands and claims thereto under the public land laws; and in none of these enactments is there anything indicative of a purpose to treat riparian gold placer claims differently from other claims. Not only so, but the first expression of this recognition and sanction was incorporated in the mining laws of the United States at the time of their enactment and still remains a part of them. It broadly includes 'rights to the use of water for mining, agricultural, manufacturing, or other purposes,' and leaves no room to doubt that it was intended that the local law should apply to riparian gold placer claims the same as to other claims to public lands. Mr. Lindley, in his work on Mines ([2d Ed.] vol. 1, sec. 428), puts the matter quite accurately when he says:

'As to what rights accrue to a placer locator to the water of a non-navigable stream found within the limits of the location, no definite rule can be stated. It will depend upon the locality in which the claim is situated. If in a state where the ultra doctrine of the common law prevails, his rights to the water would be limited to those of a riparian proprietor. *If in a state where the riparian doctrines are abrogated* or declared never to have been adopted, his right to use the water would depend upon its proper appropriation for that purpose, and the mere location of the placer claim would not of itself confer any right to the water.'

What has been said disposes adversely of the first branch of the contention before stated, and also makes strongly against the second branch, viz., that a patent for a placer claim carries, by implication, the right to the unappropriated waters of any stream bordering upon or traversing the claim. It needs only to be added that, by the settled rule of decision in the Supreme Court of the United States, conveyances by the United States of public lands on non-navigable streams and lakes, when it is not provided otherwise, are to be construed and have effect according to the *law of the state* in which the lands are situate, in so far as the rights and incidents of riparian proprietorship are concerned. Hardin vs. Jordan, 140 U. S., 370, 384, 402; 11 Sup. Ct., 808, 838; 35 L. Ed., 428; Hardin vs. Shedd, 190 U. S., 508, 519; 23 Sup. Ct., 685; 47 L. Ed., 1156; Whitaker vs. McBride, 197 U. S., 510;

25 Sup. Ct., 530; 49 L. Ed., 857; Harrison vs. Fite, 78 C. C. A., 447, 449; 148 Fed., 781, 783. Here it is not provided otherwise, either by statute or by the patent, and, as has been seen, the local law does not recognize a conveyance of the land as carrying any right to the unappropriated waters of the stream."

In a former part of the opinion, the court had announced the appropriation doctrine as it prevails in Colorado in the following language:

"* * * *The common-law doctrine in respect of the rights of riparian proprietors in the waters of natural streams never has obtained in Colorado.* From the earliest times in that jurisdiction the local customs, laws, and decisions of courts have united in rejecting that doctrine and in adopting a different one which regards the waters of all natural streams as subject to appropriation and diversion for beneficial uses, and treats priority of appropriation and continued beneficial use as giving the prior and superior right. Yunker vs. Nichols, 1 Colo., 551; Coffin vs. Left Hand Ditch Co., 6 Colo., 443, 447; Platte Water Co. vs. Northern Colo. Irrigation Co., 12 Colo., 525, 531; 21 Pac. 711; Crippen vs. White, 28 Colo., 298; 64 Pac., 184. In so choosing between these inconsistent doctrines, Colorado acted within the limits of her authority, first as a territory and then as a state, and her choice was recognized and sanctioned by Congress, so far as the public lands of the United States were concerned. United States vs. Rio Grande Irrigation Co., 174 U. S., 690, 702-706; 19 Sup. Ct., 770; 43 L. Ed., 1136; Gutierres vs. Albuquerque Land & Irrigation Co., 188 U. S., 545, 552-554; 23 Sup. Ct., 338; 47 L. Ed., 588; Clark vs. Nash, 198 U. S., 361, 370; 25 Sup. Ct., 676; 49 L. Ed., 1085; Kansas vs. Colorado, 206 U. S., 46, 94; 27 Sup. Ct., 655; 51 L. Ed., 956; Boquillas Land & Cattle Co. vs. Curtis, 213 U. S., 339; 29 Sup. Ct. 493; 53 L. Ed., 822."

From the language of the foregoing opinion so overruling the lower court in the case of Schwab vs. Beam, and announcing that water may be appropriated for use on "non-riparian claims quite as much as those which are riparian" and that sufficient water for this purpose must be frequently obtained "by drawing upon another stream," it is apparent that the Circuit Court of Appeals has expressed its disapproval of the

riparian theories entertained by Judge Hallett and announced in both Hoge vs. Eaton and Schwab vs. Beam, and has overruled the former as well as the latter decision.

That Judge Hallett erroneously construed the laws of Colorado in these earlier cases of Hoge vs. Eaton and particularly Schwab vs. Beam, is likewise recognized by Mr. Kinney on pages 1111 and 3333-4 of his recent work. In Section 1804, on the pages last mentioned, he discusses the abrogation of riparian rights in Colorado and quotes at length the language of the Circuit Court of Appeals in the case of Snyder vs. Colorado Gold Dredging Company, *supra*, in that portion above quoted wherein the rule as announced in Schwab vs. Beam is overruled, and also calls attention to a very recent decision of the Colorado Supreme Court in the case of Sternberger et al. vs. Seaton Mining Co., 45 Colo., 401, 404; 102 Pac., 168, wherein that court forever sets at rest any possible application of the theories announced in Schwab vs. Beam in the following language:

> "The doctrine of this state, that the common law rule of continuous flow of natural streams is abolished, is so firmly stated by the constitution, the statutes of the Territory and of the State and by many decisions of this court that we decline to reopen or reconsider it, however interesting discussion thereof might otherwise be, and notwithstanding its importance. Perhaps a leading case in this state is *Coffin vs. Left Hand Ditch Co.*, 6 Colo., 443."

On page 1111 Mr. Kinney, in a foot-note, thus comments of Schwab vs. Beam:

> "This position is clearly untenable under either the common law rules or the arid region doctrine of appropriation. Under the common law rule there is no 'appropriation' of the waters of the stream, but mere ownership of riparian lands. By reason of this ownership the owner is entitled to a reasonable use of the waters of the stream as an incident to his land * * *. Upon the other hand under the arid region doctrine of appropriation, the mere location of mining claims or the purchase of land upon the bank of the stream is not *ipso facto* an appropriation of the waters thereof. Some act of actual appropriation of the water is required."

Mr. Wiel, in his work written with particular application to the California common law—appropriation doctrine, thus disposes of that portion of Judge Hallett's decision in the case of Schwab vs. Beam wherein he states that "in Colorado, as

elsewhere in the United States, the law is now as it has been at all times, that for such purposes each riparian owner may use the waters of running streams on his own premises, allowing such waters to go down to subsequent owners in their natural channel." (86 Fed., 41.)

> "This seems to show that the decision rested *not* on the principles of appropriation but on those of riparian rights. The placer claimant under the California doctrine, has a right to the use of water in that way but not by appropriation. Schwab vs. Beam would seem to be an attempt to apply the California doctrine in Colorado, a principle which the State court repudiates. The case has been criticised; is contrary to the weight of more recent authority just cited, and is properly overruled." Citing Snyder vs. Colorado Gold Dredging Co., *supra*.
>
> Wiel on Water Rights, 3d Ed., Vol. 1, p. 395.

Judge Lewis, successor to Judge Hallett, overrules the erroneous impression entertained by Judge Hallett to the effect that the riparian doctrine still obtained within Colorado, in his recent 1910 opinion in which he says:

> "The first contention of both complainants is that the government, while it was the owner of the lands on which the canon and the falls are situate, had riparian rights in the stream and that those rights were conveyed by patent from it, their true mesne conveyances, to the complainants.
>
> This contention cannot be accepted. *There are no riparian rights in Colorado* as against the valid appropriation of water."

Judge Lewis then adopts the quotations which we have already given from Sternberger vs. Seaton Mining Co., 45 Colo., 401, 404; Coffin vs. Left Hand Ditch Co., 6 Colo., 443; U. S. vs. Rio Grande Irr. Co., 174 U. S., 690, 702, 704; Gutierres vs. Albuquerque Land Co., 188 U. S., 545, 552; Clark vs. Nash, 198 U. S., 361, 370, and Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62, as a part of his opinion, and concludes by saying:

> "It is therefore believed that the patent from the government did not pass, and the patentee did not take, riparian rights to the waters in question, but that said lands are held by the complainants subject to the law of appropriation of waters as established in this state." (Colorado.)
>
> Cascade Town Co. vs. Empire Water & Power Co., 181 Fed., 1011, 1013-6.

The decision by Judge Lewis in the above case was reviewed by the Circuit Court of Appeals. On April 4, 1913, the case was remanded for further proceedings upon another point and the court affirms that portion of the decision above quoted in the following language:

> "In all other respects the conclusions of the court were in accord with the views we have expressed."

The opinion by Judge Hook reads, in part, as follows:

> "Moreover, the common law of riparian ownership in *all* its features never obtained in Colorado. Snyder v. Dredging Co., 104 C. C. A., 136; 181 Fed., 62. It was unsuited to the region and would have tended greatly to prevent the very development which made the lands valuable. Express recognition of the local conditions and necessities is found in the acts of Congress above referred to and in the patents from which complainant derives its title. See 174 U. S., 690; 19 Sup. Ct., 770; 43 L. Ed., 1136. The National Constitution speaks in the terms of the common law, and that law has been qualifiedly adopted by statute in many states. But there has been no statutory adoption of it for the United States. There its acceptance rests on judicial construction proceeding upon historical reasons and a general sense of suitableness, and like that of the states is qualified to a harmony with our institutions and conditions. It does not automatically apply all over the United States, its territories, and possessions as a blanket of unvarying thickness, but yields here and there to a universal recognition of necessity and propriety. For examples: Our test of the navigability of waters is not that of the common law (The Daniel Ball, 10 Wall., 557; 19 L. Ed., 999); and we have quite generally denied the doctrine of ancient lights. It *would be as illogical to impose the English doctrine of flowing waters upon Colorado as it would be to say judicially that their climate and soil and the imperative needs of their people are the same.* Referring to Montana and Wyoming and the use of waters of non-navigable streams, Mr. Justice Holmes said, in Bean v. Morris, 221 U. S., 485; 31 Sup. Ct., 703; 55 L. Ed., 821:
>
> 'The doctrine of appropriation has prevailed in these regions probably from the first moment that they knew of any law, and has continued since they became territory of the United States.'
>
> And so in Colorado. That rights may vary and be adjusted somewhat to the *imperative necessities* of natural conditions is also exemplified in Clark v. Nash, 198 U. S. 361, 25 Sup. Ct. 676, 49 L. Ed. 1085, 4 Ann.

Cas. 1171, and Strickley v. Mining Co., 200 U. S. 527, 26 Sup. Ct. 301, 50 L. Ed. 581, 4 Ann. Cas. 1174."

Empire Water & P. Co. vs. Cascade Town Co., 205 Fed., 123, 127.

The opinions by the United States District Court and the Circuit Court of Appeals are, to all purposes, affirmed by this court:

> "The right to the use of water is not confined to riparian proprietors. Gutierres vs. Albuquerque Land Irr. Co., 188 U. S., 545, 556; Coffin vs. Left Hand Ditch Co., 6 Colorado, 443, 449, 450; Willey vs. Decker, 73 Pac. Rep., 210, 220. Such limitation would substitute accident for a rule based upon economic conditions and an effort, adequate or not, to get the greatest use from all available land."

Boquillas Co. vs. Curtis, 213 U. S., 339, 347.

It thus appears that the erroneous construction of the Colorado law by Judge Hallett, in Hoge vs. Eaton, has been overruled by his successor, by the United States Circuit Court of Appeals and by this court.

Accident has placed the divides between watersheds or the "mighty barriers" on the face of the earth. The limitation of the use of water in Colorado to the drainage area of the stream, in order that such water might be returned to the stream for use of other riparian owners, would be such a limitation as "would substitute accident for a rule based upon economic conditions, and an effort, adequate or not, to get the greatest use from all available land."

The imperative necessities of Colorado forbid the application of this riparian rule and

> "It would be as illogical to impose the English doctrine of flowing waters upon Colorado as it would be to say judicially that their climate and soil and the imperative needs of their people are the same."

The carrying of water across divides for reclamation of arid lands is, in all essentials, the same, and prompted by the same rule of imperative necessity, as the construction of isthmian canals between great oceans in aid of navigation. Either is in direct opposition to nature and in either case the natural barrier is wholly disregarded in order that the greatest good may come to the greatest number of mankind. The necessities of agriculture in the arid regions are as imperative as those of commerce upon the seas, and it would be just as reasonable and logical to forbid the construction of

isthmian canals in aid of commerce as it would be to deny the right of inter-watershed diversions in aid of reclamation of arid lands. To argue that a sanctity attaches to an isthmus separating two oceans, would be as unreasonable as the argument advanced on page 116 of the brief of counsel for complainant that "each watershed has a natural unity and sanctity of its own" and that "there can be no equitable division of waters between lands or inhabitants within one watershed and those located in other watersheds, which does not recognize the laws of nature and the natural preference which is inherent in the lands and the people of the valley." We fail to find any reputable authority for such argument in any of the many decisions of the state and federal courts of the arid west or in any decisions of this court, and it is evident that any limitations against inter-watershed diversions have been imposed in regions where the common law doctrine of equal (not exclusive) use of the waters of the streams runs alike to all riparian proprietors.

To argue that a "sanctity" attaches to divides between watersheds or to what Judge Hallett terms "the mighty barriers which the Creator has placed on the face of the earth," is as ill-founded as were the early arguments against the construction of the Isthmian canal wherein it was urged that because the Creator had placed the Isthmus of Panama between the Atlantic and Pacific oceans, no man should part it asunder. The United States has constructed the Panama Canal to the benefit of all mankind, and yet it is historically reported as follows:

Philippe Bunau-Varilla, Minister Plenipotentiary of the Republic of Panama, in his work "The Creation, Destruction and Resurrection of Panama," page 19, says:

> "It was not the destiny of Cortez to make that discovery, or that of any other navigator who dreamed of finding the *Secret of the Straits.*
>
> The idea of connecting Nature was mooted, but Phillip the Second forbade any modification of what God had created. The junction of oceans remained in the realm of dreams."

A. Barton Hepburn, in the work entitled "Artificial Waterways of the World," on page 26 states:

> "In the reign of Charles II, the Council of Castile opposed canal plans, as an interference with the wisdom of Divine Providence, which had fixed the waterways."

On page 109 the author states:

"The advantage of such a canal was clearly perceived as early as 1520, when Charles V of Spain is reported to have given it consideration. In 1534 a survey was ordered, but unfavorable reports of the Spanish governor at Panama and probably also his suggestion that such a work would be in 'opposition to the will of the Almighty, who had placed this barrier in the way of navigation between the two oceans,' caused the project to be abandoned; * * * "

The author makes the following note in regard to this statement:

"The medieval religious fervor that dominated the action of Spain in all things, seems ludicrous in the light of present day advancement."

Frederic J. Haskin, in his work entitled "The Panama Canal," on pages 194, 195, says:

"The idea of the canal through the American Isthmus was in the mind of Charles V of Spain as early as 1520. In that year he ordered surveys to ascertain the practicability of a canal connecting the Atlantic and Pacific. His son, Phillip II, did not agree with him about the desirability of a trans-Isthmian waterway, holding that a ship-way through the Isthmus would give to other nations easy access to his new possessions, and in time of war might be of greater advantage to his enemies than to himself. He invoked the Bible to put an end to these propositions to dig a canal across the American Isthmus, calling to mind that the Good Book declared that 'What God hath joined together, let no man put asunder.'"

(*d*) *Plaintiff's Brief.*

Little discussion of this topic, as treated by plaintiff's counsel on pages 112-21 of their brief, is necessary owing to the fact that their whole discussion is predicated upon the erroneous assumption that the common-law doctrine of riparian rights prevails in Wyoming and Colorado, notwithstanding, as we have previously observed, that in Wyoming, as well as in Colorado, the doctrine of appropriation has been adopted for intra-state regulation, and the common law doctrine of riparian rights abrogated by the constitution, statutes and decisions of the courts of each of said states.

We have previously observed that under the riparian doctrine of common-law rights, inter-watershed diversions are, in some cases, prohibited wherever waters so diverted could

not be returned to the stream for the use of other riparian owners, and that the reason for the rule lies in the riparian doctrine that each and all of the riparian land owners have an equal, rather than exclusive, right to the use of the waters of the streams as they flow.

We have also observed that the contrary rule obtains under the doctrine of appropriation where the first appropriator has an exclusive (not equal) right to the beneficial use of the waters of the stream to the extent of his necessities to the exclusion of all junior appropriators and others claiming any waters of the stream, and that his exclusive use may be made upon non-riparian lands including those outside the natural watershed of the stream and that this right to the exclusive use of the water of the streams in order of priority obtains in Wyoming as well as in Colorado.

Counsel open their argument upon this topic with the following statement:

> "We feel bound to concede that the common law doctrine of riparian rights is substantially a world doctrine which has persisted through historical times."

and, after stating that they have been able to find but one case under the *riparian* doctrine wherein such inter-watershed diversion was permitted, state:

> "On the other hand, it seems to be fairly well established that such conduct is not consistent with the rights of *riparian* proprietors where such rights are recognized, and that lands beyond the watershed are *not riparian* to the stream." (Italics ours.)

Several citations, admittedly from riparian states and authors, upon the common law doctrine, are then made as authority for the statement last quoted. Inasmuch as the appropriation doctrine is in derogation of and opposed to the common law rule of riparian rights, it would seem unnecessary to undertake a detailed analysis of these several citations from courts construing the law of states where the riparian doctrine prevails, for the reason that a different rule obtains under the doctrine of appropriation.

Counsel then admit that the underlying reason of these decisions is the fact that water diverted beyond the watershed does not return, in whole or in part, to the parent stream, but fail to state that there is a duty of return under the common law doctrine purely by reason of the fact that all riparian appropriators have the same and equal rights to the use of the water of the stream, while the contrary is true under the appropriation doctrine. They then state that the obligation to return

surplus water is very generally established in the various states by the statutes and decisions of courts and that Colorado alone seems to have dissented from this rule.

The error of this last statement is revealed in the preceding paragraphs of this brief wherein it is observed that the rule prevails throughout the arid region as well as in Colorado, and an inspection of the two citations (I Wiel on Water Rights 282; Hutchinson vs. Watson Ditch Co., 16 Idaho, 484), offered as authority for the statement of the general establishment of the rule in the arid states, reveals the contrary.

The citation from Mr. Wiel, who is recognized as an exponent of the California common law or riparian doctrine, does not bear out the interpretation given it by counsel. The opening paragraph of the section reads:

> "*The necessity for taking the water to distant lands without returning it to the stream* and making the right to water independent of ownership of riparian land aided in giving rise to the rule that the right is independent of ownership of land. *Use on distant land is hence characteristic.* This characteristic use on distant lands involves loss of the efficiency of the water and is a necessary evil of the law of appropriation."

The case of Hutchinson vs. Watson Ditch Co., *supra*, is not in point and does not involve the return of any water back to the stream. In that case parties diverted water from Snake River through an intermediate side-channel or slough which constituted a natural watercourse. They took the water from Snake River into and along this slough to their headgates where they diverted it for use upon their lands. It became their custom to shut the water from their ditch by closing the mouth of the slough at Snake River rather than by closing their headgate from the slough, and in so doing they prevented the water from passing down the natural slough or watercourse by the lands of the plaintiff, as they would have flowed if the defendants had shut the water out at the headgate of their ditch instead of at the mouth of the watercourse. No question of return to the stream of waters once diverted for irrigation was involved, but purely the question as to whether or not they had a right to obstruct a natural watercourse when not using or diverting any water for irrigation. The court says:

> "When they were not needing it or using it for carrying out or fulfilling the purposes of their appropriation, they were not content to allow it to flow in the natural channel of the stream where any and all might freely use it or acquire a right by appropriation and diversion, but they entirely cut off the source of supply and di-

verted it into another stream so that it could not flow in its natural stream. * * * This case must be considered independently of the question of appropriation and diversion. * * * As we have before seen, the common-law doctrine of riparian proprietorship, *whenever it comes in conflict with a water right acquired by appropriation*, is thus in conflict with and repugnant to the constitution and statutes of this state."

The court then decides that when the appropriators are making no diversion at all, they have no right to obstruct the stream and uses the following language:

"While appellants have acquired by location and appropriation the right to carry and convey waters through this slough and natural stream and waterway to the full capacity of the stream for irrigation purposes, and for those purposes may control the stream in so far as it is necessary to keep the same open and in repair, * * * still they have no right to entirely divert the water from the stream and turn it to waste down another stream or into another channel at such times as they are not using the water or exercising their rights under their appropriation * * * when they can not or will not use it they must allow it to flow in its natural channel, undisturbed, for the use of any other persons who may have a subsequent or inferior right to appellants or who may desire to acquire such right by appropriation or use."

See also,

Schodde vs. Twin Falls Water Co., 224 U. S., 107. 125.

Counsel next make the statement that in Colorado "it is not permitted to change the use under an appropriation once established, so that the surplus water will not return to the stream" and cite as authority therefor the decision of Fort Collins M. & E. Co. vs. Larimer and Weld Irr. Co. (Colo.), 156 Pac., 140, 143. A reading of the opinion in that case will reveal that the statement of counsel speaks but half the truth. In that case an attempt was being made to transfer the point of diversion from an old ditch with a large appropriation but theretofore used for a small acreage of land and from which the major portion of the water diverted had returned to the stream and constituted a source of supply of the stream at the time the rights of a junior appropriator attached. It was asserted

that making a change at the point of diversion and conveying the amount of water specified in the decree to distant lands, where it would all be consumed, would constitute an enlarged diversion and a depletion of the supply of the river to the extent of the enlarged use to the detriment of a junior appropriator. No question of inter-watershed diversion or return of the water after use to the original source of supply, like the one here in controversy, was there involved. It was purely a contention between a junior and senior appropriator involving the question of the right of the senior appropriator to cut off, by enlarged use, waters which had become tributary and a source of supply of the stream before the rights of the junior attached.

Counsel then cites the case of Montrose Canal Co. vs. Loutsenhizer Ditch Co., 23 Colo., 233, as authority for the statement that Colorado

> "pays tribute to the natural integrity of the watershed by certain constitutional provisions referring to certain natural use of riparian owners to the right to deplete the stream by appropriation."

It again happens that the citation is not in point. Counsel evidently confuses certain provisions of the Wyoming constitution with Section 6 of Article XVI of the Colorado constitution. In the latter, provision is made for three general classes of use which the Colorado court in a later case has construed as merely giving a right of condemnation to the higher as against the lower use (Town of Sterling vs. Pawnee D. & E. Co., 42 Colo., 421, 426), in which case the Montrose Canal Co. vs. Loutsenhizer is discussed. The natural integrity of a watershed is in no manner involved in either case, and neither can be cited as in any way modifying the rule of appropriation as it obtains in arid states.

Principal reliance seems to be placed in Mr. Wiel's work on Irrigation and Water Rights and upon a number of California decisions. We have already noted that Mr. Wiel is regarded primarily as an exponent of the riparian doctrine as construed in California where appropriation is only permitted when not in conflict with riparian rights. (See Kinney on Irrigation, 2nd Ed., Vol. 1, p. 1034-6.) The doctrine of appropriation there obtained as elsewhere until the decision of Lux vs. Hagan, 69 Calif., 255, since which time preference has been given riparian rights until quite recently, when the court, in the case of Katz vs. Walkinshaw, 141 Calif., 116, has again modified the rules theretofore announced and adheres to the rule that the necessities of the country, rather than the ancient rules of common law, must govern.

Kinney on Irrigation, (2nd Ed.) Vol. 1, p. 1023-5. See also chapter "Arid Region Doctrines of Appropriation," chapter 31, pages 1005-36.

It is here interesting to note that in construing the following statute:

> "The water appropriated may be turned into the channel of another stream and mingled with its waters and then reclaimed; but in reclaiming it, the water already appropriated by another must not be diminished."

Sec. 1413, Calif. Civil Code of 1872.
Deering's Ann. Code & Stat. of Calif. (1886), Vol. 2, p. 267, Sec. 1413.
Pomeroy's Codes of Calif. (1901), Sec. 1413, p. 405.

The Supreme Court of California referred to two cases involving inter-watershed diversions wherein they treated such diversions and the mingling of the foreign waters as entirely proper.

Eddy vs. Simpson, 3 Calif., 249.
Hoffman vs. Stone, 7 Calif., 426.
See also Butte Canal & Ditch Co. vs. Vaughn, 11 Calif., 143.

The first two of these cases are properly read together. In the latter case, Chief Justice Murray, after stating decisions involving the right to appropriate waters had been based upon the wants of the community and the peculiar conditions in the state, says:

> "The fact early manifested itself, that mines could not be successfully worked without proprietorship in waters and it was recognized and maintained. To protect those who, by their energy, industry and capital, had constructed canals and races, *carrying water for miles into parts of the country which must otherwise have remained unfruitful and undeveloped*, it was held that the first appropriator acquired special property in the waters thus appropriated."

The above California statute, with its early construction by the Supreme Court of California, was later adopted by Idaho (Revised Code of Idaho, Sec. 3244). It will be noted that the decisions of the California court are prior to the case of Lux vs. Hagan.

Decisions are also cited from New York, North Dakota,

South Dakota, Nebraska, Kansas and Texas, in all of which the courts have declared the common-law doctrine of riparian rights applies, somewhat modified in connection with the use of water for irrigation.

Long on Irrigation (2nd Ed.), Sec. 10, p. 20.

The decisions of these courts are therefore not in accord with the appropriation doctrine of the arid states as adopted by both Wyoming and Colorado. The same observation will obtain with relation to the case of Sturr vs. Beck, 133 U. S., 541, applying the common-law doctrine as adopted in Dakota, and Winters vs. U. S., 207 U. S., 564, involving water rights upon Indian Reservations, the title to which had not yet passed to Montana, one of the states adhering to the riparian doctrine as applied in California.

The erroneous construction by counsel of the laws of Mexico is evidenced by:

U. S. vs. Rio Grande Irr. Co., 174 U. S., 690.
Gutierres vs. Albuquerque Land Co., 188 U. S., 545.
Boquillas vs. Curtis, 213 U. S., 339.

See also—

Kinney on Irrigation (2nd Ed.), Vol. 1, Secs. 576-84, pages 987-1003, for complete discussion of Mexican laws.

Counsel unfortunately confuse the common law rule with the opposite appropriation rule, with relation to the return of waters to the stream (p. 117). At common law it was the duty of the riparian owner "to return all that is not needed for such use" to the stream in order that other riparian owners might obtain a like use of the same water (Long on Irrigation (2nd Ed.), Secs. 65 and 66, pages 117-20), but under the appropriation doctrine no such rule obtains and the appropriator may convey the water "whithersoever necessity may require for beneficial use, without returning it or any of it to the natural stream in any manner."

Oppenlander vs. Left Hand Ditch Co., 18 Colo., 142, 149.

Kinney on Irrigation (2nd Ed.), Vol. 1, Sec. 587, pages 1009-10.

Under the riparian rule, the water could only be diverted for reasonable and non-consuming use, and any use which would consume the stream was prohibited in that no return of the

water could be made for other riparian owners with equal rights. Under the rule of appropriation, the owner of the ditch, as we have heretofore observed, may, if his needs require, consume the entire flow of the stream to the exclusion of all riparian owners and all junior appropriators. The essential difference between diversions under the two doctrines is that in the former the diversion was made with a specific intent and legal prerequisite that the water should be again returned to the stream before it should leave the riparian lands of the owner, while, with the latter doctrine, the appropriator must not divert more than enough water to satisfy his needs and must shut back and leave the remainder of the water in the stream for other appropriators. As said by the Colorado Supreme Court:

> "A right to the use of water is limited in time and volume to the extent of the needs of the party in whose favor such right is established for the purpose named."
>
> White vs. Nuckolls, 49 Colo., 170, 177.

In fact, the whole theory of exclusive right of the appropriator is predicated upon the limitation that he must not divert any more water from the stream than is required by his needs, and that all other waters of the stream must pass to other appropriators who have like rights in their order of priority. This limitation is *read into* the right and the water officer is authorized to shut out from the appropriator's ditch any water in excess of that required for his beneficial use.

The observations of counsel on page 121, to the effect that the riparian laws of Dakota may have some possible bearing upon the rights of Wyoming appropriators, is set aside by the decisions of this court, as well as by reason of the fact that none of the few small appropriations which existed on the Laramie River in Wyoming prior to its admission as a state are in any way here involved, and no possible injury can result thereto by the diversions in Colorado. (See separate portion of brief, "Priority of Appropriation.")

Pollard vs. Hagan, 3 How., 212.
U. S. vs. Rio Grande Irr. Co., 174 U. S., 690.
Gutierres vs. Albuquerque, 188 U. S., 545.
Kansas vs. Colorado, 206 U. S., 43.
Boquillas Cattle Co. vs. Curtis, 213 U. S., 339.
U. S. Freehold Land & Immigration Co. vs. Gallegos. 1 Legal Adviser, 412.
Snyder vs. Colorado Gold Dredging Co., 181 Fed., 62, 65, 69.
Kinney on Irrigation (2nd Ed.), Vol. 1, Sec. 593, pages 1025-9.

The rights here in controversy are not, as at common law, merely an incident to and a part and parcel of lands which, by accident of nature, happen to be fortunate enough to border on the stream. The distinct, exclusive, usufructuary estate acquired by an appropriator is *property of the highest order* which is protected by law as such and subject to all the incidents of property. The property in such a water right consists not alone in the amount of water claimed, but also in the priority which often is its chief value. It has none of the characteristics of personal property. It is real property. It is an inheritable estate and passes to the heirs or devisees. It is conveyed with the same formalities as any other real estate. It is a property right independent in itself, based upon application of the water to beneficial use, and is not subordinate to any land, but exists independent of the ownership of land or of the channel of the water-course.

Kinney on Irrigation (2nd Ed.), Vol. 2, Chap. 41, pp. 1311-43.

And for counsel to now contend that Wyoming may enforce upon Colorado, contrary to her will, the riparian doctrine of return of water to the original stream, is for them to deny the constitution, laws and decisions of their own state, Wyoming, and to declare that the doctrine of appropriation does not there prevail.

The constitution, statutes and decisions of the courts and the quasi-judicial tribunals of Wyoming are in direct conflict with and are sufficient reply to the argument of counsel. If the common law rule of riparian rights obtains in Wyoming, irreparable injury will occur to the best agricultural regions of that section, as well as in Colorado.

(e) *Conclusion.*

We believe sufficient authority appears to justify the following conclusions: That the common law doctrine of riparian rights has been entirely abrogated in the arid region of the United States and that the doctrine of appropriation has been adopted by each of the states therein for intra-state regulation and control of the waters of the streams flowing within the borders of each of said states; that under the doctrine of appropriation, the first appropriator within each such state, obtains an exclusive right to the waters of the stream to the extent required for beneficial use and even to the entire flow thereof if his necessities so require, without regard to the rights of junior appropriators or of persons owning lands riparian to the stream; that in adopting the rule of appropriation, each

of the states abrogated the common law rules of equal rights of all riparian land owners including all right to return of diverted water to supply such equal rights of other riparian owners and that under the doctrine of appropriation diversion may be made whithersoever necessity may require for the irrigation of lands wherever situate, whether within or without the drainage area of the stream, and that this doctrine applies within each of the states of Wyoming and Colorado.

PART II.

PRIORITY OF APPROPRIATION.

DISCUSSION OF THIS GENERAL SUBJECT WILL BE SUBDIVIDED AS FOLLOWS:

I. OPENING STATEMENT

(1) METHODS OF INITIATING APPROPRIATIONS:
In Colorado
In Wyoming

II. PRIORITY A QUESTION OF FACT

III. COLORADO APPROPRIATIONS

(1) MEADOW DITCHES

(2) SKYLINE DIVERSION

(3) SAND CREEK DIVERSION

(4) GREELEY-POUDRE APPROPRIATION
(a) *The Region*
(b) *Progress, August 25, 1902, to April, 1908*
1902-4 inclusive
1905-6 "
1907—April, 1908
(c) *April, 1908—Sept. 8, 1909*
Sept. 8, 1909-1913, inclusive

(5) ERRORS IN PLAINTIFF'S BRIEF
(a) *Erroneous Priority Assumption*
(b) *Erroneous Assumption in re Upper Rawah Ditch*

IV. WYOMING APPROPRIATIONS

(1) THE REGION

(2) ADVANCE FINDINGS AND DETERMINATION OF QUESTION OF PRIORITY AND WATER SUPPLY IN WYOMING

(3) PRIORITY GROUPS AND NATURAL CLASSIFICATIONS
(a) *Meadow Ditches*
(b) *Laramie Plains Appropriations*
(b-1) Appropriations prior to Aug. 25, 1902
(x) River Bottom Canal
(y) Early Benchland Canals

(b-2) Appropriations subsequent to Aug. 25, 1902
(m) Sodergreen Highline
(n) Lake James System
(o) Laramie Water Company or Lake Hattie System
(p) N. W. Land and Iron Company

(c) *Appropriations East of Laramie Mountains*
(c-1) Wheatland
(x) Original Project
(y) New Projects
(y-1) Bordeaux Tract
(y-2) Sybille Tract

(d) *Recapitulation of all Wyoming new Appropriations since 1902*

(4) PLAINTIFF'S ERRONEOUS ASSUMPTION
(a) *Plaintiff's Exhibit G*
(b) *The Mythical Pioneer Highline*
(b-1) No such canal ever constructed and no connection between recent permitted surveys and other reconnaissances

(b-2 and 3) No claims of appropriation for any such canal ever filed with State Engineer of Wyoming or made before Board of Control or District Court at adjudication of priorities on Laramie River

(b-4) Permit No. 2719 Enl. filed July 11, 1912, limits claims and bare assertions of any prior claims

(b-5) Conclusion

(c) *Other Errors*

V. GENERAL CONCLUSION

VI. WYOMING'S DISREGARD OF COLORADO PRIORITIES

I. OPENING STATEMENT.

While either Colorado or Wyoming may at any time otherwise legislate, for the present they have both adopted what is known as the "Colorado doctrine" (as distinguished from the "California doctrine") of appropriation for intra-state regulation of diversions and use of water from the streams within their respective boundaries. While this doctrine at present applies to distribution of water *within* the borders of each state, we contend that it does not apply to the use and distribution of water between the states for the following reasons:

The sovereignty of each state is in all respects equal with that of the other and with any of the original thirteen states of the United States;

Each state has full jurisdiction over the lands within its borders, including the beds of streams and other waters;

Either state may change its doctrine in any manner, to any degree and as frequently as it may desire. Either may adopt the riparian doctrine tomorrow, a mixed doctrine, such as prevails in California, on the day following, and again another and a still different doctrine, without the slightest regard to the neighboring commonwealth;

Neither state has a right to impose her present or any future adopted doctrine upon her neighboring state;

The fact that the two states happen at the present time to recognize the same doctrine does not amount to extra-territorial recognition by the other state;

Distribution of water by priority of appropriation upon interstate streams, regardless of state boundaries, would involve the interference with property of citizens of one state by officials of another state and contravention of the sovereign rights of both, and would do violence to the rule of equality of states.

The doctrine is impossible of administration. While the officers of each state have full authority and control of the distribution of water according to decreed rights within the state, the restriction of use to necessities of the user, the prevention of waste, the substitution or exchange of water between appropriators or between reservoirs and ditches or vice versa and the execution of the many duties essential to obtain the maximum beneficial use of the limited available quantity of water, nevertheless this authority and jurisdiction ceases at the state line. Colorado has no jurisdiction in Wyoming and Wyoming none in Colorado. Neither state can impose its will upon the other. Who then is to adminster the distribution of the waters between the states? No state or federal official has such power. Furthermore, the performance of such duties would of necessity supersede the authorities of each commonwealth and in turn each state would lose entire control over the distribution of all interstate

and tributary waters within its borders and in case of states situated as either Colorado or Wyoming, with waters almost wholly interstate, entire control would be lost over all the streams. The laws of either state would cease to operate. Her statutes would become mere mockery. Another doctrine than that of her choosing would be forced upon her without right of change or amendment and her rights as a sovereign would become mere fiction.

The doctrine is impossible of administration for a further reason, that in no two localities or states along an interstate stream are the conditions the same, and an interstate stream passing through several states under several jurisdictions and under varied conditions must needs be regulated by different rules along its course.

The Colorado River rising in Colorado and Utah, flows more or less through six different states from its various sources to the sea. Through portions of the United States separated by mountain chains and natural obstacles, it traverses in excess of one thousand miles by meander. What human mind is capable of properly distributing its water according to priority among the appropriators of the six different states and at the same time limiting each right to its purely beneficial use without waste, making exchange between appropriators and generally conducting the administration of the distribution of this water throughout the great areas and over the great mountain chains covered by this interstate stream?

The application of the doctrine would subject the states and their development to chance or accident and make the fate of each commonwealth a lottery irrevocable. To illustrate: the gold excitement happened to cause the regions nearest the Rocky Mountains to first develop the use of water for irrigation. The Great Plains, sloping easterly from these mountains and constituting a considerable portion of both Wyoming and Colorado, are extremely arid and require irrigation to sustain life and agriculture. By chance alone this earlier irrigation occurred in the regions adjacent to the mining districts. It needs but a glance to determine what would have been the fate of either Wyoming or Colorado, under application of the doctrine, had no minerals been early discovered in the Rocky Mountains and had the agricultural development, following lines of natural opportunity, advanced gradually westward from the humid to the semi-arid, from the semi-arid to the arid regions, absorbing and appropriating the water from the stream with the trend of progress. In such event, either of the litigant states would have been forever deprived of even the smallest use of her streams, and would have been doomed to eternal aridity where now thriving communities support local, state and national governments.

To use another illustration: the lands in one state are withheld from settlement by forest reserve, Indian reservation, or some other cause, and remain undeveloped for a long period, during which the waters of the streams arising within that state, necessary to reclaim these lands, are all appropriated in a neighboring state where development has progressed during the time the lands in the other state were withheld. When the obstacles are removed, the state of origin of the water would find herself forever barred from the use of the water of her streams in the development of her lands which must forever lie arid while she perpetually gives to the foreign state, without return, the water necessary for the development of her own area. While, as between citizens dwelling *within* these states, necessity has compelled the adoption of the doctrine of right by priority of appropriation, on the other hand, necessity likewise forbids the leaving of future development of states to chance of first appropriation, and to so permit a foreign state to forever prevent any development within the state of origin of the very water upon which the lower state fattens, would be contrary to the law of nations, and were it not for the Constitution, would be sufficient cause for the upper state to sustain her own existence and the right to use at least an equitable portion of the waters within her borders by force of arms, arbitration or other adjustment with her neighbor.

Each state is entitled to administer her water as she may elect, regardless of any other state, or, at least, is entitled to the use and benefit of an equitable portion of the waters of her interstate streams. Any other doctrines do violence to the inherent right of the commonwealth to develop her own territory, use her own natural resources, and sustain and protect her people on a basis of equality with every other state of the Union. What is an equitable portion of the water of an interstate stream must ever depend upon the facts and circumstances of each case and cannot perforce be determined by the lottery of first settlement and appropriation.

Notwithstanding what we have said, priority is an issue joined in this case, and to meet that issue considerable evidence was introduced, not so much by the plaintiff to sustain the issue, in which we believe it signally failed, as by the defendants to forever conclude any possible contention. While we contend that the doctrine of priority of appropriation has no place in this action between sovereign states, nevertheless, out of ample caution and with a desire that the case may be fully and fairly presented, we shall discuss at length the various diversions from the Laramie River in both states.

(1) Methods of Initiating Appropriation.

While right by priority of appropriation at present prevails in both Colorado and Wyoming, the methods by which these appropriations are initiated, perfected and finally approved, are essentially different in the two jurisdictions. (3348-52.)

In Colorado: The water right is initiated by the first act which leads ultimately to beneficial use. This may begin with survey or actual construction. The appropriator may make a filing with the State Engineer (formerly with the county clerk and recorder) for the purpose of giving notice of the intended appropriation and preserving a record of his enterprise, or he may omit to make the filing and prove his priority by other methods. The appropriation is fixed, both in date of priority and amount, entirely by the district courts under procedure prescribed by statute, and all decrees limit the right of diversion to beneficial use and prohibit waste and excessive diversion. Priorities of appropriation are determined in Colorado exclusively by the courts and not by quasi-judicial officers. No permit to divert water is necessary, each appropriator having the right to go upon the stream and construct his diversion system in manner and extent as he may desire and without previous sanction or adjudication by any official.

In Wyoming: An appropriation is initiated by the filing of an application for a permit. This is a prerequisite before commencing construction, enlargement or extension of any ditch or diversion system or performing any work in connection therewith. The State Engineer endorses on the application the date of its receipt and notes the same in the records of his office. If, in due form, he then determines (1) whether or not the proposed diversion and beneficial use will impair *existing rights,* and (2) whether there is *unappropriated water* in the stream to supply the proposed enterprise. If, upon his quasi-judicial determination, it is found that there is no unappropriated water, or where the proposed use conflicts with existing rights or threatens to prove detrimental to public interest, he has power to reject the application and the appropriator is forbidden to proceed with the construction of the enterprise.

If, however, the State Engineer officially determines that there is *unappropriated water* in the stream from which the proposed diversion is to be made, he grants a permit for the construction of the enterprise upon such conditions and limitations as he may impose, whereupon the appropriator may proceed to construction in conformity with the application and the limitations imposed by the State Engineer and not otherwise. The application is accompanied by maps and plats showing accurately the extent and location of the proposed work

and the rights of the appropriator are defined by the application and the permit.

The priority of each Wyoming appropriation dates from the filing of the application in the engineer's office.

The permit authorizes the diversion of water whereby the appropriator makes his beneficial use. His rights are finally adjudicated and decreed by the Board of Control, consisting of the State Engineer and the various superintendents of the water divisions of the State. The findings and determinations of this Board of Control in Wyoming are similar in legal effect to the decrees of the district courts in Colorado. An appeal lies from the decree of the Board of Control to the District and Supreme Courts.

The limitations imposed in the permit and in the final decree define the priority and extent of the appropriation. There can be no greater appropriation in Wyoming than those fixed by each permit and decree.

The State Engineer of Colorado has no judicial or quasi-judicial powers such as are vested in the State Engineer of Wyoming. In Colorado the appropriator constructs his ditch and makes his appropriation without previous permission. In Wyoming he must have the permit from the state. In Colorado the appropriation dates with the beginning of work or survey and is completed by application of the water to beneficial use, and the District Court simply confirms and quiets by decree the rights of the appropriator as the facts may warrant. In Wyoming, beneficial use is a prerequisite to the final decree by the Board of Control and the right relates back to the date of the filing of the application for permit and the appropriation is, in effect, granted its priority in advance.

In Colorado the appropriator determines for himself the question of available water supply. In Wyoming this fact is determined in advance by the State Engineer.

II. PRIORITY QUESTION OF FACT.

Priority of appropriation is, of necessity, a question of fact settled within each state by courts or tribunals having jurisdiction so to do: (1) In Colorado by the district courts and (2) in Wyoming by the state engineer in filing and passing upon the application for permit and subsequently by the Board of Control in granting final certificate or decree.

The statutes of each state control relation of the priority to some initial date, in Colorado to the date of the beginning of the first work (survey or construction), and in Wyoming to the filing of the application for permit with the state engineer.

The priority of the enterprise on completion and applica-

tion of water to beneficial use, reasonable diligence having been used, relates back to the initial date. What constitutes reasonable diligence is likewise a question of fact depending upon the circumstances connected with each particular case. (Kinney on Irrigation, Vol. 2, page 1278.) The whole subject of priority being largely a question of fact, it is necessary to review the evidence at considerable length in arriving at the relative rights of the private appropriators taking water from the Laramie River within the two litigant states. Consideration of the subject is tedious and repetition is frequently necessary. We shall omit small diversions or those earlier diversions whose rights, it is evident, are in no wise materially involved, or shall pass them with brief notice. The material diversions will be considered by states.

We shall consider (III) diversions and use of water from the Big Laramie River in Colorado, the state of origin of that branch of the general stream, and (IV) diversions from the Laramie River as it flows through Wyoming.

III. COLORADO APPROPRIATIONS.

In considering diversions and use by Colorado and her citizens (all within her territory), we will speak of (1) diversions and use on the limited area along the narrow valley of the Big Laramie as it rises and flows through Colorado, (2 and 3) inter-watershed diversions made long prior to the Greeley-Poudre enterprise for irrigation of lands now in a high state of cultivation in Colorado, and (4) the Greeley-Poudre enterprise.

(1) Meadow Ditches.

There are numerous small appropriations along the narrow valley of the Big Laramie River in Colorado. These are used exclusively for the irrigation of narrow strips of meadow, aggregating but 4,250 acres (3458), and from which the water returns rapidly to the stream. The same is true on the upper reaches of the Little Laramie in Wyoming, and throughout this case these diversions at the head-waters of these two branches of the stream have been treated by all the experts as off-setting one another and as unworthy of serious consideration in this case (1271, 1274, 3458, 3460-1, 3463-5). These minor appropriations will be omitted.

(2) Sky Line Diversion.

In 1891 the Sky Line Canal of the Water Supply & Storage Company was initiated, diverting water from the head waters

of the Big Laramie in Colorado across the Green Mountains and over into the Cache la Poudre River for use in the irrigation of lands immediately adjacent to and in all respects similar to the lands of the Greeley-Poudre Irrigation District hereinafter mentioned.

(3) Sand Creek Diversion.

Subsequently, but long prior to any project here in controversy, the Divide Canal and Wilson Supply Ditch, working in combination as one system, were constructed for the diversion of water from the upper reaches of Deadman Creek over into Sand Creek, both rising and flowing in Colorado, and thereafter for re-diversion from Sand Creek into Sheep Creek, a tributary of the Cache la Poudre River, for use upon lands immediately adjacent to those served by water diverted from the Laramie River by the Sky Line Canal of The Water Supply & Storage Company.

(4) Greeley-Poudre Appropriation.

August 25, 1902, the Laramie River portion of the enterprise of the Greeley-Poudre Irrigation District was initiated. It consists of a tunnel through the Green Mountains from the Big Laramie to the Cache la Poudre (herein described as the "Greeley-Poudre" tunnel) and a system of diversion and collection ditches and reservoirs on the Laramie River for storing and conveying water to the tunnel (1935, 2039, 3933, Exhibit 179—Decree District Court Larimer County). There is one diversion and collection ditch on the east side of the Laramie valley known as the "East Side Collection Ditch," and two such canals on the west side of the valley, one high up at timberline, known as the "Upper Rawah" or "Rawah" Ditch, and the other lower down in the valley and known as the "Lower Rawah" or "West Side Collection" Ditch.

Actual survey of the enterprise did not begin until August 25, 1902, although there had been previous preliminary reconnaissance (1933-5, 2039). Priority as of this date is asserted and has been awarded the project by the District Court of Larimer County, Colorado, in its decree entered in adjudication proceedings for the water district including that portion of the Laramie River in Colorado (Ex. 179, 3933).

In discussing the system, we will subdivide the subject as follows:

(a) The region in which the construction has proceeded and the natural and other obstacles necessarily encountered;

(b) The initial acts upon which the priorities of the enterprise were established and the subsequent progress down

to March and April, 1908, when the large, new and junior projects in Wyoming were initiated (in whose behalf this suit is brought); and,

(c) Progress subsequent to April, 1908.

(a) The Region.

The Laramie River portion of the enterprise is situate in a remote, inaccessible, heavily timbered mountain region, nearly at timberline, amid perpetual snow, where winter prevails the greater portion of the year (1894), and work is limited to a very short period during each summer season (792-6). Remoteness from railroad centers necessitates wagon freighting of labor, supplies and machinery from 70 to 100 miles through the mountains. Progress is slow and very expensive under such conditions and years are required to construct the same character of works that could be completed in months upon the plains. Construction is largely in solid rock and its cost is several times that of similar work in plains regions (792-6, 1404-5, 1619-20, 1754-6, 1777-9, 1895-8, 1912, 1920-3, 2076-8, 2239-40).

One of the Wyoming engineers describing similar work, more favorably situate, at the head waters of the Little Laramie River, says:

> "The period for favorable construction work at that altitude is between June 1 and November 1. Prior to June 1 there is too much snow and the ground is waterlogged and a spring is under every rock, and in September the winter snows begin. * * * Work then ceases. * * * We had innumerable difficulties in connection with that work. In addition to the climatic conditions that have to be contended with, the country is hard of access at any time of the year. Practically no roads can be traveled with an ordinary load and team of horses. * * * Comparing this work with a similar construction and excavation of material in an open country if the same kind of construction that is on Douglas Creek was done within five miles of the City of Laramie, it would require about one-fourth the time." (792-3.)

This is the statement of the engineer for the Laramie Water Company, in charge of construction of the Douglas Creek interwatershed diversion in Wyoming where the waters of that stream are to be conveyed across the divide and into the head waters of the Little Laramie as a part of the Lake Hattie system, which we will hereafter consider. A reference to his testimony will show that this work is only six miles, while the Gree-

ley-Poudre is more than seventy miles, from the nearest railroad point.

The Colorado witnesses, in the references given, state, in part, as follows:

Professor Carpenter says:

> "The most difficult and expensive development undertaken is probably in the class of trans-mountain diversions. Here it is necessary to build canals in regions remote from labor, materials and markets, through comparatively unoccupied territory and over lines where a large part of the work is through rock and along steep hillsides, where seasons suitable for construction of canals are short and labor hard to obtain, where the most substantial construction is necessary and where the utmost care must be exercised in the selection of the route and the performance of the work. The ice and snow conditions of winter must be provided for and guarded against and tunnels of greater or less extent are generally necessary.
>
> The Greeley-Poudre District has about 20 miles of collecting ditches along steep hillsides, largely in rock, and the construction of the Greeley-Poudre tunnel 2½ miles in length, required the transportation of labor and materials by men and teams for a distance of about 78 miles from Laramie, Tie Siding or Fort Collins. It was an engineering feat worthy of the attention of the best engineering talent and required the expenditure of a large amount of money and time.
>
> While the time consumed in the actual construction of the tunnel was not great, its location and necessary preliminary examination of almost the entire mountain region to determine the probable water supply and the raising of capital, necessarily consumed a number of years." (1404-5.)

John R. Wortham, engineer, says:

> "Surveying and construction in that region is limited to a short period during the summer season. The season is very short * * * and it is impossible to haul supplies in there during any but the summer months. * * * After that the snows come in very heavy and it is impossible to get supplies in there in order to carry on construction work. * * * Supplies have to be hauled from the railroad points on wagons * * * about 80 miles from Fort Collins or Laramie, Wyoming." (1619.)

Charles R. Hedke, formerly construction engineer for the enterprise, said:

"* * * Laramie River system is in a region inaccessible; supplies, etc., must be hauled by wagon. Material encountered is of character much harder to work than upon plains and cost is many times more, and from the nature of things surrounding that class of construction, it is impossible to do that work in anywhere near the same time that similar work is done down on the plains.

Shortness of working season in mountains creates an obstacle in the way of speedy construction. The character and class of workmen required usually employed on such work must be found and there is much loss of time in beginning of each season's work on such construction. Working season closes early in fall. That necessitates entire abandonment of forces when work is shut down and reorganization in the spring.

* * * *To compare a mile of mountain ditch with a mile of similar canal in the plains district by difference in cost, a ditch of the same capacity on the plains as our mountain ditches would cost in the neighborhood of $1,000 per mile. Up in the mountains it would cost $30,000 per mile and a mile of plains ditch can be built in a matter of several weeks, while a mile in the mountains may take a year*, requiring nearly all the men you can get on that mile to construct it in one season's work.

Work can be carried on throughout the entire year on the plains. Mountain construction entails a certain knowledge of handling that class of material, requiring powder and drilling, and consequently a class of men that are more experienced and expert. Ordinary labor obtained for driving teams on plains ditch construction is impractical on mountain construction. * * * The Sky Line Ditch was contemplated and under construction for several years and has been under reconstruction almost continually since, covering a period from 1890 to the present time." (1777.)

"Cost of transportation of materials from supply station at base of mountain on the Laramie River to the Upper Rawah Ditch was as great as cost of transportation of material from Fort Collins or Laramie to this supply station. The distance in the first instance is seven miles, while in the latter it is 65 or 70 miles. The principal reason * * * is the grades to overcome, the difference in elevation being about 2,000 feet in three

or four miles and requiring six horses for hauling a ton of material.

We had a fixed wagon freight rate from Fort Collins and Laramie to the supply station on Laramie River. * * * The rate was $1.10 per 100 lbs. to that point with $1.00 per hundred from there on to the construction camp at the Upper Rawah Ditch.

Fort Collins, Colorado, and Laramie, Wyoming, were nearest railroad stations.

Laborers were taken up at the same rate as freight; they were weighed and hauled by weight." (1756-7).

The comparison between the Greeley-Poudre work and the mountain work on the headwaters of the Little Laramie on the inter-mountain water diversion of The Laramie Water Company in Wyoming, the difficulties encountered in the construction of which are described by Engineer Bishop, from whom we just quoted, is easily ascertained by comparison of the wagon freight rates. On the Greeley-Poudre system the rate was from $1.15 to $2.15 per cwt. from railroad to works, on the Wyoming canal it was only 25 cents per cwt. from railroad to works. (792.)

Zac T. Duvall, a veteran construction engineer who made complete surveys of the tunnel, ditches and reservoirs in 1904, says:

"I have had considerable experience with mountain construction over a long period of years. This class of construction requires much more time than it would if located on the plains and is much more expensive. The comparison is quite startling. * * * Cost of construction increases with increase of elevation in this mountain work. The working seasons shorten as the elevation increases. * * * On the Upper Rawah Ditch we could only work from July 1 to October 10 in 1904. Even during that time work was not as convenient or easy of accomplishment as similar work involving similar materials would have been on plains region, because of elevation, expense of getting material in and climatic conditions. * * * It is very difficult to keep men in the fall on work of that kind situate as high as it is. Even during summer months it is not as easy to keep them as it is on other work.

Organization of a working force on mountain work, followed by necessary abandonment and necessary reorganization the next season interposes an obstacle to rapid construction. It is almost impossible to retain men in

the late months. * * * Early winters in these high regions usually bring about a spirit of discontent." (1895-7).

Wallis A. Link, one of the originators of the Greeley-Poudre enterprise and long a resident of the vicinity of the Laramie River portion of that system, says:

"On account of elevation of country, snowfall is very heavy. It comes early in the fall and goes off late in the spring. You cannot work profitably * * * before July 1. * * * The time you would have to cease construction in the fall is very uncertain. Have seen it cease in September, and in September of 1890 or 1891, snow was so deep four horses could not haul empty wagon." (1920-1.)

"From 90 to 120 days is the limit of the working season, depending upon the snow fall in the fall of the year and the lateness of the spring. It is possible to work throughout the entire year on the plains." (2077.)

In this region the Laramie River portion of the Greeley-Poudre enterprise is in process of completion. The comparisons drawn between the obstacles and required time of construction under such conditions and in plains districts should be borne in mind when considering the more recent construction upon the Laramie Plains, particularly the Lake Hattie enterprise of The Laramie Water Company and the James Lake project, in whose behalf this suit is prosecuted.

In these plains projects, as we shall observe, none of the obstacles encountered in mountain construction at high altitudes need be overcome and construction proceeds along lines of least natural resistance.

While that part of the Greeley-Poudre system situate within the Cache la Poudre drainage is as essentially a part of the whole enterprise as is the Laramie River portion, and while work within either drainage is, in effect, work upon the whole system, and runs to the benefit of every portion thereof (Hedke, 1748), nevertheless, to enter upon a detailed discussion of the history of the Cache la Poudre portion of the system would unnecessarily encumber the argument and will be avoided except where necessary to answer the brief of plaintiff.

(b) Progress August 25, 1902, to April, 1908.

1902-4 Inclusive.

August 25, 1902, engineer Frank Beach began the *first actual surveys on the project*, as distinguished from previous

reconnaissances. These surveys started upon that unit of the system now known as the Upper Rawah Ditch. The relation of this ditch to the tunnel and entire enterprise will be considered in detail in a separate portion of the brief. These surveys continued until winter snow prevented further work. (1933, 1938-9, 2039.)

During the year 1903, as soon as natural conditions would permit, construction of roads for transportation of men, supplies and machinery to the theretofore inaccessible regions, in which the project was to be constructed, was opened and prosecuted throughout the entire working season and until the party was driven out by deep snow (1942-5, 2042-3). During the winter months of both 1902-3 the efforts of those engaged in construction of the enterprise were continuous in its behalf (1941, 1946-7, 2043-5.)

March 17, 1904, engineer R. Q. Tenney and party from Fort Collins ran the first survey of the Greeley-Poudre tunnel, and a reservoir near the west portal thereof, and made filings of the survey in the office of the State Engineer of Colorado. (1882, 1947-50, 2045-6, Defts.' Ex. 75, map.)

Early in that season a large engineering party went into the field to establish, as nearly as then possible, the final lines of the tunnel and the remainder of the system, and during that summer, after the roads were completed, excavation and open construction upon the ditch lines began with a full force of men, teams and equipment. Engineering and other construction was prosecuted with great activity from the opening of the season to the close thereof in October. (1877-97, 1947-60, 2046-51 and exhibits.)

The engineering work of 1904, after May 22nd, was in charge of Zac T. Duvall, a skilled irrigation engineer of wide experience. He was assisted by engineer R. Q. Tenney of Fort Collins and a full engineering corps. This party was engaged continuously from May 22 to October 10, 1904, and during that time the entire system was definitely surveyed and located. (1882-92).

Mr. Duvall thereafter made a filing map, showing his surveys, which was placed of record in the office of the State Engineer. (1891, Defts' Ex. 51). This filing included final surveys of the line of the Upper Rawah Ditch and Link Lake Reservoirs preliminarily surveyed by Engineer Beach in 1902 and the tunnel line surveyed by Engineer Tenney in March, 1904, as well as the units of the system completely surveyed by Mr. Duvall.

Construction in 1904, other than engineering, commenced with further road building. This continued until along in

July. (1886, 1892.) Of this road construction in 1903 and 1904, Mr. Duvall says:

> "Construction of highways in such regions is a necessary prerequisite to excavation work on ditches. *Road construction in such cases compares with the necessity of road construction in mining enterprises.*" (1886.)
>
> "These two roads were necessary before construction could begin on this system. They were necessary prior to permanent survey work done by me, although connections of the two roads were not made until later. In making my survey I had to use pack animals to complete the upper line. I made use of the roads up to the ditch line. * * * Prior to construction of these roads, supplies could be brought to this line only by pack animals from the Skyline ditch. That is not a practical method of transporting machinery, supplies and men." (1892-3.)
>
> "Prior to July 4, we had also constructed a road from the camp at the head of the Skyline ditch to the lower end of the Upper Rawah ditch. On that road we raised 1,000 feet in elevation in about a mile and a half." (1888.)

The first canal construction on the system took place prior to June 10, 1904. Mr. Duvall says of this:

> "In addition to locating the inlet ditch from the west fork to the west portal of the tunnel, I *constructed* about 500 or 600 feet of *canal* from the creek and turned water in from the west fork of the Laramie River July 10, 1904.
>
> That was the first actual excavation work on any part of the Laramie River system. Water ran through that portion of the inlet ditch which we constructed from the west fork. In constructing this portion of the ditch, I went to the outlet end of the Upper Rawah ditch and commenced permanent construction of that ditch to Rapid Creek, so that the right of way could be cleared for excavation." (1885.)

At this point let it be observed that the tunnel, later constructed and completed for the Greeley-Poudre Irrigation District, and concerning which this controversy has arisen, was upon the line selected and staked during the spring of 1904 by engineers R. Q. Tenney and Zac T. Duvall. This line is indicated on the maps, Defendants' Exhibits 51 and 75. As already noted, the first canal excavation for the entire Laramie River

system was the construction of a portion of the canal to convey water from the Laramie River to the west portal of this tunnel prior to June 10, 1904. (1885, 1898-9.)

Of the work on the Upper Rawah Ditch, being the higher collection ditch of the system, Mr. Duvall says:

> "We were able to get up to the lower end of this Upper Rawah Ditch to start our surveys July 4, 1904. We could not get up there earlier on account of the snow at the head of Fall Creek and Rapid Creek. Snow was deep and we could not do anything." (1886.)

The work prior to July 4, 1904, is described by Mr. Duvall. He says in part:

> "Crews of men had been working on the Laramie River system before I went there in 1904. A road was made from the mouth of the west fork up to the Skyline ditch, our first camp. That road was necessary as all our supplies came in that way. * * *
>
> When I arrived on Laramie River in May, 1904, the road had been constructed up to the Skyline ditch. Between June and July, 1904, I commenced work on the lower collection ditches. I commenced on the east side of the tunnel. * * * Prior to July 4 I had also constructed a road from the camp at the head of Skyline Ditch to the lower end of Upper Rawah Ditch. * * * We also constructed a log house at the head of the Skyline and Camp No. 1."

Mr. Duvall further describes the work during 1904 at considerable length. (1882-1906, 513-19 Abstract.)

He says in part:

> "Was engaged with my engineering party in engineering work on Upper Rawah Ditch during summer of 1904, from July 4 to August. Immediately after engineering, Wallis A. Link proceeded to clear right of way and blow out stumps. He had a force of men and teams. We afterwards let a contract to Walthall & Ianson to commence excavation. * * * They had the contract for excavation of 9,750 feet of work. * * * Earthwork and solid rock. * * * All rocks measuring a cubic yard and all rock in place were rated as solid rock.
>
> Mr. Link continued clearing right-of-way and as he cleared I re-located line and put in slope or cross-section stakes. Mr. Link worked rest of summer clearing right-of-way with a force of men and teams. Snow on October 10 stopped him, although he remained a short time after-

wards. I left October 10. I finished my engineering work on this ditch August 5. Ran the permanent location about seven and a half miles to McIntyre Creek. * * *

Plaintiff's Exhibit P represents line of ditch thus permanently located by me in 1904. In locating Link Lakes I used Mr. Beach's surveys.

I completed engineering work done by me on two lower collection ditches October 1, 1904. Worked on those ditches during August and September.

Plaintiff's Exhibit P represents work done in 1904. I did not assume to represent any other work done by any other engineer prior to that time. The sentence appearing in statement of claim on Plaintiff's Exhibit P: 'And work was commenced on additional ditches and pipe lines going to make up this entire claim August 6, 1904, etc.,' is the date of completion of survey. I commenced the work actually on May 22, 1904. I don't know how that date occurs in the statement. *The dates I have previously given are correct.* I have refreshed my memory by consulting a diary kept during the work.

Estimated capacity of tunnel I located and designed was 1,000 cubic feet per second. I had full engineering party with me during all this work in my department throughout year 1904. I had the assistance of engineer R. Q. Tenney for a short time and Mr. Norvelle was instrument man and assisted me in mapping.

Activities in construction of ditch line were going on during all the time I was there. Both surveying and actual excavation. The first work was clearing right-of-way before we commenced final location. * * *

Headquarters for work done on Laramie River that year was at Lanning's. Our supplies were brought in by teams to Lanning's place and other teams would * * * bring them up onto the line of work. That was a freight station. An employee was in charge. * * * It is on floor of Laramie Valley.

We had light snow storms pretty nearly all summer in 1904. * * * Snow drifts were lying on ground on line of upper ditch up to August 5. This canal is located in regions where the snow falls the year around. * * * Upper Rawah Ditch is in neighborhood of 1,800 feet higher than west portal of tunnel. * * * (1888-95).

He further says:

"In 1904 and 1905 I ran three tunnel lines; one indicated by tunnel line appearing on Plaintiff's Exhibit P,

One coming out of Laramie River a little west of portal of that tunnel and discharging into Poudre at the same point, and one coming out of Laramie River about a mile and a half north of first portal named and also discharging waters into the Poudre River at the same point.

The one found on Plaintiff's Exhibit P was selected. It is the one on which the present tunnel is located. (1899) * * *

Mr. Link did a small amount of work at the outlet end of the Upper Rawah Ditch and on August 6 had charge of the work of excavating on the north side of Rapid Creek. (1902.)

When we finished the work in 1904 we had a road along the line of the Upper Rawah Ditch clear to the head of the ditch at McIntyre Creek. Work was done to Station 67 from lower end of the ditch about 6,700 feet, although it was not all completed over this portion. The contractor was given credit in two estimates for 8,538 yards excavation." (1903.)

Wallis A. Link and A. I. Akin were the original projectors of the Greeley-Poudre system and the earlier work on the system was under their direction and supervision. Mr. Link, after describing at considerable length the work done in 1902 and 1903 (1932-47), of the work of 1904 says, in part, as follows:

"Left Fort Collins March 9 and arrived there March 12, 1904. We concluded we had better make survey of tunnel so I took team and number of men with R. Q. Tenney, surveyor (1948). We were engaged five or six days surveying. There was a great deal of snow on tops of mountains. It averaged two feet on Laramie Valley from what we call Middle Mountain to tunnel site.

Site surveyed by Tenney is practically same place previously selected by me (1948).

After return of survey party to Fort Collins Mr. Tenney made up notes of his survey and Mr. Hedke was engaged with him figuring out distances and other like work. We were active all along the line in raising money until about April first. From about that date it was decided I had better go back again and take men and do work on reservoir site, which we called East Fork Reservoir and which was intended as equalizing reservoir for tunnel. * * * Mr. Tenney ran fly line from East Fork Reservoir to tunnel * * * March 15, about same time we surveyed line over tunnel. * * * (1949).

I knew Mr. Duvall to be a practical man for mountain ditch construction. * * * His services were secured. * * * I took crew of men up to the territory and left them there and came back and got Mr. Duvall and another man and we went to work surveying and making final survey of tunnel. Men had been working on road up west fork of Laramie River all time I was gone. (1951.)

Survey was carried on throughout entire summer of 1904 during which time the entire mountain system was surveyed.

All surveys of all ditches now in course of construction were completed during summer of 1904. We had to work here and there as the snow would permit.

The line of the tunnel selected by Mr. Duvall was about the same line as selected by Mr. Tenney and myself. The lines might vary a few feet from one another. Other lines were run to ascertain which was best line. (1952.)

During 1904 * * * Considerable money was raised and expended * * * both in surveying and construction. *$13,000 to $14,000 was expended* in surveying and construction on the Link Lake properties during that summer.

The Upper Rawah Ditch was also surveyed * * * final line was run and most of its cross-sections. The line finally selected was practically the same line as selected by Beach in 1902. The only difference was the difference of opinions of the two engineers in getting around some obstacle. It was practically the same line described by me before first survey in my first conversation with Mr. Akin. (1954.)

There was a great deal of construction work done in 1904 outside of surveying. All necessary clearing was done from west fork of Laramie River for ditch across to east fork of Laramie River and to tunnel. Considerable of ditch line was plowed and some of it finished so as to turn water into it. The ditch required considerable clearing of timber at this point. Work was done on floor of Laramie Valley nearly level with west portal of tunnel. * * * It was so constructed that water flowing through the lower west side collection ditch as well as from the Upper Rawah Ditch, would be carried across and into the tunnel. First clearing on any part of the project was on East Fork Reservoir and next clearing was on ditch line from west fork to the tunnel. * * * (1954.)

Established construction camps in 1904. We excavated about 6,000 feet of canal on Upper Link Lake

Ditch as we then termed it. * * * This is the same ditch now known as Upper Rawah Ditch. We also cleared about three and one half miles of timber. * * * Necessary to construct road up west fork of Laramie River and over the mountain to meet the south end of the road coming from the north to Grassy Pass in order to construct this upper ditch line. * * * Country up west fork and mountain side is very hard place to build roads. * * * (1956.)

Camp was established and excavation by force of men and teams was commenced on Upper Rawah Ditch about middle of July, 1904. I was in charge of outfit doing work that season. Work was continued until along in October when snow stopped us. Work was continued throughout all weather permitting excavation. Snow got so deep that we could not work. * * * I stayed there longer with five or six men and continued clearing. * * * We did considerable of this work on this ditch with teams. * * * (1957.)

Supplies were hauled in with freight teams hired to transport it to Lanning's cabin. * * * From the cabin I had a four horse team that hauled supplies from the cabin up the mountain to the work. Did not have freighters for provisions all the way up because * * * their horses were not used to that character of work.

In 1904 in prosecuting excavation and construction work on Upper Rawah Ditch *we had 35 men in our camp* and *contractor* Ianson had *18 or 20 men all the time.* * * * (1958.) *My gang of 35 men* were employed all along the line from west fork of Laramie River to Grassy Pass. The work was prosecuted by this force of men and equipment that I have mentioned throughout the entire period of construction in 1904. The work ceased only when the snow got so we could not handle the timber to advantage." (1959.)

The work by Link and Akin and associates during 1902, 1903 and 1904 is well illustrated by Defendants' Exhibits 52 to 73 inclusive, a series of photographs taken at various times during those three years.

The Exhibits 52 to 55 inclusive show the 1902 party at the time of the early preliminary survey during that year. (1965-7.)

Exhibits 55 to 64 inclusive show the general character of the timber in the mountain country in which the collection ditches of the system are constructed and through which no existing roads or means of travel existed prior to the roads constructed by Link and Akin and associates in 1903 and 1904. (1968-71.)

Exhibit 65 is a photograph showing the first survey of the Greeley-Poudre tunnel March 12, 1904, by R. Q. Tenney. (1972.)

Defendants' Exhibits 66 to 72 inclusive indicate, to a slight degree, the construction taking place on the Upper Rawah Ditch during that year. (1975.)

Mr. Link further says:

> "In 1904 about fourteen thousand dollars was expended on construction work and clearing, not including surveys." (1988.)

With reference to filing No. 1722, office of State Engineer of Colorado, which is the same as Defendants' Exhibit 51, witness Link says:

> "That is the same filing identified by Mr. Duvall and pertaining to surveys made by him. This map does not pretend to show anything else than the surveys made by Mr. Duvall."

With reference to Defendants' Exhibit 75:

> "Filing No. 1417, office of the State Engineer of Colorado, pertained only to Mr. Tenney's survey and especially the tunnel line surveyed by Mr. Tenney during 1904. The map merely attempts to show the lines run by Mr. Tenney." (2029.)

Mr. A. I. Akin, one of the original projectors, after describing the activities of 1902, including the surveys made by Engineer Frank Beach and party commencing August 25, 1902, and terminated by snow (Defendants' Exhibit 74, map by Mr. Beach), (2039-42), and after describing the activities of 1903 consisting largely of necessary road construction and financiering (2043-5), refers to the work of 1904 in part as follows:

> "May, 1904, Mr. Duvall went to work. Have heard Mr. Duvall's testimony. He covered the situation very fully. I corroborate what he said in that regard. *In 1904 construction work was carried on on Upper Rawah Ditch* * * * *from west fork to east fork* of Laramie River and to *tunnel.* * * * Have heard testimony of Mr. Duvall and Mr. Link concerning construction work going on in 1904. They stated the facts in that regard.
>
> About *$20,000* was placed in this enterprise in the construction of the *work in 1904.* No construction work was going on that year on the plains distribution end of the system. * * * (2046-7.) August, 1904, Mr. Link started excavation on Upper Rawah Ditch at lower

end. * * * Ianson & Walthall started work on August 10. I have photographs of work completed during season of 1904 on Upper Rawah Ditch.

Defendants' Exhibit 76 is picture taken about 1,000 feet above lower end of Upper Rawah Ditch where it drops into west fork of Laramie River around the rock point. * * * It shows conditions as they existed that year. I have photographs which, though taken at later date, show conditions at close of work in 1904.

Defendants' Exhibit 77 is photograph of lower end of ditch where it drops into west fork of Laramie River and where Link started to cut in 1904, showing water coming out of end of ditch. Shows conditions as they existed in 1904. (2048.)

Defendants' Exhibit 76 is ditch line where Ianson & Walthall did their work. * * * Shows ditch lines and how it was constructed.

Was with surveying party of Zac T. Duvall during most of season of 1904. Defendants' Exhibit 51, known as Duvall's map * * * shows Upper Rawah Ditch * * * East Side and West Side ditches * * * and tunnel line. Mr. Duvall did no engineering work on other units or parts of this system than those shown on Exhibit 51. Only difference between Duvall's survey and present West Side Collection Ditch is that it is carried on side of mountain to tunnel instead of crossing river with pipe line.

Diversion system portrayed on three maps, Exhibits 51 (Duvall map), 74 (Beach map) and 75 (Tenney map) is practically the same system first conceived by Mr. Link and me in our expedition in 1902. Beach survey was preliminary. Tenney survey was also preliminary. Duvall survey was definite location. (2049-50.)

Mr. Duvall was engineer in charge of work of excavation as well as definite location of lines. * * * Harry L. Monroe came into association of individuals interested in project in summer of 1904, just before we started work on Upper Rawah Ditch. He advanced money in connection with starting work. Later severed his connection with firm." (2051.)

"As I recall the amount paid Ianson & Walthall for work on the Upper Rawah Ditch in 1904 was between $3,700 and $3,800, this not including the work that Mr. Link performed. These contractors had a contract for 2½ miles on the lower end of the Upper Rawah Ditch, but they did not do all the work. They distributed the work over the whole distance and we completed the work with Japs and Greeks in 1907. Mr. Link worked a gang

of men in 1904 clearing the right-of-way through 2½ or 3 miles of timber and excavating along the ditch line both before and after the contractors did their work. The gang he worked, of about 30 men, was changed back and forth from clearing to excavating from August to October, but I cannot say how much work was done on excavation by that gang. Sometimes we had as many as 50 men, and I believe never less than 25, there being on an average about 30 or 35 working for * * * two months and a half. Part of the time he had four teams upon this work." (2071.)

Mr. Akin, after describing at considerable length the work and expenditure from the beginning down to 1908, says:

> *"Our work from 1904 to and including 1908 was open and notorious and open to the observation of people both in Colorado and Wyoming. People in Laramie River valley knew of the work 1904 to 1908.* We bought supplies, butter, eggs and other like commodities up and down the river. We were freighting from Fort Collins all the time. *People* were coming and going *from Laramie City* at the time we were surveying and we had parties *visiting at the camps there off and on and watching the work.* We bought all our meat supplies on Laramie River." (2064.)

Charles R. Hedke, subsequently construction engineer on the entire Greeley-Poudre project, thus speaks of the 1904 work:

> "My first acquaintance with the Greeley-Poudre project of the Laramie valley was in 1904, when there was under consideration the diversion of water from the Laramie River to the Cache la Poudre River by means of a tunnel. The matter was brought to my attention and discussed. Persons working on the project consulted me at that time. * * * My work in 1905 consisted of a general analysis and special detailed survey as a means of applying the waters of the Laramie River to the lands in the Cache la Poudre valley, and also work in connection with the settlements of the contractors and owners of the Laramie River system, upon work done on the Laramie River system in the year 1904, upon the unit of the Greeley-Poudre system now called the Upper Rawah Ditch * * * situated on the west side of the Laramie Valley at an altitude of about 10,500 feet. Work had been done the year previous and the contractors were forced to go out of the country on

account of the snow, and final and complete estimates were not made that year but were completed and made by me in 1905. This required me to go over that work already done in great detail for purpose of estimate. The work performed at that date was of a very good character * * * of mountain ditch construction. Between 4,500 and 5,000 feet of mountain ditch construction had been completed at that time. There was considerable solid rock and loose rock material. * * *

There had been actual construction done before I became associated with the project. * * * Roads were built to the works, clearing had been done to a great extent, necessary preliminary work had been performed. The 1904 work had progressed under the direct supervision of Mr. Zac T. Duvall, an engineer of Denver, Colorado. In 1904 some work had been done by Mr. R. Q. Tenney, of Fort Collins, prior to the time that Mr. Duvall was employed.

In 1905 I found a road constructed from the valley of the Laramie proper, up the west fork to the work outlined and to Rawah Creek, which is a very rough section of the country, and involves a difference in elevation of about 2,000 feet in two or three miles. This was a very heavy piece of road work. There was also a road constructed to the state road to the north of this property. This road was constructed * * * in a southerly direction to the upper end of the Rawah system in the neighborhood of McIntyre Creek and Rawah diversions. It was about seven miles long. The principal obstacle that had been encountered in the construction of that highway was the heavy timber, both green and fallen. Several sections of that road were constructed through a burned timber district that it was required to clear and remove the boulders from the surface, thereby usually permitting a pretty good road to be constructed.

These two roads penetrated a country which in fact had never had even trails previously. It was a country ranging in elevation from 8,500 to 11,000 feet and even higher elevations. It was in the region of perpetual snow and was very wet during the summer time and required many structures of corduroy to make the roads passable over swampy places. *The construction of these roads was an absolute necessity before beginning actual ditch construction,* as there was no other means of getting into the country. It would be impracticable to pack materials, machinery, tools and supplies that would be necessary for the work contemplated in that region.

The region thus penetrated by these roads is one of short working seasons, lasting from July 1st to October 1st out of the year. Sometimes the season is even shorter than that, depending on the snowfall and the character of the spring, which causes heavy thaws and a greater run-off. From October 1st snow storms are frequent and snow gets very deep and it is impracticable and impossible to do any such work. The canal is very close to timber line. The region above the line of this canal has peaks above an elevation of 13,000 feet.

I found the first work upon this system and in this inaccessible region performed. There had also been considerable surveying, clearing and other work done on the system preceding that time.

In 1905 I found then surveyed and in process of construction the system of works afterwards constructed. *It was substantially the system as it exists today*, that is, the main features are the same. The details had been worked out in somewhat different lines and some changes of a slight character have been made, but in the main the system is the same.

I found the tunnel line located and surveyed.

The final line of the tunnel was placed on exactly the same line that I found surveyed in 1905, after all possible other considerations had later been taken into account. That was the line of the Duvall and Tenney surveys. The collection ditches of the present system were substantially outlined at that time, minor changes, due mostly to the size and character of the enterprise and the existing conditions, and also brought about by a better class of construction than originally contemplated, had been made.

The system as a whole is the same for all practical purposes. As an example of the slight departures made I will state that the system of collection ditches on the west side was designed to carry water on that slope from the drainage area, and on account of the physical obstacles it was then proposed to take water across the valley in a pipe line. These difficulties were great cliffs of rock. * * * I discarded the idea of the siphon line and substituted tunnels on the ditch. * * * These changes made no difference on diversion of water and the object was just the same." (1743-8.)

The testimony of witnesses Zac T. Duvall (1874-1906), Wallis A. Link (1907-2038) and A. L. Akin (2038-78) gives a complete history of the enterprise for the years 1902, 1903 and 1904. Their testimony is not contradicted. The first two of

these witnesses had severed their interests with the enterprise long prior to this suit.

It will be observed that commencing with August 25, 1902, work was continuous throughout the remainder of that year and the open seasons of 1903 and 1904. Also that this work was open and notorious; that the people all up and down the Laramie Valley were fully aware of what was going on; that wagon freighters were passing to and from the far distant railroad stations hauling men, supplies and machinery; that visitors from Laramie, Wyoming, were frequently at the construction camps and stood by watching the work; and that in the construction large crews of men were engaged in large part in rock excavation requiring the use of powerful explosives, the reports of which could be heard for miles.

That all this was well known to the citizens of Wyoming is not denied or disputed. Here was not a mere fiction,—a mere reconnaissance coupled with a possibility that some succeeding generation might construct an enterprise,—but on the contrary, a direct, positive, open and notorious demonstration. Continuity of surveys was coupled with open construction involving expenditure of large sums of money, and all was directed toward the one common objective of conveying the water through the tunnel from the Laramie into the Cache la Poudre. The first excavation upon the ditch leading from the Laramie River to the west portal of this tunnel was a physical demonstration and proof of the intent of the parties. It was upon to the observation and access of all those who visited the region and became at once a matter of public knowledge.

Subsequent to 1904, work continued with equal diligence upon the project as a whole. The works necessary to divert, carry and distribute water to the lands in the Cache la Poudre valley are as necessary as the Laramie River diversion system. Hence activities alternated more or less from the mountain or Laramie River portion of the system to the plains or Cache la Poudre portion of the system from year to year thereafter.

Mr. Hedke says:

> "It was on the same general project, in fact, it was the lower end of the same project, the distribution end. *Diversion without distribution would be of absolutely no avail.* The plains work was only a portion of the same project, one is as essential as the other." (1749.)

He further says:

> *"Work was always going on somewhere in connection with the project, it never ceased. It was continuous."* (1749.)

1905-6 inclusive.

A knowledge of the work upon the system in the years 1905 and 1906 is best obtained by reading in full the testimony of the witnesses Link and Akin, already referred to, and also that of engineer Charles R. Hedke (1723-1873), who became acquainted with the project while acting as consulting engineer in March, 1904, at the time Mr. Tenney ran the first survey of the Greeley-Poudre tunnel and was actively engaged as engineer on the project in the early part of 1905. The years 1905 and 1906 were largely devoted to extensive surveys and definite location of works for the distribution and application of the water of the system to lands in the Cache la Poudre valley. (1748-9, 1751-2, 1961-3, 2051.) Employees were also on the Laramie River working upon that portion of the project. (1753, 1964.) In 1906 Wallis A. Link disposed of his interest in the project. (1965.) During these years surveys were also made to verify the wisdom of building the long Greeley-Poudre tunnel. (1753, 1760-3.)

The testimony of Charles R. Hedke with relation to these two years is quite complete and corroborated by the other two witnesses:

> "They had a supply of water and the general plan of working out that problem of supply and a general, natural and inevitable place to put that water. The problem was the connecting up of the two ends of an irrigation system, viz., supply and use. In this particular instance, in a highly developed country with many previous enterprises, it resulted in the problem of gathering many enterprises having the same general end into one large enterprise.
>
> The area possible to irrigate, when this enterprise was originated, was much larger than that now embraced. There is much more available land than is included within the Greeley-Poudre Irrigation District. It was natural to investigate and get all the water possible, including rights initiated, on the Cache la Poudre and those initiated and carried out on the Laramie River and all their constructions and extensions." (1818.)
>
> "The work I did in 1905 * * * was the investigation of the distribution end of the system and of the plans and examination of the work performed in 1904 in the mountains, which I went over in order to make a settlement of the contract for that work * * * which was on the Upper Rawah Ditch under the direction of Mr. Duvall. (1792.)
>
> My work of 1905 consisted of a general analysis and special detailed surveys as a means of applying the water

from the Laramie River to lands in the Cache la Poudre valley. (1743.)

In 1905 I found then surveyed and in process of construction the system of works afterwards constructed. It was substantially the system as it exists today, that is, the main features are the same. (1746.) During 1905 the company was preparing itself for the expensive financing necessary to develop this project and such work was performed as could be done with the means at hand. (1749.) The major portion of my time in 1905 was spent on this enterprise on the plains. The relation of the plains work to the Laramie River work was that of working out the details connected with the work of distribution and application of that water to lands in the Poudre Valley." (1748.)

"In 1905 and 1906, we considered almost every piece of property on Cache la Poudre river in connection with this system, and surveys were made in these computations. Lines of distribution, water supplies, lands to be irrigated, and how the system could be used in connection with other systems for distribution were considered; necessary surveys from reservoirs and all lands, several of which went as far as the Crow Creek county east of the Union Pacific Railroad. Other work was done in connection with the system at the upper end taking into consideration group of reservoirs then belonging to the North Poudre Irrigation Company and its relation to this system.

This involved surveys for the different reservoirs and computations were made as to capacity and cost of incorporating them under the general system." (1751.)

He then describes the absorption during that year of the Eastman Canal and other systems into the distribution portion of the Greeley-Poudre system, and continues:

"These are examples of work which was generally going on during that time. The works were numerous and entailed a very careful consideration of a large number of the systems of Cache la Poudre valley. Expenditure of money on the system was constant during years 1905 and 1906, principally along line I have mentioned."

"In connection with development of an enterprise as large as the Greeley-Poudre, involving large expenditures of money, it is always necessary to investigate every possible means of accomplishing the same general end by the cheapest and best means." (1752-3.)

"In 1905 and 1906 diversion of this water from Laramie River and its effect upon the stream and interests

along river were investigated by me. Data was collected and brought into shape, hydrographs were made of the flow and computations made of supply available at the various points of diversion for the best design of works and other information of general value obtained. This work involved expenditure of money, largely in office force. It continued entire time we were employed on river." (1758.)

"In 1905 and 1906 surveys were made in connection with general project to verify wisdom of building tunnel. Investigations of every possible means of diverting water were carried on. Laramie River Reservoir was surveyed in connection with survey for purposes of ascertaining feasibility of diversion of water from Laramie River drainage through the reservoir and an outlet canal from it in place of tunnel and collecting ditches. * * *

The result of this survey in 1906 was that it was impracticable to build this canal." (1760-1.)

"Surveys of Laramie Reservoir were completed, but it was separate and apart from the system commonly called the Greeley-Poudre system. It was surveyed and mapped as a subsequent and junior enterprise. (1767.) * * * during the summer of 1905 I did considerable work in the way of going over various properties and ascertaining their relations to each other and to the new project, and making some detailed surveys, one being of Reservoirs 5, 6, 7 and 9, and determining the area of lands the outlet from those reservoirs and from Cobb Lake Reservoir would cover." (1791.)

"In addition to the construction work which I have mentioned as being performed since 1904, the engineering work in the field with oftentimes as many as four parties, the office investigations and classification of data, the financial efforts of Mr. Hibbard and his associates, were going on continuously and practically all the time." (1817.)

"The two major considerations in connection with this project were the water supply and the expense of conducting the water to the land. It was understood from the first that at least 125,000 acre feet must be delivered at the land, and reservoir facilities for about 100,000 acre feet were provided in the plans." (1847.)

Let it here be noted that the Greeley-Poudre project involves reclamation of area almost half as extensive as the entire

present reclaimed area within that drainage, from all ditches, canals and reservoirs. These have been in process of construction through more than forty years.

Wallis A. Link stated:

"It was recognized by me and by my associates that it would be necessary to locate ditches and works upon plains of Poudre Valley as well as to construct ditches in mountains.

Poudre Valley Ditch had been constructed out of mouth of Poudre Canon in 1902. I have viewed lands that might be served from extension of this canal. I was along at time survey was made of such extension by Mr. Charles R. Hedke, engineer. * * *

In 1905 expenditure of both money and time was made in investigation of territory in Cache la Poudre Valley in which to make use and application of water to be obtained by means of the Laramie River system. I was engaged in this work as well as in work in the mountains during that year. Was in mountains during all fore part of season and later in summer we came down and ran survey from Reservoirs 5 and 6 of the North Poudre system down to Union Pacific Railroad and beyond. The Reservoirs 5 and 6 are capable of being filled from the Poudre Valley Canal.

Poudre Valley Canal is upper end of ditch for carriage of water from Poudre River in Cache la Poudre Valley to the Greeley-Poudre Irrigation District. Mr. Hedke made two surveys from Reservoirs 5 and 6 for an extension of Poudre Valley Ditch to Union Pacific Railroad and beyond. Generally speaking, this line of survey is indicated by the ditch line leading out towards McGrew Reservoir and shown on the map, Exhibit 1, attached to answer of corporate defendants. (1961-2.)

* * * I heard testimony of witness Charles R. Hedke, who just preceded me. The surveys as he described them for the year 1905 works are correct. He was the engineer who did the surveying. (1963.) * * *

In 1905 I was in mountains from about April 1 until sometime in August or latter part of July. Excavation work was not going on in mountains during that summer. * * * I was engaged all summer in caring for the ditches and other work." (1964.)

"In 1904 the principal place of business of those interested in this project was in Fort Collins. Mr. Hibbard was financial promoter of proposition. He resided

all the time in Fort Collins after entering into project. He engaged in no other business than the projection of this system and was continually employed in promoting it. He made several trips east, met people, financial firms, and bond brokers, to promote the proposition and raise money.

The co-partnership had engineers in field the most of the time from 1904 on." (1963.)

Witness A. I. Akin says:

"In 1905 and 1906 efforts of myself and associates were directed principally toward the distribution end of the system, on Poudre River side. To taking water through Poudre Valley Ditch out to plains east of Nunn and Pierce. Charles R. Hedke was engineer for association of individuals during that period. I have heard his testimony given in this case. He described correctly the work done by him or under his supervision during those years." (2051.)

"A contract to run water through the Poudre Valley Canal was the result of the negotiations carried on with The Poudre Valley Reservoir Company during years 1905 and 1906. Water to be carried for use on land from ditch extending east from end of present Poudre Valley Canal.

During 1905 and 1906 the association of individuals and The Laramie Reservoirs and Irrigation Company expended considerable money to further the enterprise.

Up to October, 1906, $31,736.90 had been expended by the association of individuals and the company on this enterprise. We had also expended $4,998 in purchase of property on Laramie River.

At the beginning of work in 1907 (March 1), my associates and I had expended on the system, outside of purchase of properties on Laramie River, $34,045.01. In both ranches and work we had expended $46,079.32." (2053.)

The initial survey was commenced August 25, 1902, and outside of the work performed by Messrs. Link and Akin that fall, some $350 was expended in making the Beach survey. (2042.) The necessary road work of 1903 has already been described. During 1904 about $20,000 was placed in the enterprise. (2047.) Practically all of this work for these was on the Laramie River portion of the system, so that during 1905 and 1906 it was essential that plans for the distribution end be completed and before the beginning of work in 1907, $46,079.32

had been expended upon the project, and upwards of $20,000 during 1905 and 1906.

1907—April, 1908.

During the years 1902-6, the title to the property had vested, first, in Wallace A. Link and A. I. Akin; subsequently, in the early spring of 1904, Myron Akin and Wellington Hibbard became interested, the latter continuing his services in connection with the enterprise until killed while in the performance of his duties on March 25, 1910. (2045.)

September 19, 1906, The Laramie Reservoirs and Irrigation Company was formed and succeeded to the previous association of individuals. (2051.)

March 19, 1907, the defendant, The Laramie-Poudre Reservoirs and Irrigation Company, was organized and succeeded to all the rights, titles and property theretofore owned by The Laramie Reservoirs and Irrigation Company. (2052.)

Thus we find the defendant corporation in full charge of affairs before the opening of work in 1907.

The winter of 1907-8, prior to the opening of work in the spring months in the latter year, will be treated along with the year 1907.

With the opening of the working season of 1907 (not 1909 as erroneously suggested in plaintiff's brief), *general construction proceeded from the furthermost canal of the system, the Upper Rawah Ditch on the Laramie River, clear through to the principal distribution canal now known as the Greeley-Poudre Canal,* being an extension of the Poudre Valley Canal, eastward along the north side of the Greeley-Poudre Irrigation District. The matured plans, thoroughly worked out at great expense under the supervision of Engineer Charles R. Hedke, for distribution as well as diversion, had been adopted by the defendant corporation and construction proceeded upon the entire system. (1768-71, 2054-68.)

Crews of men with full equipment, including about fifty white men, a pick and shovel crew of about one hundred Japanese, and a heavy rock excavation crew of about fifty Greeks were at work on the Upper Rawah Ditch from the opening of the season (July 1) to the close (October 1), during 1907 (2054-8, 2060), and numerous wagon freighters were hauling supplies, men and machinery to and from Fort Collins, Laramie and southern Wyoming points.

The character of this work is well illustrated by photographs taken by A. I. Akin and introduced as exhibits:

Exhibit 79, photograph of Upper Rawah Ditch at point where snow had been shoveled out in early part of July, 1907.

Exhibit 80, showing gang of Greeks shoveling snow of road in July, 1907.

Exhibits 81, 82 and 83, photographs of gang of about one hundred Japanese, foreman, engineers and portions of work in process of construction.

Exhibit 84, photograph showing gang of Greeks working at heavy rock work on the Upper Rawah Canal.

The Upper Rawah Ditch was completed from its point of discharge into the west fork to a point in the neighborhood of Camp Lake (one of the Link Lake Reservoirs) and clearing and surface work were done to the latter point. The work continued until prevented by snow. (1757, 2054.)

Evidence of work on this portion of the system during 1907 shows:

Charles R. Hedke:

> "In beginning of season 1907 labor conditions were favorable, men were hard to get in a region of that kind, work was plentiful and after considerable negotiation along those lines finally some foreign labor was used in construction." (1754.)
>
> "In 1907 upper unit of Laramie River portion of works known as Upper Rawah unit was extended and surveys were made in connection with the canals and works of that entire unit. The work covering the largest expense was in connection with the Upper Rawah Ditch, upon which considerable work was done that season." (1754.)
>
> "In 1907 there was completed on Upper Rawah Ditch the section of canal from its discharge into the west fork, * * * to a point in the neighborhood of Camp Lake. Clearing and surface work was done as far as Camp Lake. Several hundred feet of excavation was opened up at the upper part of this clearing, but snow stopped work and parties were obliged to cease just as snow found them so that certain portions of upper line were not entirely completed." (1757.)
>
> "The work performed on the Upper Rawah Ditch during 1907 was a part of the general work going on over the entire system. *From $40,000 to $50,000 was expended in 1907 on the Upper Rawah Ditch.*" (1795.)

A. I. Akin:

> "In 1907 in mountain division we let contract * * * for use of his teams and equipment * * * also made contract with some Greeks * * * to do part of work on Upper Rawah Ditch * * * and contract with Hokosana, a Jap, to do part of the hand or pick and shovel work on that ditch where we could not use teams. We proceeded to excavation work along line of these contracts.

Work was carried on during season of 1907 from July 1 to October 1, when snow storms started in and we had to come out. I have photographs representing conditions along line of Upper Rawah or Link Lake Ditch at beginning of work in 1907." (2053-4.) (Ex. 79-84.)

"We got excavation along line of Upper Rawah Ditch entirely completed to point above Rapid Creek. Then there are portions above Rapid Creek and towards Camp Lake where the work is finished. Right of way is cleared of timber to Camp Lake. Capacity of ditch as completed from Rapid Creek to West Fork of Laramie River is 224 cubic feet of water per second of time." (2058.)

"In 1907 we paid the men who were working on the Upper Rawah Ditch every 15 days in money. * * * I carried the money * * * from Fort Collins to the Upper Rawah Ditch for payment of the Greeks." (2065.)

Work on a larger scale was proceeding on the distribution portion of the system in the Cache la Poudre Valley during the Summer and Fall of 1907 and the Winter of 1907-8. This was principally upon the main canal of the system, beginning at the lower end of the then existing Poudre Valley Canal and extending easterly to Crow Creek via the McGrew Reservoir (see Exhibit 1 attached to corporate defendants' answer). This work was in charge of Engineer Charles R. Hedke and was performed by the defendant, The Laramie-Poudre Reservoirs and Irrigation Company.

Mr. Hedke says, in part:

"There was other work going on at that time on plains division. That work opened up about April 1, 1907. Prior to April, 1907, plains work was generally outlined and a definite location with cross-sections marked. Purchase of rights of way was commenced in 1907 and actual excavation was commenced immediately after. * * *

In the Spring of 1907 active operations on excavation began on plains, rights of way were purchased and arrangements were made with various enterprises which were to be linked up with this system. *Construction work was done on not less than 30 to 35 miles* at various points. * * * Condemnation proceedings were commenced and construction work had to proceed at intervals along line, thus making continuous ditch impossible.

Work was carried on through entire year of 1907. A large amount was done, principally in the vicinity of

Wellington, Colorado, and a little to east. All to east and along the line of the extension of the Poudre Valley Canal. That is same line of canal commonly known as Greeley-Poudre Canal. It is indicated on Exhibit 1 by red line along north border of colored area and to west of such area indicated by red line. It is the upper canal of the Greeley-Poudre system.

General construction went on over the entire system of which I have spoken. Work on plains was that of ordinary earth work construction of the vicinity and the outfits usually consisted of men and teams with fresnos and slips, and at that time we had an elevating grader and steam engines for pulling. Had two of these outfits on this line of canal. There were six or seven team outfits averaging 15 to 20 teams per outfit. * * * There was some rock excavation requiring use of powder and materials were taken out with carts and stone-boats.

This work continued entire year of 1907 and into year 1908. It continued after we had ceased labor on Upper Rawah Ditch in Fall of 1907. The force employed on the Upper Rawah Ditch on Laramie River division, when compelled to come out on account of weather conditions, continued to work on the plains division.

In the Fall of 1907 financial panic interfered to some degree with finances of company. To overcome the situation there was issued by Company obligations called script, which obligated Company to pay same out of first moneys derived from sale of bonds of Company in future. About $50,000 of such indebtedness was incurred. It was all used in keeping up work on system after October, 1907. Its full value was received in work upon system after panic. * * *

In 1907 and 1908 $129,572.00 was expended on actual construction on the system, in addition to overhead expenses. That was all expended in construction of the Greeley-Poudre system. * * * *About $25,000 was expended in 1908 on the work.*" (1768-71.)

Same witness, on cross-examination, said:

"In that year there was considerable work in the Poudre Valley, in the extension of the Poudre Valley Ditch. The Laramie-Poudre Reservoirs and Irrigation Company having acquired the carrying interest in the Poudre Valley Ditch, although not a stock interest in the Company, built several sections of a proposed extension of that ditch to the town of Nunn.

I would say that the amount expended on this exten-

sion work was about $70,000, this covering only construction work. Several separate sections of the proposed extension were completed, and some sections were not worked upon on account of the lack of right-of-way." (1796-7.)

"In the Poudre Valley the work of 1907 continued through the winter and into the spring of 1908, and in that year some work was done on the Black Hollow Cut on the Greeley-Poudre Canal. * * * All of the work that was done was on the extension of the Poudre Valley Canal." (1799.)

A. I. Akin says:

"In summer of 1907 final location of Laramie-Poudre Canal to Crow Creek was finished. While we were working in the mountains with the Japs, the Greeks, and also the gang of white men, Mr. Hibbard and Mr. Siegler, acting for the Company, purchased two * * * engines and graders and started those at work west of Wellington and east of the end of the Poudre Valley Ditch. They worked those engines until October on that piece of work * * *. They took the Greek crew which we had in the mountains, when they came down, and used them till after Christmas putting in the siphon across Box Elder Creek * * *. This was crew of 50 men. (2059.)

* * * In 1907, Ianson, after coming out from the mountain work, took charge of the engine crews with grading teams * * * and worked there until Christmas time. * * * Coal Bank Draw is 12 miles east of Fort Collins.

During 1907 and 1908 other construction contractors were excavating earth along line of Greeley-Poudre Canal. Mr. Lemonds of Nunn, Colorado, had a crew working west of that place, and about 5 miles due west of Pierce. In 1907 Mr. Harry Knowlton finally took contract to build the whole ditch system out to McGrew Reservoir, and in that contract he took over the engines and graders and all camp equipment that the Company owned, and took charge of the work and kept going part of the summer of 1908. * * *

There may have been other contractors in 1907 and 1908 other than those I have mentioned * * *

These contractors I have mentioned were strung out along the line between the lower end of the Poudre Valley Canal and the McGrew Reservoir during 1907 and 1908. This new ditch constitutes an extension of the Poudre Valley Canal. * * *

I should judge about $250,000 was expended in excavation work, enlarging equipment and supervision in 1907. * * *

In 1907 the financial panic temporarily tied everything up. As the result of the panic we had to issue script owing to the fact we were running out of money. We had made arrangements for more money. The panic caused these parties to fail to keep their contract and furnish us money. * * * We paid the men half in cash and the balance in script. This we did until February, 1908." (2065.)

It is apparent that an enormous amount of work was done upon the enterprise during 1907 and the winter of 1907-8. $129,572 was expended in actual construction on the system, in addition to overhead expenses. About $250,000 was expended in construction, rights-of-way, equipment, engineering and all overhead expenses during this time. Crews of men were actively engaged from the mountain peaks on the Laramie River to McGrew Reservoir in the Cache la Poudre drainage. In the latter division teams and contractors were strung along some 30 to 35 miles of canal and great steam drag-lines were at work on part of the canal. With $46,079.32 expended upon the system prior to 1907, a total of $296,079.32 had been spent prior to the Spring of 1908, not including purchases of additional water-rights, properties, etc.

The Lake Hattie, James Lake and other minor projects on the Laramie Plains in Wyoming were initiated in the Spring of 1908. The initial surveys on the James Lake project were commenced March 22, 1908. (638.) Those on the Lake Hattie system were commenced April 16, 1908. (650.) These surveys continued with slight interruptions for a little over a year. The final location of the canals was started about May 1, 1909. Actual construction was started on the Lake James project July 17, 1909.

It thus appears that during less than six years immediately prior to the initiation of and construction upon the Wyoming projects, there had been expended on the Greeley-Poudre project upwards of $296,079.32 (not including purchase of properties, etc.), between August 25, 1902, and March, 1908. During that time definite and final surveys had been made of the entire Greeley-Poudre system and open construction had proceeded on mountain roads and canals during the working seasons. Canal construction proceeded upon the Plains of the Cache la Poudre where all travel from Wyoming to Denver passed in plain view. All of the operations upon the entire Greeley-Poudre system during all of these years was most open and notorious and well known to the citizens of both states.

No pretense is made by Wyoming that the Lake James project diverting waters from the Little Laramie River and to that extent depleting the general supply of the stream, had its inception before the dates given, and the record shows conclusively that all other recent Wyoming projects were initiated subsequent to the above described work upon the Greeley-Poudre enterprise in Colorado.

Notwithstanding the Colorado work, Wyoming and her citizens, early in 1908, commenced new projects for utilizing water from the same stream almost six years subsequent to the beginning of the work upon the Greeley-Poudre project in Colorado.

(c) *April, 1908,—Sept. 8, 1909.*

Work continued during 1908 and 1909 on the Laramie River portion of the system, although not to the extent in 1907. (1757, 1798, 2058.)

During 1908 the work progressed upon the plains division. A contractor, who had taken charge of the plains work, stopped his principal efforts during June, 1908, but continued to do some work after that. (2062.) Some work was done on the Black Hollow Cut of the Greeley-Poudre Canal. All plains excavation that year was paid for in script of the company and was done on the extension of the Poudre Valley Canal. (1799.)

The panic of 1907 required re-adjustment of the financial affairs of the defendant, The Laramie-Poudre Reservoirs & Irrigation Company. The general result of this re-adjustment was the formation of the lands, for the irrigation of which the project had been in construction since 1902, into the Greeley-Poudre Irrigation District. This organization began in the early part of 1908.

Mr. Camfield testified as follows:

> "Early in 1908 I began consideration of proposed system of works, water supply and general conditions surrounding the Greeley-Poudre project. Had thoroughly familiarized myself with everything connected with the project long prior to that time. Became interested through efforts of Mr. Hibbard. Had several meetings wit Mr. Hibbard and Mr. Duvall and also another engineer, Mr. Green. Also Mr. Charles R. Hedke, engineer. We went over entire matter and considered everything in Poudre Valley and on Laramie River. * * * *At that time had general understanding of condition of works then in course of construction to accomplish diversions of Greeley-Poudre system from Laramie and*

Poudre Rivers. They had been working on the system prior to that time. (2156-7.)

* * * * * * * * * * *

After making investigation of Greeley-Poudre project and considering the possibilities of same from every standpoint, I bought 23 per cent of stock in The Laramie Poudre Reservoirs and Irrigation Company. (2159.)

* * *

Approximately $800,000.00 had been expended before we went into company. This had been expended in promotion and construction of system. Prior to my entering and purchasing stock, I had understanding with stockholders that I would buy only on condition that irrigation district would be formed. * * * Soon after I bought into the company, we made arrangements for formation of irrigation district. District finally formed in 1909."

The $800,000 which had been invested in the project included cost of purchase of additional property, such as the Mitchell Lakes reservoirs in the Cache la Poudre Valley, in addition to that which had been expended in construction and other like expenses, the amount of which has been previously given.

April 3, 1909, (1811) the lands to be served by the system in the process of construction since August 25, 1902, by the defendant, The Laramie-Poudre Reservoirs & Irrigation Company and its predecessors, were formed into defendant, The Greeley-Poudre Irrigation District. This public corporation on September 8, 1909, entered into a contract with The Laramie-Poudre Reservoirs & Irrigation Company whereby that company was to complete its project and thereafter turn the same over to the district for the irrigation of its lands.

It is unnecessary to go at length into the details of the organization of this district and the contract with the company, all of which will be found in the testimony of engineer John R. Wortham (1602-1722) and engineer Charles R. Hedke (1820-32, 1835-55.)

The contract with the district involved no change in the Laramie River portion of the system except that the work upon the collection ditches for diversion and carriage of water to the west portal of the tunnel was shifted largely to the two lower collection ditches. The one and only reason for this change is thus given:

"Plans for constructing the remainder of this Upper Rawah Ditch, adopted subsequent to 1907, were that after 1908 they started construction work on the tunnel

and the two collection ditches in the valley, the one from Deadman and the one from Rawah, and it was decided that we could do the remainder of the construction work on the Upper Rawah Ditch cheaper with maintenance crews than we could by putting gangs up there and keeping them there. After we could get the rest of the system running, we could put our maintenance men up there and have them there in case there was any break in any of the ditches, and at the same time keep them working at construction work on the Upper Rawah Ditch, back to McIntyre Creek.

There never was any intention of abandoning the Upper Rawah Ditch. That ditch is an essential and necessary unit of the system. It has been carrying water and discharging into the West Fork of the Laramie River since 1904." (2058-9.)

1909-1913.

September 8, 1909, the general contract was made between the defendants, The Laramie-Poudre Reservoirs & Irrigation Company, and The Greeley-Poudre Irrigation District. A general description of construction will suffice. The two and a quarter mile tunnel of the system was completed at a cost of $600,000 (1652, 1772) before the closing of construction as a direct result of this suit and its influence upon the sale of the bonds and securities of the Irrigation District (Camfield 2163-5; Iliff 3653-62, 3665-70, 3682-7, Decree, Ex. 179.) This tunnel has a carrying capacity of 1,000 cubic feet per second (1853) and its prosecution continued day and night (1652.) The difficult portions of the two lower collection ditches on the river were completed at a cost of $233,503 to the district (2125.) About $20,000 was expended on the tunnel reservoir (1860) and numerous other smaller units on the Laramie River were either wholly or partially completed. On the Poudre River side, the work proceeded upon the entire distribution portion of the system. Contractors were engaged on the different canals and reservoirs upon the plains and but little work remained to put the distribution system in running order for the use and application of the waters of the Laramie River. A more detailed portrayal of the magnitude of this system and the work done upon it during these years appears in the testimony of Charles R. Hedke (1723-83), construction engineer for the company, and John R. Wortham, engineer for the district (1602-1722, 2078-2137.)

After August, 1911, the Greeley-Poudre Irrigation District, at an expense additional to that provided for in the contract with the company, constructed concrete lining in the tunnel

under the direction of Mr. Wortham, its engineer. This work was finished May 1, 1914 (1628). Charles R. Hedke severed his connection with the construction company February, 1911, and at that time $1,825,000.00 in cash (not bonds) had been expended on the Greeley-Poudre system (1779). The subsequent tunnel lining by the district cost $20,720.19 in cash (1654).

At the time of taking the testimony in this case, the Greeley-Poudre Irrigation District had expended upon this system the sum of $3,046,780.00 in bonds, on account of the construction (2139), and also the additional sum of $8,500 in cash (1656), for the completion of the approach cut from the Laramie River to the west portal of the tunnel. On the Laramie River portion alone over $900,000 had been expended by the district and its predecessors (1654, 1772, 1795, 2047, 2125). These amounts represent the sum total of the expenditures on the project from August 25, 1902, to the date of the close of the testimony in this case, and include not only those made by the district, but as well the expenditures made by The Laramie-Poudre Reservoirs & Irrigation Company and its predecessors, the sum total of which was about $800,000.00 at the time Mr. Camfield bought into the company. More than two million dollars of bonds of the district were expended in construction and in payment under the terms of the contract from September 8, 1909, to the summer of 1913. In February, 1911, when Mr. Hedke severed his connection with the company, a great part of this expenditure had been made.

Of continuity of work from 1904, when he became associated with the project, Mr. Hedke makes the following general statement:

> "Work and expenditure of money upon the system now known as the Greeley-Poudre system was continuous and uninterrupted from 1904 until February, 1911, at the time I severed my connection with the Company. It was done under some difficulties and conditions that showed remarkable progress for these conditions and difficulties." (1776.)

The witness then continues to describe, more in detail, the progress made, concluding with the remark that a world's record was made during the drilling of the tunnel (1776-9).

Record of each of surveys upon each unit was made. Proper filings were made in the office of the State Engineer of Colorado. Copies of these filings were introduced as Plaintiff's Exhibits N to T inclusive (1835-9), and also, in part, as Defendants' Exhibits 51, 74 and 75.

All of these filings are merged into the decree of the Dis-

trict Court of Larimer County, Colorado (Defendants' Exhibit 179), wherein the court, after reviewing the history of the enterprise from the initial survey and specifically finding that more than ordinary diligence had been used, fixes the priority of the enterprise as of August 25, 1902. No appeal has been taken and the decree is final and binding upon all Colorado appropriators.

Regardless of the decree of the District Court fixing August 25, 1902, as the priority of the Greeley-Poudre project, the fact remains that under the doctrine of relation (by which priority dates as of initiation of the enterprise), the priority of right of this system to divert water from the Laramie River would date as of August 25, 1902, the date of the beginning of the first survey, a date, as we shall observe, years prior to the first initial act in any way having to do with those Wyoming projects in whose behalf this suit is prosecuted.

(5) *Errors in Plaintiff's Brief.*

Plaintiff seeks to obscure the true dates of the initiation and priorities of the early Greeley-Poudre enterprise in Colorado on the one hand, and the very recent and far junior Wyoming enterprises (principally Lake Hattie and James Lake) on the other hand, by two erroneous and wholly unwarranted assumptions:

(a) That Colorado seeks to claim priority for her Greeley-Poudre enterprise as of 1897, when, in truth, August 25, 1902, is the only priority for that system asserted by defendants in their answer, established by the evidence or fixed and determined by decree of the District Court of Larimer County, Colorado, in adjudication of water rights in Colorado; and,

(b) That the Upper Rawah Ditch, one of the three necessary collection canals of the Greeley-Poudre system, constructed for the diversion and carriage of water from tributaries of the Laramie River back to the tunnel portal, never was intended as or to be a part of the system.

(a) *Erroneous Priority Assumptions.*

The first of these assumptions finds no foundation in either the pleadings or the record. In truth, possibility of a tunnel, collection ditch and reservoir system similar to that of the Greeley-Poudre Irrigation District on the Laramie River, first came to the attention of Wallis A. Link in 1897, while he was searching for a wounded deer on the mountains over the location of the now completed Greeley-Poudre tunnel. Mr. Link later interested Mr. A. I. Akin in the plan and drew a rough plat showing the general location of the tunnel and the three (not two) collection ditches which he exhibited to Akin and early in

1902 he and Mr. Akin visited this remote region and made reconnaissance of the whole tunnel and collection ditch scheme. As a direct result of these efforts upon the part of Link and Akin, the first and initial survey was commenced on the project August 25, 1902. (1929-35, 2039-42.)

These uncontradicted historical facts are interesting and of some value to show the system first conceived by Mr. Link in 1897 and later planned by Link and Akin in 1902, to be, in all essentials, the same project now partially completed for the Greeley-Poudre Irrigation District, but are but preliminary and no more vest a priority of right to the appropriation of water than would the early search for mineral by a prospector constitute the location of a mining claim.

Priority for the Colorado enterprise is not predicated upon these preliminary acts of Link and Akin, but entirely upon the commencement of survey, August 25, 1902, since which time work has proceeded with diligence and continuity. (1935, 2039.)

The answer of Colorado, on page 8, reads:

> "Defendant avers that other appropriations of said water of said Laramie River and its tributaries have been made by the State of Colorado and its citizens within the State of Colorado, prior to the appropriations of said waters by complainant and its citizens, as set forth in the complaint, *and avers that on the 25th day of August, 1902*, the defendant, The Laramie-Poudre Reservoirs and Irrigation Company and its predecessors in title, by commencement of construction, initiated its rights to the diversion * * * through the tunnel mentioned in the bill of complaint, * * * and that at the time of the initiation of said rights of the defendant, The Laramie-Poudre Reservoirs and Irrigation Company and its predecessors in title, there was abundant water in said stream to satisfy *all prior appropriations then in existence in the State of Colorado and in the State of Wyoming.*"

To the same effect are the averments on page 15. On page 8 of answer of corporate defendants, the averments appearing on page 8 of answer of the State of Colorado are substantially repeated, and on page 15, among other averments to the same effect, corporate defendants say:

> "* * * that prior to the initiation of this suit—that is, *on August 25, 1902*—the construction of said system was begun by a predecessor in title of these defendants * * * that *defendants are the owners* of all rights so initiated *August 25, 1902.*"

On page 19 corporate defendants say:

> "* * * that long prior to the initiation of this suit—to-wit, *August 25, 1902*—and while there was abundant unappropriated water in the run-off of the Laramie River * * * predecessors in title of these defendants initiated, by commencement of actual construction on *August 25, 1902, the water rights which are sought to be exercised by diversion through the tunnel* mentioned in the bill of complaint; that since such initiation, the defendants and their predecessors in title, have diligently, by continuous work and expenditures on the construction of an extensive irrigation system, preserved the rights so initiated."

August 25, 1902, is the only date of priority for the Greeley-Poudre enterprise asserted or claimed by the defendants. The District Court of Larimer County, Colorado, so decreed (Exhibit 179), and no contradictory evidence appears throughout the entire record. Nowhere are defendants heard to assert any earlier priority for the enterprise.

To urge that an adversary is entitled to a senior priority is unusual between contending appropriators. The opposite is almost universal. Colorado here asserts and conclusively proves that she is entitled to priority as of August 25, 1902, the date of commencement of the surveys in conformity with which her project has been constructed, and no earlier, and yet Wyoming argues, in her brief (in which Colorado does not concur), that the Colorado appropriations are asserted as of 1897.

The reason for this unusual, and somewhat mysterious argument, is alone revealed by that portion of the Wyoming brief wherein she seeks credit for one of her own recent 1908 enterprises (the Lake Hattie Reservoir), for a few random and wholly irrelevant reconnaissances made during the past twenty years, and which, according to the Wyoming testimony, had very little in common with each other and absolutely no bearing upon and were in no manner connected with the Lake Hattie enterprise. (660-1, 665, 770-1, 935, 971-5.)

We shall later discuss these random, disconnected "surveys" more in detail when considering the Wyoming appropriations, and particularly the mythical "Pioneer Highline Canal." For the time being it is sufficient to say that the testimony shows, without contradiction, that the survey of the Lake Hattie project was begun April 16, 1908 (650) by an engineer who had no knowledge of and whose work was entirely foreign to any former reconnaissances or so-called "surveys." (661.)

For Wyoming to admit the true priority of her project (1908) would be to admit that the Greeley-Poudre (Colorado)

enterprise is almost six years senior. Rather than make such admission, cover is sought in suggesting that by some vague legal fiction, and notwithstanding all the pleadings and proof, excuse might be found for urging a date for the Colorado appropriation five years earlier than August 25, 1902, by reason of the early preliminary efforts of Link and Akin. If this argument is sound, then, it is argued, some semblance of excuse exists for Wyoming to contend that her new projects, in whose behalf this suit is brought, by some stretch of legal fiction may possibly be entitled to priority somewhere between 1886 and 1908, according to which one of the few random and heretofore abandoned efforts may be selected, notwithstanding no previous assertion of any such claims, all of which are long since forever barred by Wyoming statutes.

In other words, only by urging that Colorado does not claim enough may Wyoming find fiction for claim anterior to the Colorado system. With this evident purpose, counsel refer to certain evidence of witness Wallis A. Link, frequently designated as Wallace A. Link, wherein he stated that he first observed the opportunity of building the tunnel in 1897, while searching for a wounded deer in the vicinity, but that he took no steps toward completion of the system at that time (193), and, contrary to the pleadings and all the evidence, say:

> "It is the purport of the evidence for the defendants that the tunnel, which was commenced twelve years later, had its origin in this episode." (P. 22.)

The next portion of the brief, which we quote, shows that by the use of the word "origin" is meant "priority."

This line of thought must have originated in the mind of counsel, for they are the first to so utter. The purpose of this attempt to confuse the time of the initiation of the Greeley-Poudre project by the creation of a fictitious claim on behalf of defendants, is self-evident:

> "In view of the contentions of Colorado that the Greeley-Poudre system is entitled to assert a priority of appropriation relating to the time of the *vision* of Wallace Link, despite the many years before any real work was performed, it is interesting to note that the Lake Hattie system was constructed by the owners of the Pioneer Canal after their predecessors had made surveys from time to time since 1886," etc. (P. 76.)

If the court can be convinced, contrary to the truth, that Colorado claims priority for the Greeley-Poudre enterprise from 1897, at the time when the possibility of the enterprise was first casually observed by Wallis A. Link, and that she is

attempting to take advantage of certain reconnaissance work thereafter done by the early projectors of that enterprise prior to initiating the actual surveys on August 25, 1902, then pretext may exist for attempting to assert an anterior priority for the Lake Hattie enterprise. Unfortunately for counsel, the evidence conclusively shows that while certain disconnected reconnaissances were made by some three or four persons during a period of twenty years prior to 1908, these so-called "surveys" had no relation one to another and none of them to the Lake Hattie system, so that in no event might that system claim semblance of priority anterior to 1908 or to August 25, 1902, the priority of the Greeley-Poudre enterprise.

For the present, we say that for the Greeley-Poudre enterprise to attempt (which it most decidedly does not) to assert priority upon the early efforts of Link and Akin prior to August 25, 1902, or upon what is termed by counsel for Wyoming the "vision of Wallace Link," rather than by authority of the initial surveys leading to the final construction of the project, would be almost as spurious as the attempt to cloud the issues by so-called "surveys" which had no part in the initiation of the Wyoming enterprise. It is true that the early efforts of Wallis A. Link and later of Link and Akin, prior to August 25, 1902, were a broken series of acts having the one common end of building the tunnel and collection system, and none other, and were put forth by the men who were finally instrumental in setting in motion the final construction of the enterprise. It is also true that they continued to be financially and otherwise interested long after construction commenced. But these facts are wholly unlike the "visions" of some of the residents of Wyoming prior to April 16, 1908, to the effect that at some distant time or by some future generation an imaginary canal (not reservoir system), which still remains a fiction, might, and may be, constructed upon the Laramie Plains, all of which "visions" and all acts in consequence thereof were disconnected with one another and wholly foreign to any enterprise now in process of construction.

The Colorado enterprise began August 25, 1902, and the Wyoming enterprise April 16, 1908, and not before, and erroneous assumption of fancied claims, or gathering together of random ideas or disconnected acts, can no more vest any other priority in the Wyoming enterprise than can the "wounded deer" incident of Wallace Link justify other or earlier claim by Colorado. The date when work actually and definitely began in good faith upon each enterprise fixes its priority.

(b) Erroneous Assumptions in Re Upper Rawah Ditch.

The assumption that the Upper Rawah Ditch was not

originally intended to be a part of the Greeley-Poudre system is equally in error. This supposition, however, is evidently made with a different and more natural design, viz., to try to discredit the earlier construction upon the Greeley-Poudre enterprise in order that semblance of accuracy may be given to the contention that very little had been done upon the Colorado enterprise prior to April 16, 1908, when the newer Wyoming enterprise was actually initiated, notwithstanding more than $296,000.00 had been expended in construction, equipment and supervision, and upwards of $800,000 for all purposes, upon the Colorado system during the five and one-half years prior to 1908.

The argument advanced by counsel in support of this new theory is founded on substantially the following facts and suppositions:

The Greeley-Poudre system has two canals on the west side of the Big Laramie River in Colorado, constructed for the purpose of collecting water from tributaries and carrying the same to the west portal of the tunnel. One is located high up on the mountain sides, nearly at timberline, and is known as the Upper Rawah Ditch, and the other at a lower elevation and diverts and carries whatever water the upper ditch fails to capture and is known as the Lower Rawah or West Side Ditch.

The *Upper Rawah Ditch, of 22¼ cubic feet per second carrying capacity,* discharges its waters directly into the West Fork of the Laramie River, whence it flows down to the tunnel. It so happens that *a part* of these waters may be (but never were) captured and carried out of the Laramie watershed by the Skyline Canal of The Water Supply and Storage Company, constructed during the 90's for the diversion of water flowing in the West Fork. This later canal has a carrying capacity of only *130 cubic feet* per second, and at times, when there is not sufficient water in the West Fork to completely fill the canal, *some* space is available wherein *a small portion* of the 224 cubic feet per second of the water of the Upper Rawah Ditch might be (but never was) carried through the Skyline Ditch, if proper arrangements to that end were made with the owners of the canal. In such case *all of the remainder of the 22¼ cubic feet of water* from the Upper Rawah Canal must, of necessity, pass down the West Fork, and to the Laramie unless intercepted by the tunnel.

Climatic conditions limit operation of the Skyline Ditch to a few months in each year, and during the greater portion of that time its carrying capacity is utilized by its own appropriation and there is no opportunity to carry even a small part of the water from the Upper Rawah Ditch except during a very brief interval in each year.

To attempt to carry the 22¼ cubic feet of water per second from the Upper Rawah Ditch through a small available portion

the *130* cubic feet capacity of the Skyline Ditch, would, to e the common phrase, be attempting to insert "a square stick to a round hole."

Those who had charge of early construction upon the Gree-y-Poudre system do state that some temporary (not perma-nt) arrangement was made with the owners of the Skyline anal to use any available space in that canal for the carriage a part (not all) of the waters from the Upper Rawah Ditch ring the period of years necessarily required to construct the nnel portion of the Greeley-Poudre system. Thus early use ight be (though never was) made of a small part of the water the Upper Rawah Ditch in much the same manner as a street temporarily occupied during repairs upon adjacent build-gs. The Greeley-Poudre parties had no other or different ght-of-way through the Skyline Canal and had no right to en-rge it or intent so to do.

Counsel for Wyoming presume to argue that, because a all part of the Upper Rawah water *could be temporarily* con-yed to the Cache la Poudre Valley by means of the Skyline tch, and because those in charge of the project saw fit to per-rm a part of the early construction upon this upper unit of e system in order that advantage might be taken (if desired) the temporary arrangement to carry a small part of the water rough the Skyline Ditch, this Upper Rawah Ditch should be eated as a separate construction, as no part of the general stem and of no use to the tunnel enterprise.

All those who directed early construction upon the Greeley-udre enterprise appeared as witnesses. The testimony upon l phases of the early history was complete and at consider-le length. From this entire testimony not the slightest foun-tion can be obtained for any such theory as that advanced. he whole record shows, without the slightest contradiction, at the three collection ditches, including the Upper Rawah itch, were, from the outset, considered and treated as a part the tunnel project; that they were so portrayed long before y surveys took place; that they were so considered by Link d Akin while they were going over the project during 1902, d that each of the three ditches are a necessary and essential rt of the system now in process of completion.

Wallis A. Link, A. I. Akin, and Engineer Zac T. Duvall d Charles R. Hedke, testified concerning the earlier con-ruction. We shall quote at some length from their uncon-overted testimony. Of efforts prior to initiation of enterprise,

allis A. Link says:

> "Am acquainted with the location of the Greeley-Poudre tunnel. I located it." (1929.)

He then goes on to describe the occasion for his discovery of the tunnel site and continues:

> "I was the originator of the *entire proposition as now constructed or planned.* I moved to Fort Collins in 1901. * * * While living there, became acquainted with A. I. Akin. * * * Imparted to him information I possessed as to possibility of system to be constructed for diversion of water from Laramie River *by means of tunnel, east and west side collection ditches and upper collection ditch.* Explained it to him some time during spring of 1902. * * * I explained to him the proposition and *made a sketch map* or chart of it.
>
> In making this sketch map, *I described* the *tunnel* and the *collection ditches coming to and feeding this tunnel.* * * *
>
> Akin and I made trips * * * down the West Fork and East Fork * * * about 1,000 feet distant from the west portal of the Greeley-Poudre tunnel. I explained to him the system." (1930-2.)

He then explains his early plan for opening construction in the first instance on the Upper Rawah Ditch rather than on the lower collection ditches:

> "We adopted a method by which we were to build a part of the system first and employ the same to demonstrate the flow which was obtainable and also to assist in obtaining money for further promotion. After our first trip to Link Lakes and over that country, we thought that the first thing to do would be to build this ditch and connect it up with the Skyline Ditch, as this" (referring to the Upper Rawah Ditch) *"being a unit of the whole,* would retain our franchise and still give us revenue to proceed in the construction of the work. * * * We visited Link Lakes. I explained to Mr. Akin the line I proposed for this first construction. I had been over to these Link Lakes on many occasions and knew the country thoroughly. *I knew the comparative elevation of necessary ditch lines and also of tunnel.* I showed Mr. Akin at that time the line where I thought the ditch would go." (1932-3.)

The survey upon which the priority of the system is predicated is next described by Mr. Link:

> "Later on in the season (1902) we had the line surveyed. The line established by the survey did not vary from the line I conceived and explained to Mr. Akin.
>
> Frank Beach, civil engineer, was taken up there

* * * to survey the proposition. Mr. Akin and I paid for the work. We had him first survey the Link Lake Ditch, which they now call the Upper Rawah Ditch.

Survey commenced August 25, 1902. Mr. Beach, Mr. Akin and I were engaged in the work.

I remember the surveys made by Mr. Duvall, the engineer, who testified just previous to me. *The lines* which he established for the lower ditches *corresponded just as near as can be with the lines we had charted.*" (Referring to Link and Akin prior to survey.) (1934-5.)

Witness next described the difficulties of getting into the mountainous country with pack animals, owing to natural obstacles, and details of the survey; also some slight changes on the Upper Rawah Ditch between the Duvall survey of 1904 and the Beach survey of August 25, 1902.

Mr. A. I. Akin says, in part:

"This project was first called to my attention in the spring of 1902 by Wallace A. Link. Made first investigation trip to Laramie River in Colorado in July, 1902, with Wallace A. Link. Went up there with him to look up prospect of bringing water into the Cache la Poudre River. * * * Were gone six or seven days.

I last saw the Greeley-Poudre Irrigation District system of works on the Laramie River in September, 1913. *System now in process of construction is same system early conceived by Mr. Link and me.* The ditch indicated on Defendant's Exhibit 74 is a part of the Greeley-Poudre system." (Referring to Upper Rawah Ditch.)

"*In July, 1902*, in addition to inspecting the land occupied by the Upper Rawah Ditch, *we looked over* the general lay of the country all up and down the Laramie River and also *the tunnel line. We checked the ground over in a general way for the entire system.* The only surveying done in 1902 is shown on Defendant's Exhibit 74. We had no other data from which to prepare maps." (2042.)

"*Diversion system* portrayed on three maps, Defendant's Exhibit 51 (Duvall map), 74 (Beach map) and 75 (Tenney map) *is practically the same system as conceived by Mr. Link and me in our exploration of 1902.* The Beach survey was preliminary, as was also Tenney's survey. The Duvall survey was definite location." (2049.)

Speaking of the 1902 surveys, he says:

"In August 1902, took engineer Frank Beach from

Fort Collins. * * * Packed up to Link Lakes and ran survey line up from upper lakes across to West Fork of Laramie River. *He began his survey August 25, 1902*, that was the day he actually began on the ground. * * * We were engaged in this survey about 15 days.

During that time we surveyed line of Upper Rawah Ditch." (2039.)

"Mr. Beach made plats of survey made by us and we filed that, Mr. Link and I, with the State Engineer; defendants' Exhibit 74 is a copy of the map prepared by Mr. Beach.

Am familiar with line of Upper Rawah Ditch as now constructed. The present line is nearly same as location shown on Exhibit 74." (2040.)

"Statement of claim indicates carrying capacity of ditch to be 224 cubic feet per second. That was size of ditch contemplated by us at the time.

On Defendants' Exhibit 74, the ditch and reservoirs are termed 'Link Lake Ditch and Feeders and Link Lake Reservoir.' That was afterwards changed to 'Upper Rawah Ditch.'" (2041.)

Mr. Link describes the construction of necessary roads during the entire working season of 1903, cut over the mountains and through the heavy timber. He further says:

"The object of building this road was for constructing the system." (1942.)

Mr. Link, after stating that new parties became interested during the winter of 1903-4, says:

"The line of ditches as *we had designated* and *designed them were explained to our associates* and *I made charts showing line of tunnel and platted entire proposition.*

The five of us *concluded we had better make survey of tunnel as early as possible*, and so I took a team and surveyed line for tunnel. * * * Left Fort Collins * * * March 9th. * * * Took about two weeks from time we left Fort Collins. * * * There was a great deal of snow on tops of mountains. * * *

Site surveyed by Mr. Tenney is in practically same place previously selected by me.

After return of survey party to Fort Collins, Mr. Tenney made up notes of his survey and Mr. Hedke was engaged with him figuring out distances and other like work. * * * Mr. Tenney ran fly line to East Fork Reservoir to tunnel. This was done about March 15,

about same time we surveyed line over tunnel." (1947-9.)

"The association then employed Mr. Duvall to make elaborate surveys of the entire system."

The witness continues:

"*Got Mr. Duvall* and went to work making *final survey of tunnel.* Men had been working road to West Fork of river all time I was gone. *Survey was continued on throughout entire summer of 1904, during which time the entire mountain system was surveyed.* Mr. Duvall first commenced surveys on tunnel in May, but had to discontinue on account of snow. * * * *The line for tunnel selected by Mr. Duvall was about the same line selected by Mr. Tenney and myself.* Lines might vary a few feet from one another. Other lines were run to ascertain which was best line." (1951-2.)

"$13,000 to $14,000 was expended during that summer. *Upper Rawah Ditch was also surveyed in 1904. Final line was run and most of it cross-sectioned.*

The line finally selected was practically the same line selected by Beach in 1902. * * * It was practically the *same line designed by me before survey in my first conversation with Mr. Akin.* There was a great deal of construction work done in 1904 outside of surveying. * * *" (1953-4.)

"*Work was done*" (in 1904, prior to any construction on the Upper Rawah Ditch) "*on floor of Laramie Valley* nearly level with *west portal of tunnel.* * * * It was *so constructed that water flowing from the west side collection ditch, as well as from Upper Rawah Ditch, would be carried across and into the tunnel.* First clearing in any part of the project was on east fork reservoir and next clearing was on this ditch line from *West Fork to the tunnel.*

It would be *impossible to take water* diverted or carried by this East Fork Reservoir or the ditch from the West Fork of the Laramie River to the tunnel out of the Laramie Valley by *any other means than by a tunnel.* It was *impossible to take it out by the Skyline* or any other canal." (1954-5.)

The East Fork Reservoir was located just above the present tunnel reservoir of the system, the latter having been substituted for the same purposes for which the East Fork Reservoir was originally planned. (1845.)

The first actual construction on any of the several units of

the system is naturally indicative of the original intent of the parties.

> "*First work of construction following any surveys on this entire mountain system,* exclusive of road work, was done on East Fork Reservoir and *on line of ditch leading from West Fork of Laramie River to west portal of the tunnel.* * * * This was first work along any surveyed line. * * * I mean work of excavation done on the ditch, the survey of which had been located and cross-sectioned by engineer." (1958-60.)

Mr. Link further said:

> "The cost of the work which I had planned was estimated at about $2,000,000." (1988.)
>
> "We had an arrangement with the owners of the Skyline Ditch to carry our water for a percentage. *About 130 second feet* had previously been carried through their ditch, which *was practically its capacity,* and *we had no arrangements for its enlargement.* During the flood period in May and June the owners of that ditch had enough water to fill it and would have none of our water carried through it during that time." (2002.)

Of the original project:

> "I am familiar with File No. 1417 (State Engineer of Colorado), made in name of Myron H. Akin in May, 1904, covering the *tunnel,* the East Fork Reservoir and other portions of this system. At the time this was made, the two lower supply ditches were contemplated, but surveys had not been commenced.
>
> Filing No. 1722, made October 6, 1904" (Defendants' Exhibit 51) "* * * was made on behalf of our association. *It shows the tunnel, the West Side Supply Ditch, the East Side Supply Ditch and the Upper Rawah Ditch, and was made for the purpose of combining our entire project as then contemplated."* (2014.)
>
> "That is the same filing identified by Mr. Duvall and pertaining to surveys made by him. *This map does not pretend to show anything else than surveys made by Mr. Duvall.*
>
> Filing No. 1417 (State Engineer's office number), pertained to Mr. Tenney's survey and the contour line of East Fork Reservoir. * * * The tunnel line is Tenney's survey. If the East Fork Reservoir is omitted from Exhibit 51, it does not signify that Mr. Duvall did not see the reservoir. I do not know whether he did any work on it.

Actual cost of construction is the true gauge and not estimates of engineers. Estimates have nothing to do with the real cost, as we found out." (2029.)

"I was the explorer in a sense. The forerunner of the proposition and directed where those lines should be run. *If we could not have made our objective point, the tunnel, from those streams, then it would not be feasible.*" (2020.)

Mr. Akin:

"Mr. Tenney began his survey March 12, 1904, on the tunnel. 'Defendants' Exhibit 75 shows the R. Q. Tenney survey." (2046.)

"Was with the surveying party of Zac Duvall during most of the season of 1904. Have seen *Defendants' Exhibit 51*, known as *Duvall's map. It shows Upper Rawah Ditch and two gathering ditches*, the East Side Ditch and West Side Ditch * * * and *the tunnel line.* Mr. Duvall did no engineering work on other units or parts of the system than those shown on Exhibit 51." (2049.)

Of the first actual excavation on the system, Mr. Akin says:

"*First work done in 1904 was in construction of ditch from West Fork to East Fork of Laramie River and to tunnel.* In 1904 construction work was carried on on Upper Rawah Ditch. During period of construction of 1904, I was there nearly all the time, back and forth from Fort Collins. Have heard testimony of Mr. Duvall, and Mr. Link concerning construction work going on in 1904. They stated the facts in that regard." (2046.)

Zac T. Duvall, civil engineer, testified:

"*My first acquaintance with the Greeley-Poudre system was in 1904, when I was engaged as an engineer for the permanent location of the tunnel. Also had charge of permanent location of Upper Rawah Ditch.* I ran preliminary lines for East Side Collection-Ditch and West Side Collection Ditch. R. Q. Tenney of Fort Collins, Colorado, preceded me in laying out the *preliminary lines for the tunnel. Mr. Beech* had preceded me in the *preliminary surveys of the Upper Rawah Ditch.* * * *

I was under the immediate direction of Wallace A. Link while engaged on the work. *I began work on the Laramie-Poudre tunnel of the Greeley-Poudre system May 23, 1902.* I found evidences of preliminary survey

which had been made by R. Q. Tenney. *I did not vary to any considerable degree from that preliminary line."* (1882.)

"I also located the inlet ditch for the tunnel from the West Fork of the Laramie River across the East Fork and into the tunnel.

Plaintiff's Exhibit P" (identical with Defendants' Exhibit 51) "represents the survey I made during the season I was there. It indicates nothing else than the surveys made by me. The *tunnel line* located on the map is the one finally selected by me. *The inlet ditch of which I spoke is located on this map.* • • • *This ditch was constructed to carry water from the West Fork to the East Fork and to the tunnel. The waters of the Upper Rawah Ditch are discharged* into the West Fork and down that stream and *into this inlet ditch and then into the tunnel."* (1884.)

"In addition to locating the *inlet ditch* from the *West Fork* to the *west portal* of the *tunnel,* I constructed about 500 or 600 feet from the *canal and turned water in* from the West Fork of the Laramie River *June 10, 1904. That was the first actual excavation work on any part of the Laramie River system.* Water ran through that portion of the inlet ditch which we constructed from the West Fork.

After constructing this portion of the ditch, I went to the outlet end of the Upper Rawah Ditch and commenced permanent location of that canal to Rapid Creek, so that the right of way could be cleared for excavation and afterwards continued the survey through to Rawah and McIntyre Creeks. The line thus permanently located by me was practically the same from the outlet end of the ditch to Rapid Creek as the line located by Beach. • • • So far as diversion of water is concerned, the line I selected is practically the same as that laid out by Beach." (1885.)

"The Upper Rawah Ditch which I have located was designed to gather water in the higher elevations northwest of the West Fork and we could either carry it through the Sky Line Ditch into Chambers Lake or down the West Fork into the tunnel." (1901.)

"I completed the engineering work on two lower collection ditches on October 1, 1904. I worked on these ditches during August and September, after leaving the Upper Rawah Ditch and completed both surveys, one on east side and one on west side of Laramie River. • • • These two ditches together constitute what is

now called the Lower Rawah or West Side Collection Ditch and the East Side Collection Ditch." (1891.)

"*I have been on the ground since the tunnel constructed* by the Greeley-Poudre Irrigation District and the Laramie-Poudre Reservoirs & Irrigation Company was completed. *The line of tunnel thus completed is the same* as the *line of tunnel* indicated on the map, Plaintiff's Exhibit P." (Same as Defendants' Exhibit 51.) (1885.)

"Plaintiff's Exhibit P represents work done in the year 1904. I did not assume to represent any other work done by any other engineer prior to that time." (1891.)

"Estimated capacity of tunnel I located and designed was 1,000 cubic feet per second." (1892.)

Charles R. Hedke, civil engineer, to whose supervision was entrusted the construction of the Greeley-Poudre enterprise, says, in part, as follows:

"*My first acquaintance with the Greeley-Poudre project in the Laramie Valley was in 1904, when there was under consideration a diversion of water from the Laramie River to the Cache la Poudre River by means of a tunnel.* The matter was brought to my attention and discussed. Persons working on the project consulted me at that time. I began active operations in connection with that system in 1905. * * *

My work in 1905 consisted of a general analysis and special detailed surveys as a means of applying the water from the Laramie River to lands in the Cache la Poudre Valley, and also work in connection with the settlements between the contractors and the owners of the Laramie River system, upon work done on the Laramie River system in the year 1904, upon the unit of the Greeley-Poudre system now called the Rawah Ditch. It is sometimes called the Upper Supply Ditch, and is situated on the west side of the Laramie River Valley at an altitude of about 10,500 feet, and work had been done the years previous and the contractors were forced to go out of the country on account of the snow, and final and complete estimates were not made that year but were completed and made by me in 1905. * * *

The work performed to that date was of a very good character. Very good class of mountain ditch construction. Between 4,500 and 5,000 feet of mountain ditch construction had been completed at that time. * * *

There had been actual construction done before I became associated with the project. * * *

The 1904 work had progressed under the direct supervision of Mr. Zac T. Duvall, an engineer of Denver, Colorado. In 1904 some work had been done by Mr. R. Q. Tenney of Fort Collins, prior to the time that Mr. Duvall was employed." (1743-4.)

Speaking further of the tunnel and collection ditches, heretofore surveyed by Tenney and Duvall during the year 1904 and constructed 1905-11 under the direction of Mr. Hedke, he says:

"The final line of the tunnel was placed on exactly the same line that I found surveyed in 1905, after all possible other considerations had later been taken into account. That was the line of the Duvall and Tenney surveys.

The collection ditches of the present system were outlined at that time. Minor changes, due mostly to the size and character of the enterprise and the existing conditions, and also brought about a better class of construction than originally contemplated, have been made.

The system as a whole is the same for all practical purposes." (1747.)

Speaking further of the tunnel, he says:

"Tunnel may be considered most important unit of the system. It is the means of diverting water through the divide between the watersheds and is very important. Tunnel *completed August, 1911."* (1778.)

"The *tunnel* was actually *constructed on the lines* shown on the *map* filed October 6, 1909" (Duvall map, Defendants' Exhibit 51), "and not on lines shown by subsequent maps." (1843.)

"It is a fact that the construction of the tunnel was the culmination of efforts beginning with Link and Akin and early designated by Tenney and Duvall surveys. There is no substantial departure from the original idea. The other surveys * * * were the necessary investigations * * * and further analysis of the entire system, and as each part was done it was filed upon and rights protected as much as possible. They represent in record form the various sidelights upon the enterprise.

At no time was the tunnel plan abandoned. We never had an investigation that suggested the possible

abandonment of the tunnel. It was so apparent almost on its face, owing to the natural conditions, that it was very hard to figure out any means whereby the tunnel would be improved on. * * *

When I have been speaking of the Duvall map, I refer to Plaintiff's Exhibit P, being map of 1904, No. 1722." (1866.)

The system of today is the system surveyed in 1902-4:

"In 1905 the plan of this project as previously made by Mr. Duvall was outlined to me and the system as constructed is substantially the same as was contemplated in that plan. The tunnel as constructed is on exactly the same line as was used by Mr. Duvall, at the west end, with a slight variation at the east end. * * * There was no change in the location of the tunnel from the location shown on the maps filed in the office of the State Engineer."

Finally, in speaking of the various filings made in connection with the maps filed in the office of the State Engineer of Colorado, he says:

"The various dates mentioned on the various maps as the dates of commencement and indicated on Exhibits O and T, inclusive, indicate the dates of actual commencement on that portion of the works. In each case the date was noted on which we started surveying each portion. *These dates do not indicate the date on which the first survey was begun on the system. All surveys were done upon the same general system."* (1873.)

The extensive work constructed both upon the plains and in the mountains during 1907-8 has already been reviewed. Of the work on this canal, Mr. Hedke says:

"The work performed on Upper Rawah Ditch during 1907 was a part of the general work going on over entire system. There was other work going on at that time on plains division." (1767.)

The reason for the change of construction forces from the Upper Rawah Canal to the lower canal after 1908, is thus given by Mr. Akin:

"Plans for constructing the remainder of this Upper Rawah Ditch, adopted subsequent to 1907, were that

after 1908 they started construction work on the tunnel and the two collection ditches in the valley, the one from Deadman and the one from Rawah, and *it was decided that we could do the remainder of the construction work on the Upper Rawah Ditch cheaper with maintenance crews than we could by putting gangs up there and keeping them there.* After we could get the rest of the system running, we could put our maintenance men up there and have them there in case there was any break in any of the ditches, and at the same time keep them working at construction work on the Upper Rawah Ditch, back to McIntyre Creek.

There never was any intention of abandoning the Upper Rawah Ditch. That ditch is an essential and necessary unit of the system. It has been carrying and discharging into the West Fork of the Laramie River since 1904." (2059.)

Very evidently none of the very expensive and difficult construction upon the Upper Rawah Ditch of 224 cubic feet capacity would have taken place had the Sky Line Ditch been considered the permanent outlet to the Poudre Valley for this Upper Rawah Ditch. Mr. Link said:

"The carrying capacity of the Sky Line Ditch is about 130 cubic feet per second. * * * *I had no purpose to enlarge this Skyline Ditch, nor right to enlarge it in any of my plans.* I could not have used that canal in any year, either temporarily or otherwise, until the ditch was fully open to the headgate." (Referring to open from snow and ice.)

"This canal is burdened to its full capacity until July 15th of each year and we could not have obtained carrying capacity in that ditch prior to that date. After that date it might have been possible for them to carry *some* other water. *We would never have been able to obtain carrying capacity to its full capacity. They would always have 30 feet of water in their ditch from the West Fork.*

All the water that we were intending to carry in the Upper Rawah Ditch would be carried through the tunnel to the east side.

Upper Rawah Ditch was built to carry 200 cubic feet per second. It was planned to do that. *Waters of that ditch, when running to its capacity, would not be carried except as to a minor portion, through the unused capacity of the Sky Line Ditch.* This carriage could

only have occurred in a small part of the irrigation season, just a short time in the summer.

It was not our plan to use the Sky Line Ditch as a permanent means of carrying water of the Upper Rawah Ditch.

We would not have built the Link Lake Ditch (or Upper Rawah Ditch) to carry 200 cubic feet per second when we knew that the company owning the Sky Line Ditch would not enlarge their ditch. We did not feel that it would be possible to enlarge their ditch to carry the water on account of the kind of construction involved. * * * The water that we could gather in the Upper Rawah Ditch and carry through the unused capacity of the Sky Line Ditch would not bring sufficient return to warrant all the construction work necessary on the whole system I have described." (2021-3.)

Of the completion of this Upper Rawah Ditch and its capacity, Mr. Akin, who had been actively associated with the enterprise from the opening of 1902 until the taking of testimony, said:

"We got excavation along line of Upper Rawah Ditch entirely completed to point above Rapid Creek. There are portions above Rapid Creek and towards Camp Lake where the work is finished. Right of way is cleared of timber to Camp Lake.

Capacity of ditch as completed from Rapid Creek to West Fork of Laramie River is 22½ cubic feet of water per second of time." (2058.)

"Work was done on this ditch subsequent to 1907."

Statement by counsel for plaintiff (page 25, brief) that the Upper Rawah Ditch is "of little or no value" to the Greeley-Poudre system and that the lower or west side collection ditch now in process of construction serves all the purposes of the Upper Rawah Ditch is not borne out by the testimony. Mr. Link said:

"The West Side Collection Ditch" (referring to the lower west side canal) "was included in the plan prefected by me and, as constructed, *does not perform all of the duties which would be performed by the Upper* Rawah Ditch. The seepage on the mountain sides is very great and it is always advisable to turn the water into a natural channel as soon as possible, and a large part of the water caught by the Upper Rawah Ditch would be lost if not picked up by the West Side Ditch.

• • • We did not contemplate a smaller upper collection ditch on the east side because the mountains were lower, causing a smaller run-off tributary to such an upper ditch, and there are a great many canons making the cost of construction excessive.

I would have constructed the Upper Rawah Ditch under any circumstances." (2003-4.)

"*If the Upper Rawah Ditch had not been constructed, then the west side or lower collection ditch should be built to a much greater carrying capacity than now planned.*

It is far *more feasible* considering the mountain conditions in that vicinity *to build* the *two ditches* on the west side of the river as now planned, *than* it would be *to build one ditch where the lower ditch is constructed*, and of sufficient capacity to handle the water now carried by both ditches.

It is much safer to divide the capacity in the way it has been done. By this means more water is captured, conserved and conveyed to the point desired and a great deal more rapidly than it would be on the single line lower down.

Then you have two capacities instead of one. If one should break, the other would be working. • • •

All these matters were considered and talked over with my associates when we commenced construction of this upper ditch. Mr. Akin and I met with considerable opposition with regard to this upper ditch, but we insisted on constructing this upper ditch because our knowledge of conditions was superior to that of our associates.

Following the plan advocated by myself, work was done on the Upper Rawah Ditch first. That was in 1904 and continued in 1907. This upper ditch was sold later to the Greeley-Poudre Irrigation District." (2024-5.)

(Mr. Link sold out his interest in the system during 1906 and was not interested thereafter.) (1965.)

Further quotation along this line seems unnecessary. The Upper Rawah Ditch, one of the collection ditches of the Greeley-Poudre system included in the initial plans of the tunnel enterprise, was never proposed as a mere extension of the Sky Line Ditch of The Water Supply & Storage Company. That carriage through the Sky Line Canal of a small part of the large quantity of water conveyed by the Upper Rawah Ditch might be made during the period of construction of the tunnel and that such possibility was in the minds of the men who actually initiated, planned and aided in the construction of the tunnel enter-

prise cannot be doubted, but to argue that these men would deliberately construct the large Upper Rawah Canal at an enormous expense in order that a small part of its waters might possibly be (though never were) conveyed through the Sky Line Ditch, is as unreasonable as the general argument advanced by counsel that all of the labor and painstaking surveys and extensive construction upon the Greeley-Poudre enterprise in the six years beginning with 1902 were without definite plan or object.

It may not be amiss to here suggest that Wallis A. Link, whom counsel for complainant term "a small ranchman" and A. I. Akin, whom they designate merely as "a neighboring farmer," nevertheless were men of enough resourcefulness and creative genius to plan the Greeley-Poudre project. Eminent engineers later made the most exacting surveys to ascertain the best method of constructing this great enterprise, which Professor L. G. Carpenter describes as an "engineering feat worthy of the attention of the best engineering talent," (1405) and each engineer finally approved and accepted the general scheme and plan conceived in the first instance by these two men.

Not only were these men able to plan, but they were equally able to thereafter supervise and direct the early construction upon the project. Engineer Duvall states that all of the extensive work of 1904 was under the direct supervision of Mr. Link, and Mr. Akin continued his intimate relations with the construction of the enterprise from the beginning to the day of the trial.

Nearly all of the great mines of the United States are the discovery of lowly prospectors, many of whom have subsequently become the directing minds in the development of their projects. The continuity of plan, purpose and effort of these two men and their subsequent associates and successors is probably without a parallel in the history of Colorado irrigation enterprises.

It is but natural that junior appropriators should seek, as in this case, to describe initiation and construction of an enterprise such as the Greeley-Poudre over the first six years of its existence as "intermittent" (p. 22) and "desultory" (p. 78), in order that as little credit as possible may be given. The evidence is unanimous in its declaration of the continuity of activity upon the enterprise from 1902 down to 1908, at which time the recent large Wyoming enterprises were first commenced. The activity in Colorado, instead of being "desultory" was directed to the construction of a system on the one general original plan and all the labor and money was expended in order that the system might be completed along the best lines of construction with all possible dispatch.

Before considering the Wyoming appropriations, we suggest:

That the map, Exhibit B, attached to the bill of complaint, is manifestly in error in that no notation of the Upper Rawah Ditch appears thereupon, and, further, in that the courses of the streams and the location of other natural objects are incorrectly noted. We believe that all parties to the record generally admit that the map, Defendants' Exhibit 1, attached to the answer of corporate defendants, is more accurate and complete.

The Laramie River does not rise in the Continental Divide, as stated by counsel (p. 14). On the contrary, the principal tributaries of both the Big Laramie in Colorado and Wyoming and the Little Laramie in Wyoming have their rise in the Medicine Bow range of mountains, which is the range described on page 16 of counsel's brief as having an average elevation of about 10,000 feet, and the record shows that the snow-capped peaks of this range, at the head of the Little Laramie River, are substantially of the same general height and character as those at the head of the Big Laramie in Colorado. Between these two groups, the Medicine Bow range in both states does not attain the elevation that it does at the points mentioned. The Cache la Poudre and North Platte rivers rise in the Continental Divide and the former stream receives part of its water from that portion of the Medicine Bow range between the headwaters of the Laramie and the Continental Divide.

The reservoirs and canal mentioned on page 24 of complainant's brief are described by engineer Hedke (1759-61). The surveys of this reservoir and canal were but collateral to the survey of the general enterprise and were no departure from the original tunnel project. Of these surveys Mr. Hedke, under whose supervision they were made, says:

> "Surveys of Laramie River Reservoir were completed, but it was separate and apart from the system commonly called the 'Greeley-Poudre system.' It was surveyed and mapped as a subsequent and junior enterprise * * * in 1906." (1766.)

Bearing in mind the survey of and extensive construction upon the Greeley-Poudre enterprise subsequent to its initiation on August 25, 1902, and particularly during the years 1903-8, all prior to the initial surveys upon the later Wyoming projects, to which we shall next refer, and that under the rule of priority, if the same were to obtain without regard to state lines, the rights of all junior appropriators from the Laramie River vested subject and inferior to all appropriations theretofore initiated upon the stream, we will now consider diversions from the stream in Wyoming.

IV. WYOMING APPROPRIATIONS.

In considering appropriations of water from the Laramie River in Wyoming, we should first note the contrast of natural conditions surrounding construction in Wyoming with that in Colorado, to give proper credit, under the rule of reasonable diligence, to the efforts of appropriators in the two localities and to prevent undue credit for what might otherwise appear to be speed or rapidity of construction in any one locality.

(1) *The Region.*

It is conceded by all parties to this action that the Laramie Plains have an elevation of from 7,000 to 7,500 feet. The Laramie River portion of the Greeley-Poudre system now in process of construction in Colorado is situate at a much higher elevation.

All the enterprises upon the Laramie Plains here involved (save the inter-mountain Bell Supply Canal No. 2) are within a plains or prairie region, in contrast with the mountain district in Colorado. This Laramie Plains construction consists of mere prairie earth and loose gravel excavation, easy of performance and with longer working seasons in a country so favorably situate, so uniformly smooth, and with so few natural obstacles, that nearly all of the work has been or can be performed with drag-line and steam shovel equipment, the use of which would be impossible in the mountain region of the Greeley-Poudre system. With the possible exception of James Lake, none of these new systems are complete, as erroneously asserted by Wyoming counsel (p. 78, brief).

The ease of construction in the plains region and the difficulty in the mountains is conceded by all witnesses. As stated by Mr. Hedke:

> "A ditch of same capacity on plains as our mountain ditches would cost in the neighborhood of $1,000 per mile. Up in the mountains it would cost $30,000 per mile, and a mile of plains ditches can be built in a matter of several weeks, while a mile in the mountains may take a year, taking nearly all the men you can get on that mile to do it in one season's work." (1777.)

Mr. Sevison, the engineer who made the principal surveys on the Laramie Plains, says:

> "The country between Lake Hattie and the river is very easily surveyed. Most of it is across a tableland that is quite uniform. * * * The ditch follows the line which would be run by a level. There is no tunneling or heavy cutting with but the one exception where

you go through the arm of the bluff. * * * I had an unlimited field in which to work, without any obstacles." (654-5.)

"All work on the main outlet canal, and on the north and south canals, was the ordinary small ditch building,—entirely plain earthwork, no tunnels or rock work or flumes or anything of that sort. *The whole Lake Hattie System was one of remarkably small cost and economical construction.* At no place in the entire system did we encounter any difficult engineering problems." (660.)

The contrasts between the two regions are strikingly drawn in the testimony of witnesses Lyman E. Bishop, the engineer on the Lake Hattie project who succeeded Mr. Sevison (793-6); Professor L. G. Carpenter (1404-5); Engineer John R. Wortham (1619); Engineer Charles R. Hedke (1777-9); Engineer Zac T. Duvall (1895-7); Wallace A. Link (1920-3, 2076-8) and A. A. Edwards, irrigation expert (2239-40.)

The District Court of Larimer County, Colorado, having before it the adjudication of priorities in the Laramie River region in that state, took notice of this contrast between plains and mountain construction and in its decree (Defendants' Exhibit 179), wherein it fixed August 25, 1902 as the priority of the Greeley-Poudre system, says:

"All of the construction involves tunneling and excavation through mountains and along the steep mountain sides on either side of the Laramie Valley, *requiring a greater period of time* in the completion thereof than would be required to complete an enterprise of like proportions situate under and surrounded by ordinary conditions. All supplies, machinery and labor must be transported by teams for a distance of from seventy to one hundred miles, in large part over mountain roads, from either Laramie, Wyoming, or Fort Collins, Colorado, under conditions least favorable to economical transportation.

Owing to the altitude, climatic conditions and geographical location of the system, the working season, during which men may be engaged in other than tunnel construction, and the season of transportation of freight, are limited to a short period of from three to four months out of each year. The remoteness of the works from railroads, towns, cities, and labor centers, makes the obtaining of laborers difficult, and requires payment of high wages and maintenance of expensive accommodations. The construction throughout is of hazardous character, requiring the use of dynamite, powder and

other explosives and the services of a class of laborers hard to obtain and easily dissatisfied. The shortness of the working season requires a total disorganization of the entire laboring force at the close of each year's work and complete reorganization the next succeeding year.

The foregoing and many other obstacles unknown to construction of irrigation works in plains or prairie regions or in regions of better climatic conditions and geographical location, *require longer periods of time than would otherwise be necessary, reasonable diligence being a question of years as compared with months under ordinary conditions.*" (Pages 5 and 6, Exhibit 179.)

In the *Wheatland area* on the east side of the Laramie Mountains or Black Hills, the easterly border of the Laramie Plains, construction is even less difficult than in the Plains region, as the district is of lower altitude with somewhat longer summers and better general working conditions.

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(2) ADVANCE FINDINGS AND DETERMINATION OF QUESTION OF PRIORITY AND WATER SUPPLY IN WYOMING.

A review of the methods of initiating Wyoming appropriations and the legal effect of the decisions of the State Engineer by granting or refusing permits is essential to a clear understanding of the subject under consideration.

In Wyoming an appropriation is *initiated* by the filing of an application for a permit. This is prerequisite to construction, enlargement or extension of any ditch or diversion system or to performing any work in connection therewith. The state engineer endorses on the application the date of its receipt and notes the same in the records of his office. He then, sitting as a quasi-judicial officer, determines (1) whether or not there is any unappropriated water in the stream which will be available for the proposed project, and (2) whether the proposed use conflicts with existing rights or (3) threatens to prove detrimental to public interest. He has full power to reject the application and thus forbid the appropriator to proceed with the construction of the enterprise.

If the state engineer officially determines *that there is unappropriated water in the stream* from which the proposed diversion is to be made, and *that the proposed use does not conflict with existing rights* (and is not detrimental to public interest), he grants permit for the construction of the enterprise and the appropriator may thereupon (not theretofore) proceed in conformity with the conditions and limitations set forth in the

permit. Priority dates from the filing of the application in the State Engineer's office.

This procedure is in direct contrast with that in Colorado where the appropriator determines for himself whether or not there is unappropriated water and whose filing with the state engineer is a mere record and does not move that officer to detemination of any question in advance of construction. He proceeds to construct as he may be advised and the first official determination of his rights is the decree of the District Court in adjudication proceedings brought for determination of the relative rights of all appropriators from the stream. If the appropriator has used reasonable diligence, his priority is decreed by the Court as of the date of initiation of his appropriation, whether by beginning of survey or commencement of actual construction.

In Colorado all rights of the appropriator are determined after and not before initiation, while in Wyoming the converse is true.

In other words, the State of Wyoming, by and through its quasi-judicial tribunal, the State Engineer, *officially determines certain facts in advance* (1) of permitting any rights of appropriation to attach or (2) any construction to proceed. He officially finds and determines *whether or not there is water to appropriate* and to what degree and in what manner construction may proceed and the law fixes the date of appropriation as the date of the filing of the application for the permit, thereby *also fixing in advance the priority* date of each diversion. This judgment of the state engineer binds the appropriator and the State as well.

On the other hand, in Colorado, experience alone demonstrates whether or not there was unappropriated water in the stream for the enterprise at the time of its initiation and the proof submitted moves the court to the decree which determines the relative priority and extent of each appropriation.

The Wyoming statute was enacted in 1895 and any and all appropriations of water from the Laramie River in that State, during or subsequent to that year, were made only by authority or permit of the state engineer.

Each of these permits were and are quasi-judicial decrees in effect as follows:

(1) That there was ample water supply for all diversions and initiated appropriations from the Laramie River;

(2) That after supplying all such prior appropriations, there remained surplus or unappropriated water in the stream which was available to the new projects;

(3) That the appropriations for which applications were made in no manner interfered with existing appropriations or were detrimental to public interest; and

(4) That all parties granted permits for the Laramie River and tributaries might safely proceed to construct their works to the magnitude and extent set forth in the permits. (3910-19.)

(3) Priority Groups and Natural Classification.

All these appropriations from the Laramie River and tributaries in Wyoming may likewise be considered in three general groups:

(a) Meadow appropriations in the mountain districts near the sources of the Wyoming streams.

(b) Those from the Big and Little Laramie Rivers and other tributaries upon the Laramie Plains, and,

(c) Those east of the Laramie Mountains (Black Hills) and in the Sybille and Chugwater drainage areas.

The Wyoming diversions from the Laramie River fall within two groups or epochs, those prior and those during and subsequent to 1907-8.

We are here considering the priority of the Greeley-Poudre system on the Laramie River in Colorado as compared with the later appropriations in Wyoming, and the discussion is simplified by separating the epochs of the Wyoming appropriations as either prior or subsequent to August 25, 1902 (the date of the Colorado diversion), rather than the year 1908, no new enterprises of any magnitude having been initiated in Wyoming between 1902 and 1907-8.

(a) Meadow Ditches.

The observations under this sub-head of the principal topic, "Appropriations," will here obtain. In other words, the small diversions for the irrigation of meadow lands along the narrow valleys in the mountain districts of both the Big and Little Laramies in Wyoming and Colorado are considered insignificant and offset one another.

(b) Laramie Plains Appropriations.

Within the general priority classification above noted, diversions from the Big and Little Laramie Rivers and other tributaries of the stream in the Laramie Plains region may be further subdivided into three general groups:

Those canals irrigating the river bottoms or first benches along the streams;

Those canals which have been constructed for a long period of years for the irrigation of bench lands, and

The newer enterprises involving the utilization of large natural and artificial reservoirs in process of construction for service of the higher lands of the area.

(b-1) Appropriations Prior to August 25, 1902.

All appropriations within the first two of the last mentioned groups are prior to August 25, 1902, while those in the last group are long subsequent to August 25, 1902, and were generally commenced subsequent to March, 1908, and some of them as late as during 1912, after the filing of this suit.

All of the appropriations initiated upon the Laramie Plains prior to August 25, 1902, had copious supplies of water in considerable part permitted to pass unused after the needs of these earlier canals had been supplied. The State of Wyoming has repeatedly so declared and decreed through its State Engineers by granting permits with new priorities for new enterprises since 1908. So ample has been this supply that no care or supervision of distribution had ever been necessary prior to filing the bill of complaint herein, and all appropriators have been permitted to help themselves to whatever water they chose to divert, even then leaving sufficient in the river to justify the State Engineer in awarding new priorities for new enterprises of great magnitude.

(x) River Bottom Canals.

The earliest irrigation in the region, naturally following the lines of least resistance, was entirely from numerous canals easily constructed for irrigation of the river bottom and first bench lands of the river valley proper (486, 561-2). These canals were constructed for the irrigation of native hay meadows and utilized the water only up to the last of June and never later than July 15th of any year (561-2). Water Commissioner Grant of Wyoming, the first official to ever assume to attempt a careful distribution of water, beginning with the year 1913, testified that a large number of these older ditches are "two story" or "high water" ditches, meaning that at the several points of diversion, the bottoms of such canals are considerably, and in some instances several feet above the bottom of the river, making it physically impossible for the canal to receive water except in times of flood and evidencing the fact that these canals had been constructed and always used for diversion of water from a stream with flow greatly in excess of the demands of all appropriators and not requiring diversion during low flow. A reading of the record will reveal but few declarations to the effect that these canals were ever "short of water," and in each instance the witness admitted that there was ample water in the stream and no difficulty would have been encountered in obtaining sufficient to supply his wants had his canal been properly constructed.

By these smaller canals flood waters are diverted and spread over the meadows in such a manner as to form one con-

tinuous sheet of water, standing upon and to some degree circulating over the land between the canals and the river. This method of irrigation still prevails from the time the canal is opened in the spring until closed in early July to permit the meadows to dry before the hay harvest begins. Doubtless a portion of the water thus diverted returns to the stream and is again used by other appropriators lower down, but that enormous loss occurs through evaporation and that the method is extravagant and wasteful is not seriously questioned.

Among these ditches may be mentioned the several canals used to irrigate the Sodergreen Ranch; the King, Riverside Ditches No. 1 and No. 2; Caldwell and Gardiner, Bush and Holliday, and other canals used for the irrigation of the Riverside Ranch; the Hoge and Haley, Leroy and other ditches used for the irrigation of the Hoge ranch, situate just above the mouth of Sand Creek; the Mansfield Ditch; the Dowling or Bilderbach Ditch, used to overflow a portion of the old Hutton and Hart ranches, and the Oasis canal for the irrigation of meadows belonging to that ranch, all diverting water from the Big Laramie River; the Gillespie, Boughton, Cooper Lake and McGill Ranch ditches on the main Laramie below the confluence of the two principal branches; and the canals for the Millbrook, Alsop and Ernest Ranches, and the other numerous canals used to overflow the broad flood meadows of the Little Laramie region.

This general class of ditches served the greater portion of the acreage under irrigation in Wyoming before the commencement of this suit. After taking their full measure and flooding the Big and Little Laramie valleys with one continuous sheet of water, there still remained ample water to warrant the construction of newer canals for irrigation of higher lands and it is unnecessary to enter the maze of a minute discussion of the list of these many early diversions, as the subsequent diversions in Wyoming, but prior to 1902, not to mention diversions in Colorado as of that date, have no appreciable effect upon the water supply of these river bottom canals.

(*y*) *Early Bench Land Canals.*

The second stage of earlier Wyoming development is evidenced by construction of canals for irrigation of bench lands arising above the river valley proper. These canals are larger but are likewise used primarily for irrigation of native hay land, with methods generally the same as those prevailing under the river valley ditches (866-7.) Practically none of the water from these larger canals returns to the stream, owing to the geological formation of the area, but flows or seeps into depressions, ponds and water-logged areas and in many instances is run

for long periods of time into lakes and depressions having no outlet and, in one instance, with bottom more than one hundred feet below the bed of the river. From these ponds, immense depressions and water-logged areas, the only escape for the accumulated water is by evaporation (489, 2739.)

The superintendent of the Pioneer Canal states that it has been his custom for long years to run from 50 to 60 cubic feet of water in the canal continuously from July 15 to December of each year for the sole purpose of supplying drinking water to about 2,000 head of cattle, running at large in that vicinity, and a few of the 250 people residing under the canal. One cubic foot per second delivers two acre feet every twenty-four hours, and it accordingly appears that it has been the custom of the Pioneer Canal management to run to waste 100 acre feet per day for 150 days (15,000 acre feet annually), in order to furnish drinking water for a few people and cattle in a region already filled with lakes and ponds. The witness states:

> "The people and stock and seepage and evaporation consumed this 50 second feet running constantly. Very little water went back to the river or into the numerous lakes." (See Titus, 967-70.)

The same characteristics of diversion, use and waste apply to all these earlier bench land ditches, including those on the Little Laramie River. Some of these ditches are of considerable size and waste into ponds from which there is no outlet or opportunity of re-use of water for irrigation. The Poverty Flat and Park ditches both waste into Big Basin, a large alkali lake, the bottom of which is from 75 to 100 feet lower than the level of either the Big or Little Laramie Rivers in that vicinity. (2741.) During December, 1913, water was flowing through both the Poverty Flat and Park Ditches to about three-fourths of their capacity, and wasting into Big Basin under guise of so-called "domestic use," in this, one of the dryest seasons experienced in the Laramie Plains region (2742.)

Among these larger canals, so constructed and utilized for diversion of water for some irrigation and great waste, may be mentioned the Pioneer Canal, Fischer, Last Chance and Parker ditches, diverting water from the Big Laramie River near Wood's Landing, some 75 miles (547) by river meander below the Greeley-Poudre tunnel (486-8, 492), and the Loback, Bellamy, Millbrook, Hecht, Hecht and Farrell, Poverty Flat and Park canals from the Little Laramie River.

The Pioneer Canal is alleged to have served as high as 18,000 acres during 1902 (863), but so unprofitable was the attempted agriculture under the canal that the acreage served in 1913 had fallen away to 11,556 acres (844) and but 250 people resided within the area served by it and the other men-

tioned canals diverting water from the Big Laramie River (872.)

This Pioneer Canal is alleged to have been constructed in 1879 or 1880. Its opportunity of diversion has been so unlimited that it has not only poured its copious supply over its grass lands and filled its waste lakes and ponds for annual loss by evaporation, but, in addition thereto, it has been permitted, without protest, to divert and waste annually 15,000 acre feet of the ample supply of water in the Laramie River after all necessity of irrigation in the region had passed. The decided contrast between this canal with its copious supply and prodigal diversions of water and the Larimer & Weld Canal (Eaton Ditch) in the Cache la Poudre Valley can best be comprehended by inspection of the albums of photographs taken within the two areas and introduced in evidence as Defendants' Exhibits 115, 116 and 120. See also photo albums, Defendants' Exhibits 119, 122. The more striking becomes the contrast when it is observed that the history of the Larimer & Weld canal has been one continuous contest for but a part of the water supply required to reclaim its lands, upon a stream administered under most rigid police supervision by river commissioners, as compared with the copious supply of the Pioneer Canal whose diversions have always been made without supervision or restraint, either in point of time, quantity or duration.

The above mentioned canals, diverting water from the Little Laramie River, have received as copious supplies as have the canals from the Big Laramie, and the enormous waste from all these diversions verifies the judgment of the State Engineer of Wyoming in declaring, by granting additional permits, that ample water is available for appropriation and diversion after the demands and claims of *all* prior appropriators have been supplied.

During 1913 a careful plane table survey of nearly all the irrigated lands in the Laramie Plains region (with the exception of some distance below the confluence of the Big and Little Laramie Rivers at Two Rivers) was made for defendants by an engineering party under the direction of the State Engineer of Colorado and the immediate supervision of his deputies, Engineers McAnelly and Woodhall. This survey occupied the entire summer season of that year, and its detailed accuracy is evidenced by defendants' Exhibit 114. A hasty reconnaissance, without instruments, was made of the same areas by the Laramie Water Company's surveyor, R. I. Meeker, with fairly confirmatory results. The lands served by the new enterprises initiated during 1908 and subsequently were likewise included in the totals of the acreage thus compiled.

This careful investigation reveals the fact that during 1913 there were but 78,999 acres of land irrigated from the

Laramie River and its tributaries in the Laramie Plains region, consisting of the lands served from the Little Laramie and its tributaries, and by canals diverting from the Big Laramie and its tributaries, and also from the main stream below Two Rivers and above Wheatland Reservoir (2790-1.)

The greater portion of this acreage was under irrigation and served by the old canals before initiation of either the Greeley-Poudre project in Colorado or the new Wyoming projects which we will later consider.

The granting of recent permits by the several State Engineers of Wyoming and the coincident decree that there was water supply in the stream, the large flow of the rivers as shown by the hydrographic data compiled by experts Prof. L. G. Carpenter, John E. Field and others, and the history of the entire Wyoming irrigated acreage as given by its own witnesses, are sufficient to justify us in concluding that the Greeley-Poudre enterprise, with its comparatively small diversion of but a part of the flow of the Colorado portion of the stream can work no substantial injury upon or interference with these older appropriations, the unnecessary and prodigious waste from which more than equals the sum total of the Colorado diversions. We will therefore pass all these older Wyoming canals without further consideration and will confine our discussion to the more recent enterprises, all of which were initiated long subsequent to the Greeley-Poudre system in Colorado, but which stand as accepted and approved appropriations within her borders by the complainant, State of Wyoming.

(*b-2*) *Appropriations Subsequent to August 25, 1902.*

The third and last group of the Laramie Plains diversions primarily includes several large reservoir enterprises. This period constitutes the third and last stage of Laramie Plains construction. It is the epoch of reservoir building. Following construction of the older canals, there was no important irrigation development on the Laramie Plains until about 1908. Prior to that year the region had contented itself with its existing diversions, carried on without the slightest supervision and with ample water both for use and waste.

During the spring of 1908, the Arnold Engineering Company of Chicago entered the field and commenced a series of surveys and at about the same time others of speculative tendencies undertook the promotion of new enterprises. The efforts of this engineering concern and those other parties whose activities were evidently awakened by its entry into the field, by various processes of consolidation, later took the form of two new systems, commonly known as the James Lake or Talmadge-Buntin system, and Lake Hattie or Laramie Water Company's system.

One small private enterprise was initiated immediately prior to the James Lake and Lake Hattie projects, and is known as the:

(m) Sodergreen High Line.

In November, 1907 (445), Oscar Sodergreen commenced the survey of a canal from the Big Laramie River at his ranch near Woods Landing at the upper extremity of the Laramie Plains. On December 27, 1907, he filed application for permit for the Sodergreen High Line Canal, and on April 14, 1908, it was approved by the State Engineer of Wyoming with priority as of December 27, 1907, and granted permit No. 8328. Construction was completed during 1910 (3962, 418, 445). The canal was constructed by Sodergreen for native hay irrigation on about 3,400 acres (2790), and was used without supervision and at its owners' will during the season of 1911 and 1912, and up to July 1, 1913. (446.)

No claim for earlier priority is made on behalf of the canal. Irrigation of native hay ceases with the close of the flood flow in the latter part of June and the early part of July of each year. This fact, coupled with the small acreage to be served, justifies passing this canal without further consideration.

(n) Lake James System.

The Seven Mile Creek drainage lies immediately adjacent to and north of the Little Laramie River. The creek flows down the Medicine Bow Mountains and, after serving a small acreage of meadow land in its valley, of nature discharges its waters into James Lake, a natural basin with no outlet save in exceptional years when the same overflowed and discharged into the Laramie River through the water course of Four Mile Creek, the next adjacent stream. It required the mere excavation of a cut through a narrow earth rim and installation of outlet works to convert this large natural body of water into an active storage reservoir. It is to a large degree filled with corresponding ease from the Little Laramie by extension and enlargement of the old Bellamy Canal, and naturally serves a large acreage easy of access by ditches constructed upon the open plains. The self-evident ease and economy with which the entire enterprise could be promoted and constructed, along with the equally available Lake Hattie Reservoir system which we shall hereafter consider, naturally appealed to eastern parties seeking opportunities of promotion, and accordingly Trowbridge and Niver of Chicago sent The Arnold Engineering Company into the field during the spring of 1908 and initiated the first and

initial surveys looking toward the ultimate construction of the scheme. (650.)

March 22, 1908, Z. E. Sevison, engineer for The Arnold Engineering Company, commenced survey on the James Lake project for utilization of the basin as a storage reservoir for water from Seven Mile Creek and also from the Little Laramie through an extension and enlargement of the Bellamy Canal. (638.) Wyoming admits that "the original surveys for the project were commenced on March 22, 1908," on page 75 of her brief. This admission, in turn, of necessity admits that all work by Sevison and his successors was junior to this date, as we shall hereafter observe. In due course, these efforts of Mr. Sevison were followed by filing of applications for permits for leave to construct the enterprise and praying investigation and approval of the water supply by the State Engineer of Wyoming. These applications were filed in the name of G. S. Speer of Chicago, having to do with the financial part of the project and in some way connected with Trowbridge & Niver, a brokerage concern promoting and selling irrigation district bonds in that city. (651.) In due course, the State Engineer of Wyoming adjudged that there was ample supply in Seven Mile Creek and the Little Laramie River, after supplying all prior diversions, to warrant the granting of permits, and accordingly, during May, 1908, issued permits Nos. 8385-9, and 1279 Reservoir to G. S. Speer, authorizing the construction of the James Lake system as of priority dates March 27, April 23, and May 1, 1908. (3962.)

On February 20, 1909, the State Engineer granted further permit No. 1872 Enl. to G. S. Speer to divert the water of Four Mile Creek into James Lake Reservoir, as of priority dated February 17, 1909.

Following the granting of the above permits, the Laramie Valley Irrigation District, commonly known as the "Talmadge-Buntin District," was promoted by Talmadge and Buntin (594-5, 631) with the idea of including in one project the river bottom lands on the east side of the main Laramie River below Two Rivers, theretofore served by the old Oasis Canal diverting water from the Big Laramie River, along with the new lands available for service by the outlet canals to be constructed from the James Lake Reservoir. This district was surveyed as a part of the general project by Mr. Sevison during the earlier part of 1908. (608-9.) He made a topographic survey of the lands under the Oasis Ditch as well as those under the old Cooper Lake Ditch which were likewise absorbed into the general scheme. (619-22.)

Construction followed survey and general organization of

the scheme. The old Bellamy Canal was enlarged and extended to fill the reservoir from the Little Laramie River, and the reservoir was constructed to a capacity of 41,100 acre feet. (632.) The outlet canals were constructed. The feeder ditch from the river to the reservoir was not completed until 1911, but was sufficiently complete to turn some water through during 1909. (634.) About 18,000 acre feet of water were stored in the reservoir during 1909 and about 10,000 acre feet in 1910. (635.) About 30,000 acres of land were included in the project on the west side of the river and intended for irrigation from the reservoir. (543.) During 1909 many settlers occupied a portion of the land, but in 1912 there were only about half as many settlers under the project as there were in 1909 (644), and in 1913 only a small portion of the land theretofore plowed was in cultivation and the whole project was practically abandoned, although there was ample water for their irrigation.

Subsequent to the original permits, the State Engineer issued further and additional permits, Nos. 8874, 1971-2 Enl., and 2325-6 Enl., from the Big Laramie River through the old Oasis Canal and from the Little Laramie River by way of the Bellamy and James No. 1 Canal. These permits were issued to The James Lake Irrigation Company, the successor of G. S. Speer, the original promoter, and have priority dates as of May 6 and November 24, 1908, and November 19, 1910. (See Table 3962, p. 1174 Abstract.)

All of construction authorized under these permits was certified and recorded as completed in the office of the State Engineer during the years 1909 to 1912, inclusive. (3962.)

A close analysis of the priorities of the project requires a consideration of each of the aforementioned permits with its respective priority date, but for convenience we shall treat the entire project as entitled to priority of date of beginning of the initial survey, March 22, 1908, rather than March 27, 1908, the date of filing of the first application for permit, for better comparison with the Colorado priorities, which date as of the commencement of survey or construction, which method we shall likewise follow in dealing with the many other surveys which we will hereinafter consider.

Of all the new projects constructed in Wyoming, the James Lake System probably involved the least expenditure of time, labor and money. The natural reservoir needed but little work to convert it into an immense storage basin, while all excavation was of mere prairie earth, and easy of access to a trans-continental railroad.

Almost six years from August 25, 1902, had elapsed before the Trowbridge & Niver brokerage and promotion company of Chicago caused The Arnold Engineering Company to send Mr.

Sevison into the Laramie Plains to begin his survey of the James Lake enterprise (also Lake Hattie system). This survey commenced on March 22, 1908, was of the same initial character as that commenced by Engineer Beach on August 2d, 1902 on the Greeley-Poudre system, and in no part of the record is there any assertion that any previous survey of the James Lake system had ever been made or even contemplated, but, on the contrary, Mr. Sevison asserts that he went upon the enterprise under exclusive direction of the foreign promoters then entering a new field for the purpose of initiating, planning, promoting and constructing this and the other enterprise.

This was the first and earliest of all the new reservoir projects upon the Laramie Plains. The Lake Hattie Reservoir follows immediately thereafter with others still later, but with the initial survey on March 22, 1908, the new epoch of construction opened within this region, and not before.

(*o*) *Laramie Water Company or Lake Hattie System.*

Trowbridge and Niver of Chicago, not content with the promotion of the Lake James enterprise, included the greater part of what is now called the Lake Hattie system in their field of investigation and promotion during the spring of 1908.

This work was likewise placed in the hands of the Arnold Engineering Company of Chicago, and under the immediate direction of Engineer Z. E. Sevison, who says:

> "From March 22, 1908, until September 1, 1909, I was resident engineer for the Arnold Company on all their work here," (referring to the Laramie Plains) "including the James Lake project and the Lake Hattie Project." (605.)

Mr. Sevison performed the initial engineering upon the Lake Hattie system, now owned by the Laramie Water Company. (645).

April 16, 1908, he commenced the first survey. To use his own words:

> *"Began* the work *April 16, 1908;* surveyed first Lake Hattie Reservoir, then the intake canal from the Laramie River" (referring to Big Laramie) "also preliminary surveys for outlet canals and distribution system. These surveys continued with slight interruptions for a little over a year. The final location of the canals was started about May 1, 1909." (646.)

Further, concerning this initial work on the Lake Hattie system, he said:

"At the time I began these surveys, on April 16, 1908, I was working for the Arnold Engineering Company. Mr. Rosecrans instructed me to start. He was chief engineer for the Arnold Company. I was in Laramie when I received the order, where I have been since March, 1908.

This project was surveyed by the same field party that surveyed James Lake. We shifted back and forth from one project to another. This preliminary work was under my immediate supervision. I know a man by the name of G. S. Speer. He was from Chicago. He had something to do with the financial part of the project.

The Arnold Engineering Company was doing this work up to about the first of June, 1908, for Trowbridge and Niver of Chicago." (651.)

Of procedure, he said:

"The *first survey* was made *at* the *reservoir site* to see if it was feasible. * * * My work was largely preliminary work on the Lake Hattie Reservoir; work that is usual on any project of any size. My time was taken up with that instead of final contouring and similar work." (653.)

"*After* I had worked *on the reservoir* I went over to work on the *inlet canal,* being the canal from the Big Laramie River to the reservoir. I moved my party over to go to work on the inlet ditch a week afterwards. I was 4 days in locating the lower or final line as the feasible one.

The country between Lake Hattie and the river is very easily surveyed. Most of it is across a table land that is quite uniform. * * * The ditch follows the line which would be run by a level. * * * I had an unlimited field in which to work, without any obstacles." (654.)

"The final location and line was made in May, 1909. At that time I staked out all these final lines." (658.)

As indicative of the fact that this whole survey was a matter of first impression, Mr. Sevison says:

"No old maps were given me that I followed and no old surveys." (661.)

The Lake Hattie and the Lake James projects are quite similar. As Mr. Sevison stated, the country between the river

and Lake Hattie is mere level prairie, very easily surveyed, and the ditch was surveyed along the line naturally run by a level, requiring no tunneling or heavy cutting and giving an unlimited field in which to work without any natural obstacles. The lower end of the inlet was constructed by merely running water through a small ditch which naturally eroded into the ground. All of other inlet ditch excavation was done with a "drag-line" at the low price of thirteen cents per cubic yard. (654-5). In this drag-line work, the dirt was deposited on both the upper and lower sides of the ditch which was made by simply cutting across the flat prairie. (457).

The dam at Lake Hattie was made from earth borrowed in the vicinity of the structure. It is a short dam of only 36 feet maximum height and required the placing of only 180,000 cubic yards of earth. (658).

Of work on the outlet ditch, he says:

> "All work on the main outlet canal, and on the north and south canals, was the ordinary small ditch building,—entirely plain earthwork, no tunnels or rock work or flumes or anything of that sort." (660.)

Mr. Sevison concludes his description of the character of construction as follows:

> "The whole Lake Hattie system was one of remarkably small cost and economical construction." (660.)

As Mr. Sevison proceeded with his work of initial surveys upon this Lake Hattie project, he recorded his findings, thus of first impression, by filing with the State Engineer of Wyoming applications for permit for each unit as he proceeded. These were in the name of G. S. Speer of Chicago (Trowbridge and Niver) as claimant, but under the certificate of Mr. Sevison.

The first and initial application was filed April 21, 1908, and is entitled "Map of Lake Hattie Reservoir and Supply Canal." (Defendants' Exhibit 159.)

The second was filed May 11, 1908, for an appropriation by the Lake Hattie Reservoir through the supply canal described in the filing of April 21, 1908. (Defendants' Exhibit 162.)

On September 11, 1908, application was made for the outlet canal system from Lake Hattie. (Defendants' Exhibit 161.)

And again, on September 18, 1908, the progress and enlargement of the surveys of Lake Hattie as first conceived in April of that year was evidenced by filing application for permit for a much larger reservoir, entitled "Enlargement of Lake Hattie Reservoir," wherein all rights claimed by the earlier April and May filings for smaller Lake Hattie Reservoir were included

by reference. (Defendants' Exhibits 163-164; see also Exhibit 165.)

With each of these applications is appended a map and plat prepared and certified to by Mr. Z. E. Sevison, wherein he certifies that the first map (Lake Hattie Reservoir, Exhibit 159) was made from notes taken during the actual survey, *beginning April 16, 1908*, and the last by surveys made on September 10-12, 1908.

For convenience of the court, these and all other exhibits concerning the Lake Hattie System have been photographed and bound in a volume as a part of the record, and the general expansion of the ideas of Engineer Sevison as he worked through the summer of 1908, following his initial surveys in April, is best observed by inspection of the maps attached to these exhibits.

Mr. Sevison finally filed his map of the Lake Hattie Reservoir on final survey made June 1, 1909, in behalf of "The Lake Hattie Reservoir & Irrigation Company" by him as engineer for The Arnold Company of Chicago. This map speaks for itself. (Defendants' Exhibit 165, part 1.)

Mr. Sevison states that he also made a preliminary survey of the Boswell or Robertson-McConnell Reservoir in June, 1908 (evidently intending to state October 26, 1909, see certificate, part 1, Exhibit 177), for the purpose of checking the possibility of the construction of a dam at the upper end of the canon which the Big Laramie enters immediately after leaving the interstate line, and to ascertain the possibility of utilizing the waters thus conserved through the Lake Hattie System.

(647.) He, however, says of this survey:

> "The work of construction has never commenced on it, other than mere survey." (663.)

Nothing was done toward claiming any rights for the Boswell or Robertson-McConnell Reservoir at that time and it was treated with indifference until minds of still greater promotive imagination came to have control of the project. In fact, there is no evidence that anything but a mere investigation of the dam site was made by Mr. Sevison under direction of the original promoters. Subsequent parties, however, did apparently enter upon a survey and we find them filing application for a permit during 1911. (Defendants' Exhibit 177.) This application, however, was made by one H. M. Hedges and in the certificate attached to part 1 of Exhibit 177, he certifies:

> "On January 10, 1911, I made surveys verifying this map and the statements thereon and they are correct of my own knowledge; that I am the locating engineer em-

ployed by the Laramie Water Company, the applicant herein."

This permit was granted on January 24, 1911, but nothing further came of the whole scheme save that it stands as a permitted claim upon the stream, decreeing on behalf of Wyoming that an ample water supply exists to fill it after supplying all prior appropriations, and that no prior appropriators on the Laramie River would be injured by its construction. We shall treat further of this reservoir.

The entry into the field of the engineering party sent out by the Chicago promoters evidenced the possibility of profits to those undertaking construction of projects such as Lake Hattie and Lake James. This set in motion and aroused the cupidity of other promoters desiring equal opportunity for handsome profits at small initial expense, and we witness the entry of E. J. Bell, Francis C. Grable and F. S. Wendelkin of the Rocky Mountain region in the several capacities and under the names we shall hereafter mention.

These promoters on June 29, 1908, filed their first and initial application for permit for the Stewart Canal to divert water from the Little Laramie River, wherein their engineer, C. C. Carlisle, certifies that he *commenced his survey on June 22, 1908.* (See map, Defendants' Exhibit 170.)

In rapid succession thereafter these new promoters, operating in the name of E. J. Bell and The Interstate Reservoirs and Construction Company, recorded the several epochs of the expansion of their ideas by filing applications as follows: July 6, 1908, Bell Supply Ditch No. 2, for the diversion of water over the divide from Douglass Creek of the North Platte drainage into the head-waters of the Little Laramie of Laramie River drainage, upon surveys initiated June 26, 1908 (Defendants Exhibit 173); July 19, 1908, for the Bell Reservoir (never constructed) for storage of water from the Little Laramie River through Bell Supply Ditch No. 1, and predicated upon surveys certified to begin June 2, 1908. (See Defendants' Exhibit 168, and map with engineer's certificate.)

These parties also included the Bath Reservoir, for which survey, according to the application for permit filed September 15, 1909 (Defendants' Exhibit 171), was commenced by the Interstate people *August 30, 1909.* Permit to construct was granted by the State Engineer August 11, 1910, for construction of a reservoir with an authorized capacity of 37,604 acre feet to be filled from the Little Laramie River. No construction work has ever been done.

Interlocked with the promotion upon the Little Laramie, The Interstate Reservoirs and Construction Company (Bishop, 797) projected a scheme for irrigation of lands from the Big

Laramie River. In 1910 this company filed application for permit for the Interstate Canal No. 2 (Defendants' Exhibit 176) to divert water from the Big Laramie River for the irrigation of 22,544 acres. This application purported to be based upon surveys made by one W. B. Schilling *commencing July 1st, 1910,* and the map accompanying the same shows an intent to reclaim lands on the south side of the Laramie River in the vicinity of Hutton and Creighton Lakes.

No action was taken upon this permit by the state engineer until the 28th day of January, 1911, and in granting the same he classes the same as an appropriation secondary to the Robertson-McConnell Reservoir, which, in the interim, had come into title of The Laramie Water Company.

The same Interstate Reservoirs and Construction Company on December 12, 1910, filed its application for permit for the Sand Creek Diversion Canal for the purpose of diverting water from Sand Creek and conveying and discharging the same into the Interstate Canal No. 2 as an additional source of supply. This permit was likewise held without action by the state engineer until January 28, 1911, when the same was granted as supplemental to the permit No. 10364 for the Interstate Canal No. 2.

It will thus be observed that the entire recent Laramie Plains development had its initiation with the coming of the survey party from the office of The Arnold Engineering Company in Chicago at the instigation of the irrigation bond brokerage house of Trowbridge and Niver of that city in March, 1908, and that the *first survey to be made commenced March 22, 1908,* upon the Lake James Reservoir; that the *next survey initiated* by The Arnold Company was *on April 16, 1908,* upon the Lake Hattie Reservoir. This in turn was followed by initiation of the Little Laramie development by the E. J. Bell claims and applications for permit predicated entirely upon surveys the earliest of which began on *June 22, 1908* (Stewart Canal), and lastly parties interlocked with the Little Laramie development still expanding their ideas, filed applications for development of land on the south border of the Laramie Plains and south of the Big Laramie River, predicated upon surveys alleged to have been first commenced *July 1st, 1910.*

In the interim between the March and April, 1908 work upon the Lake James and Lake Hattie systems by Engineer Sevison for the Chicago promoters, and the filing of the claims by The Interstate Reservoirs Construction Company last above mentioned, the Lake James and Lake Hattie projects passed from the Trowbridge and Niver concern. The Lake Hattie system passed into the control of The Lake Hattie Reservoirs and Irrigation Company, headed by Mr. George Rebertson of

Shamokin, Pennsylvania, and Senator McConnell of Shamokin, who was also interested in the Company. (665, 799.)

It should here be noted that Messrs. Robertson and McConnell of Shamokin, Pennsylvania, had no interest in this project until long after the initial surveys in March and April, 1908, and that they are apparently the gentlemen after whom the Robertson-McConnell Reservoir is named, giving evidence of the fact that that structure was really initiated for the first time after the arrival of these gentlemen as members of the holding concern.

By the beginning of 1910 the James Lake project had divorced itself from the original Chicago promoters, termed by Engineer Bishop for Wyoming "the ring connected with Trowbridge and Niver of Chicago." (799.) The lands had been formed into the Laramie Valley Irrigation District or "Talmadge-Buntin" project and the construction work had been largely completed under an entirely different management from that which assumed control of the Lake Hattie and other projects. (631-4.)

The Lake Hattie system had also passed from the "ring connected with Trowbridge and Niver" headed by G. S. Speer, into the control of The Lake Hattie Reservoir and Irrigation Company.

E. J. Bell, Francis C. Grable and F. S. Wendelkin and their company, The Interstate Reservoirs Construction Company, were still in control of the Little Laramie schemes, including the inter-watershed diversion from Douglas Creek of the North Platte drainage and also of the Interstate Canal No. 2 scheme for the diversion of water from the Big Laramie River, all of which were as yet mere surveys and imaginary projects upon which no construction had been done.

Some work had been done upon the Lake Hattie Reservoir project, but, taken as a whole, all but the James Lake project were still in embryonic condition.

The old Pioneer Canal, as we have previously observed, had been in operation for a great many years and had brought under reclamation, and in a considerable measure water-logged and ruined, a large portion of the irrigable lands beneath its line by prodigal use of water plentifully obtained without stint or supervision from the Laramie River and copiously supplied, even to the extent of imaginary consumption by animals and men of enough water to annually cover 15,000 acres with water one foot deep, at times when no need of diversion existed. This canal was located at the upper portion of the Laramie Plains where the Laramie River emerges from the mountains and at the point of least resistance for canal construction. It followed at the foot of the mountains that here arise almost abruptly from the Laramie Plains and formed a natural site

for canal line for diversion of water of the Big Laramie for irrigation of that portion of the Plains lying between the Big and Little Laramie Rivers. (940.)

When the Arnold Company sent their engineering party out from Chicago to reconnoiter and locate promotion schemes for the Trowbridge and Niver concern in the early part of 1908, Mr. Sevison, their local directing engineer, then entirely new to the territory and working entirely on first impressions, in seeking the best location for the canal to fill the Lake Hattie with waters from the Big Laramie, ran three preliminary lines and found that the old Pioneer Canal occupied the most strategic position for use, by enlargement, with the new project. (652.)

At that time the Chicago promotion "ring" had absolutely nothing whatever to do with the Pioneer Canal, but Mr. Sevison found that it would be more economical to enlarge the Pioneer Canal for only a short distance in the upper part of its course as the upper part of the new inlet for the new Lake Hattie scheme "provided satisfactory arrangements could be made for the use of the Pioneer to Sodergreen Lake." (652.) The old Pioneer Canal then had the capacity of about 300 cubic feet per second (656) and it was necessary to enlarge the upper portion in order that the use of the canal for service of its own lands should in no way be interfered with.

In May, 1909, the then promoters of the Lake Hattie project concluded an arrangement with the Pioneer Canal Company for the purpose of purchasing its remaining stock and interests in order that it might have control of the old Pioneer Canal for purpose of enlargement. (922.) That portion of the old Pioneer Canal south and west of Sodergreen Reservoir was relocated for about a mile in length and the enlargement began on July 17, 1909. (656, 646.) The old Pioneer Canal was here straightened and given a better alignment and was made larger by widening and excavating to the upper side, the old and lower embankment being left in place. By using the materials so borrowed from the upper side of the canal for raising of the lower embankment, and by the widening of the canal, the capacity was increased so that the new structure, so first conceived by Mr. Sevison in his 1908 surveys, was finally completed to a capacity of about 1,200 cubic feet per second. The canal was in no way disturbed beyond Sodergreen Lake (See Defendants' Exhibit 1) from which point the new canal branched off and ran northwesterly to the Lake Hattie Reservoir and at Sodergreen Lake bifurcation or division works were installed so that water pertinent to the new 1908-9 scheme could be segregated from the commingled waters belonging to the old Pioneer Canal appropriation and the latter carried in its old channel for distribution to its old water consumers. (656-7.)

During 1910 a general combination was conceived of all the embryonic enterprises upon the Laramie Plains, with the exception of the theretofore divorced James Lake project. Up to that time the work of The Interstate Company had been largely engineering. This general merger took form under the supervision of one Goldsborough, an engineer who had recently arrived from the East, and who operated under the name of The Goldsborough Engineering Company. Engineer Lyman E. Bishop was placed in charge as resident engineer on July 1, 1910.

On July 1, 1910, construction work had been done on the enlargement of the upper end of the old Pioneer Ditch, but none on the diversion works in the Big Laramie; the new canal from the point of departure from the old canal at Sodergreen Lake had been partly completed and some work had been done on the dam and outlet canal of Lake Hattie Reservoir. (776.)

The Interstate Reservoirs and Construction Company still controlled the original filings and permits for the entire Little Laramie system, under direction of E. J. Bell, one of its moving factors, and had charge of the proposed Interstate Canal No. 2, in which scheme Francis C. Grable and F. C. Wendelkin were prominent. (Bishop, 797-9.) Nothing but mere pretense of so-called "assessment work" had been in any way performed by the Interstate group of promoters upon any portion of their several schemes. Desultory efforts had been given to promotion and engineering (799) and the Lake Hattie project had not assumed its permanent form and its plans were still in a large measure incomplete, no diversion having been planned, much less surveyed, from the Little Laramie River, and no surveys had been made save merely for the reservoir and a part of its outlet canals, and the new inlet from the Big Laramie, only a part of which had been constructed.

From July 1 to December 1, 1910, small and insignificant, miscellaneous surveys were carried on by The Lake Hattie Reservoirs and Irrigation Company, successors to the Trowbridge and Niver concern, under the direction of Mr. Bishop (777), and included a new canal from the Little Laramie River, which we will next consider.

December 1, 1910, the Lake Hattie system, theretofore contemplating merely the use of the Lake Hattie Reservoir for storage and distribution of waters to be diverted by a new inlet canal directly from the Big Laramie River, was merged with The Interstate Reservoirs and Construction Company and the E. J. Bell promotion schemes, the merger taking form under the name of The Laramie Water Company, which has ever since continued as the owner thereof. (778.)

Beginning with December 1, 1910, the Goldsborough Company assumed active control of engineering of all the many units of the general combined scheme and in addition laid out new units not previously contemplated by any of the various promoters. An application for permit was filed *December 5, 1910* (Defendants' Exhibit 166), for an *inlet canal for Lake Hattie Reservoir from the Little Laramie River,* known as Lake Hattie Supply Canal No. 2.

Lyman E. Bishop, engineer for the Goldsborough Company, states that he located this Lake Hattie Supply Canal No. 2 in August, 1911 (774). Upon the map accompanying the application for permit for said canal, the certificate of the surveyor states that the surveys were commenced July, 1910, which would be the earliest date for which claim of initial survey could possibly be made for this Little Laramie diversion for the Lake Hattie system.

The Laramie Water Company also acquired whatever stock its predecessors had held in the old Pioneer Canal Company, so that this new company secured control of practically all the principal irrigation between the Big and Little Laramie rivers, combining all schemes of every promoter, entering the region since 1908, into one general scheme. It then proceeded under direction of the Goldsborough Company to continue with some of its new construction upon some portions of the project, noticeably completion of the new inlet and outlet canals and dam of the Lake Hattie Reservoir; construction of Lake Hattie Supply Canal No. 2 so first surveyed in July, 1910, and some work upon Stewart Canal and Bell Supply Canal No. 2. All of the remainder of the many units included in the general merger were permitted to lie dormant in the form of mere surveyed lines.

In addition, however, the company proceeded to survey Bell Reservoir No. 3, contemplated for construction across the channel of the Little Laramie River, making application for permit December 5, 1910, and accompanying the same with plats (Defendants' Exhibit 172), wherein the engineer certifies that the surveys were *commenced September 4, 1910.* Permit was granted by the State Engineer of Wyoming, January 25, 1911, for the construction of the reservoir with capacity of 5,121,988,144 cubic feet to be filled from the Little Laramie River. No actual work was ever done upon this project, and, while incomplete, it nevertheless remains an adjudicated right to divert as of priority of 1910 from the Little Laramie River to the extent of its capacity and a proclamation that there still existed sufficient unappropriated water to fill the same.

On May 12, 1912, long after the filing of this suit, and while the adjudication for priorities for water rights was going on before the District Court of Larimer County, Colorado, at Fort

Collins, and the testimony in the case was being prepared, The Laramie Water Company began the survey of a new lateral from their new Lake Hattie Supply Canal No. 1, leaving that canal just above the point of discharge into Lake Hattie and continuing on around the Reservoir basin on a grade line. This new lateral they designated as the "Pioneer Highline," and, in the language of Lyman E. Bishop, the engineer who made the initial survey, "was made for the purpose of serving land immediately north of Lake Hattie Reservoir and all the land in Big Hollow and land on the south limb of Big Hollow, which is above the north canal." (796.) The line of this canal intercepts and crosses the Lake Hattie Supply Canal No. 2. (785-795.)

Application for permit was filed July 11, 1912, and was accompanied by a map. (Exhibit 160.) By the terms of this application it was guaranteed and assured that this new line of canal, if ever constructed at all, would be no additional draft upon the river, but would simply aid in the distribution of water theretofore appropriated by various permits granted the several predecessors of The Laramie Water Company, none of which had ever displayed any reference by maps, words or figures to any such a scheme as this so-called "Pioneer Highline." In the application they specifically limit themselves in the following language:

> "It is understood that nothing contained in this permit shall be construed as meaning the additional appropriation of any amount of water in excess of the total amount of water covered by permits heretofore issued as a part of the Laramie Water Company's system."

We shall give thorough consideration to this mythical canal in answering portions of the brief and argument for the plaintiff State of Wyoming, and, at present, let it suffice to say that no construction and no activity, other than mere survey and filing of the permit, have ever taken place upon the canal. The evident purpose of its survey and filing as an after-thought becomes more apparent on thorough consideration.

At the taking of testimony, 1913, the Lake Hattie Reservoir and its inlet from the Little Laramie River, Lake Hattie Canal No. 2, had been completed, while the enlargement of the extreme upper portion of the old Pioneer Canal, and Lake Hattie Supply Canal No. 1, carrying water from the enlargement of the old Pioneer to the reservoir, had not been fully completed, but had been used for the diversion and carriage of water since July, 1911. The main outlet canal, with its two branches, for the reservoir, had been completed (779), the intermountain diversion from the North Platte to the Little Laramie, known as Bell Supply No. 2, was but 15% complete, and the excavation on the Stewart Canal was only about two-thirds

complete. Other than this, all the rest of the units so merged into the general scheme of The Laramie Water Company had remained dormant and with no construction upon any of them.

The many separate permitted appropriations of water from the Big and Little Laramie rivers, combined and merged under The Laramie Water Company, *all dating of and subsequent to April 21, 1908*, were enumerated by R. I. Meeker, an employee of The Laramie Water Company. Upon request, he produced all these permits for inspection, but plaintiff did not see fit to offer any of them in evidence (for plaintiff to have done so would have been an admission of the fallacy of any contention of seniority over the Colorado project), and it became necessary for the defendants to procure certified copies of the same. (Defendants' Exhibits 159 to 178 inclusive.)

It is admitted by plaintiffs that the permits enumerated by Mr. Meeker (1070-1, 3919-39), include *all of the permits and authority under which The Laramie Water Company* asserts any claim of appropriation for water for the Lake Hattie Reservoir system from either the Big or Little Laramie rivers in Wyoming. In other words, these permits represent all and the only authority of that company to construct irrigation works diverting water from these streams in Wyoming and of necessity the priority of each of these units is represented by the permit under which the same is authorized. *An inspection of the permits reveals the fact that Mr. Sevison's survey, commencing April 16, 1908, is the earliest initial act under which any of these canal or reservoir schemes were commenced,* or even contemplated, by their several promoters, and the evidence adduced by Wyoming witnesses proves conclusively that actual construction has taken place under but few of these many permits and that the claims predicated thereupon relate exclusively to the initial surveys rather than actual construction.

Arranged in order of priority, as represented by date of filing, these numerous permits of The Laramie Water Company's system (1070-1, 3919-29, Defendants' Exhibits 159 to 178), being the only and all the authority of that company to construct any part of their system, are as follows:

Date of Filing	Permit Number	Name of Ditch or Reservoir	Stream	Defts.' Ex. No.
April 21, 08	8612	Lake Hattie Supply Canal	Big Laramie River	159
May 11, 08	1372 Res.	Lake Hattie Reservoir		162
June 29, 08	8521	Stewart Ditch	Little Laramie River	170
July 6, 08	8519	Bell Supply Ditch #2 (Inter-watershed)	Douglas Creek over into Little Laramie	173
July 19, 08	1331 Res.	Bell Reservoir	Little Laramie and Douglas Creek	169
July 19, 08	8518	Bell Supply Ditch #1	Little Laramie	168
Sept. 11, 08	8613	Hattie Canal No. 1	Big Laramie	161
Sept. 18, 08	1939 Enl.	Enl. Lake Hattie Canal #1		164
Sept. 18, 08	1373 Res.	Enl. Lake Hattie Res.	Big Laramie River	163
July 3, 09	2113 Enl.	Enl. Pioneer Canal	Big Laramie River	165
Aug. 30, 09	10364	Interstate Canal #2	Big Laramie River	176
Sept. 15, 09	1883 Res.	Bath Reservoir	Little Laramie River	171
Oct. 15, 09	2051 Res.	Robertson-McConnell Res.	Big Laramie River (across channel at interstate line)	177
Dec. 5, 10	10363	Lake Hattie Supply Canal #2	Little Laramie River	166
Dec. 5, 10	2052 Res.	Bell Res. No. 3	Little Laramie River	172
Dec. 12, 10	10365	Sand Creek Diversion Canal		178
March 7, 12	11016-22	Bell Supply Ditch No. 2 (Inter-watershed diversion)	Douglas Creek to Little Laramie and Lake Hattie	175
March 7, 12	2538 Enl.	" "	" "	174
July 11, 12	2719 Enl.	Pioneer Highline Canal Enl. Lake Hattie Supply Canal	Big and Little Laramie Rivers with condition for return of equivalent amount of water back to stream	160

Separated into groups, according to the stream from which the diversion is made, we have:

Date of Filing	Permit Number	Name of Ditch or Reservoir	Defts.' Ex. No.
		Big Laramie River	
April 21, 08	8612	Lake Hattie Supply Canal....	159
May 11, 08	1372 Res.	Lake Hattie Reservoir	162
Sept. 11, 08	8613	Hattie Canal No. 1.....	161
Sept. 18, 08	1939 Enl.	Hattie Canal (Outlet to Lake Hattie Reservoir)	164
Sept. 18, 08	1373 Res.	Enlargement Lake Hattie Reservoir	163
July 3, 09	2113 Enl.	Enl. Pioneer Canal from Big Laramie River to Sodergreen Lake (and no further).....	165
Aug. 30, 09	10364	Interstate Canal No. 2.....	176
Oct. 15, 09	2051 Res.	Robertson-McConnell Reservoir (their first and only claim or permit).....	177
Dec. 12, 10	10365	Sand Creek Diversion Canal (part of Interstate Canal, 10364)	178
July 11, 12	2719 Enl.	Lateral ditch for Lake Hattie Supply Canal (designated as Pioneer Highline and making no claim for water from any stream)	160
		Little Laramie River.	
June 29, 08	8521	Stewart Ditch	170
July 19, 08	1331 Res.	Bell Reservoir	169
July 19, 08	8518	Bell Supply Ditch for filling Bell Reservoir	168
Sept. 15, 09	1883 Res.	Bath Reservoir	171
Dec. 5, 10	10363	Lake Hattie Supply Canal No. 2 (first and initial claim for this canal then first conceived)	166
Dec. 5, 10	2052 Res.	Bell Reservoir No. 3.....	172
July 11, 12	2720 Enl.	Lake Hattie Supply Canal No. 2 (first enlargement)	167
		Inter-watershed Diversions from Douglas Creek to Little Laramie River.	
July 6, 08	8519	Bell Supply Ditch No. 2.....	173
March 7, 12	11016-22	Bell Supply Ditch No. 2.....	175
March 7, 12	2538 Enl.	Bell Supply Ditch No. 2.....	174

The diversions classified under the last title are increment to the Little Laramie, but are included to show their general relation to the system, the dates of their first initiation, and the subsequent expansion of the ideas of the promoters.

Grouping the above mentioned appropriations of the Laramie Water Company's system according to the stream from which the diversion is made, the extent of the permitted diversions, and the degree to which each unit was wholly or partially completed at the date of the trial, is more graphically set forth as follows:

Filing	Number	or Reservoir	Diversion	Completed	Ex. No.
		Big Laramie			
Apr. 21, 08	8612	Lake Hattie Supply Canal..	(See 8613 and 1939 Enl.).	$34,000 yet required to complete this and 2113 Enl.	159
May 11, 08	1372 Res.	Lake Hattie Reservoir	(See 1373 Res.)	.....	162
Sept. 11, 08	8613	Outlet Canal Lake Hattie Reservoir	54,256.10 acres	Complete	161
Sept. 18, 08	1939 Enl.	Enl. " " "	6,597.17 acres	(None)	164
Sept. 18, 08	1373 Res.	Enl. Lake Hattie Res.....	93,800.00 ac. ft.	Complete	163
July 3, 09	2113 Enl.	Enl. Pioneer Canal (upper portion to Sodergreen Lake only)	(No claim other than included in 8612, 8613 and 1939 Enl.).....	(See 8612)	165
Aug. 30, 09	10364	Interstate Canal #2.....	22,544 acres (inc. in 10365)	None	176
Oct. 15, 08	2051 Res.	Robertson-McConnell Res...	335,831 ac. ft. (14,628,826,680 cu. ft.)	None	171
Dec. 12, 10	10365	Sand Creek Diversion (Feeder to Interstate Canal)	Included in 10364	None	178
July 11, 12	2719 Enl.	Pioneer Highline Canal.....	No claim from river. Merely a distribution lateral from inlet to Lake Hattie to 15,786.69 acres additional.	None	160

(NOTE.—No part of acreage under old Pioneer Canal is or should be claimed as included with lands to be served by above diversions. The appropriations of this old canal bear no possible relation to those of the new system.)

Little Laramie.

June 29, 08 8521	Stewart Ditch	95,569.74 acres	$46,000 yet to complete	170
July 19, 08 1331 Res.	Bell Reservoir	(25,000 acres included in Stewart application 8521)	None	169
July 19, 08 8618	Bell Supply Ditch			
Sept. 15, 09 1883 Res.	Bath Reservoir	37,604 ac. ft.	None	168
Dec. 5, 10 10363	Lake Hattie Supply Canal No. 2	(Included in 8612, 1372 and 1373 Res. Big Laramie)	Complete	166
Dec. 5, 10 2052 Res.	Bell Res. No. 3	117, 584 ac. ft. (5,121,988,144 cu. ft.)	None	172
July 11, 12 2720 Enl.	Enl. Lake Hattie Supply Canal No. 2	No additional acreage than already included in 8521 and 8613	None	167

All water diverted out of the watershed of the North Platte by the Bell Supply Canal No. 2 (only 15% complete) will augment the supply in the Little Laramie and relieve the demand from that stream to the extent of the increment. Here, Wyoming is doing what she would have the court deny Colorado the right to do, *i. e.*, to augment the supply of one tributary with water obtained from another tributary of the same general drainage.

RECAPITULATION.

Big Laramie.

	Canals	Reservoirs
Within the appropriation (1373 Res.) of 93,800 acre feet of Lake Hattie are included:		
(1) (8613) Outlet Canal Lake Hattie, water for.....	54,256.01 acres	
(2) (1939 enl.) Enl. Outlet Canal Lake Hattie, water for....	6,597.17 acres	
(3) (2719 Enl.) Enl. of use of water by lateral from inlet ditch to Lake Hattie called "Pioneer Highline," water for	15,786.69 acres	
Interstate Canal No. 2 (10364) has permit for water for.....	22,544.00 acres	
Total diversion Big Laramie for which permits granted since April 21, 1908	99,183.87 acres	
The Robertson-McConnell appropriation of 335,831 acre feet will be used largely as supplementary to above canals and Lake Hattie Reservoir. It may be used in any other locality and is evidently intended also as an independent supply, and, accordingly, to above should be added.....		335,851 acre feet

Little Laramie.	Canals	Reservoirs
Stewart Canal (8521), water for	95,569.74 acres	
Bath Reservoir (1883 Res.), water for		37,604 acre feet
Bell Res. No. 3 (long junior to James Lake Reservoir) is awarded permit for		117,584 acre feet
Total decreed to canals (as of priority June 29, 1908), water for	95,569.74 acres	
Total decreed to reservoirs as of priorities Sept. 15, 1909, and Dec. 5, 1910		155,188.00 acre feet

Both Laramies.	Canals
Big Laramie, water for	99,183.87 acres
Little Laramie, water for	95,569.74 acres
Total	194,753.61 acres

Also	*Reservoirs* (Other than Lake Hattie and Bell Res. #1)
Water for reservoirs which may be used on acreage additional to that served by above canals:	
Big Laramie	335,831 acre feet
Little Laramie	115,188 acre feet
Total	451,019 acre feet

(NOTE.—The call upon the Laramies will be reduced to the extent of the comparatively small amount of water received over the divide from Douglas Creek.)

(Engineer Bishop gives a total of 112,220 acres to be served by the Laramie Water Company's system as at present in process of construction. [781.])

Only those portions of the Laramie Water Company's system are completed whose construction has been along lines of least resistance and where no natural obstacles have interfered, viz.: Lake Hattie, its inlet from the Little Laramie, a portion of its inlet from Big Laramie, its main outlet ditches, and a part of the Stewart Canal. (779.) All these are on the open prairie along lines naturaly run by a level. On the main body of the system no work whatever has been performed, the Robertson-McConnell, Bath and Bell Nos. 1 and 3 Reservoirs, the construction of which would require the overcoming of natural obstacles and the expenditure of great sums of money in payment for labor (though still less expensive than that required upon the Greeley-Poudre system), remain as incomplete as on the day when the engineers folded their instruments and departed. Only that part of the work has been undertaken where expenditure of a relatively small amount of money (compared with the whole cost of the enterprise) will produce the greatest display. In Colorado the most difficult portion of the system, the tunnel, has been completed. In Wyoming the reverse is true, and the greater portion of the work still remains untouched.

(p) N. W. Land and Iron Company.

On June 3, 1909, The Northwestern Land and Iron Company, affiliated along with The Denver Laramie Realty Company as a subsidiary of The Denver-Laramie Railway Company, acquired the old Riverside ranch lying immediately below the Sodergreen ranch at the upper end of the Laramie Plains (south of Lake Hattie) and also the Hoge ranch, south of the Laramie River and immediately above the mouth of and along Sand Creek. The King Water Ditch had theretofore been used for the irrigation of river bottom lands of the Riverside ranch and the new company projected building this ditch on a higher line and extending it to the Hutton and Creighton Lakes on the Hoge ranch, which had theretofore been (and still are) used as immense evaporation waste basins, but which could be converted into storage reservoirs and used for the irrigation of unreclaimed lands on the latter ranch.

June 3, 1909, applications for permits Nos. 10149-50, 2304 Enl. and 1963 Res. were filed with the office of the State Engineer of Wyoming, wherein they sought the privilege of enlarging the King Water Ditch and re-building the same as the King Highline Ditch (2304 Enl.), for the purpose of filling Hutton Lake Reservoir (1962 Res.) and distributing the water by two outlet canals (10149-50). These applications were granted and permits issued October 17, 1910. (See

tabulated list from office of State Engineer, page 3961 of record.)

At the taking of testimony it was stated (285) that this highline ditch had been completed during 1912, with the exception of a flume across Sand Creek, and also that a portion of the work had been done upon the reservoir, but the scheme was generally incomplete. In enlarging the King Ditch, its former capacity was increased about 100%. (322.)

The record does not give the acreage to be reclaimed by this ditch and reservoir system, but it is safe to estimate that reclamation of at least 10,000 acres was contemplated in this new project thus first initiated June 3, 1909. This area lay to the south and west of that included within The Laramie Water Company's schemes.

(c) *Appropriations East of Laramie Mountains.*

The many small ditches irrigating native hay meadows along the narrow valleys of the numerous mountain streams joining to form tributaries which enter the Laramie River as it flows through the Laramie Mountains and traverses the region between the mountains and Fort Laramie, Wyoming, may be treated as of no real consequence in determining the relative rights of the larger projects here involved. The North Laramie, Chugwater and Sybille are the principal of these tributaries, although the waters of the Sybille are in large measure available for irrigation of the Wheatland tract, as we shall hereafter observe.

The appropriations along the valley of the Laramie from the mountains to Fort Laramie and in the vicinity of Uva, Wyoming, are of the same general character as those along the North Laramie, the Sybille and Chugwater (102-3), and are so abundantly supplied, both by the principal stream and the increment thereof gathered through the canyon, as well as by constant flow and discharge of seepage and return waters from the North Laramie (64), Sybille and Chugwater (173, 206), that time would be needlessly consumed by a discussion of their relative rights.

The principal irrigation within this general area, either from systems of several years standing or contemplated through new enterprises (many years subsequent to the Greeley-Poudre project) is limited to the enterprises of The Wyoming Development Company and its subsidiary, The Wheatland Industrial Company, the former of which promoted, constructed and subsequently managed the original Wheatland project, while the latter has undertaken the promotion and construction of two very recent projects adjacent to the original tract near Wheatland, Wyoming.

(c-1) Wheatland.

(*x*) *Original Project.*

The reclamation of about 60,000 acres situated to the south and above the Laramie River after it leaves the Laramie Mountains, and bounded on the east by the Chugwater and the west by the Sybille, was originally undertaken by The Wyoming Development Company during the '80's.

This original Wheatland area, of nature, depends for its reclamation entirely upon water supplied by the Chugwater or the Sybille, principally the latter, and the promoting company constructed two canals for the irrigation of the Wheatland area by waters to be diverted from the latter stream. Wheatland Canal No. 1 was constructed along the southern edge of the Wheatland flats or table land (and along the northern toe of the hills bounding the area on the south), and terminated about one and one-half miles from the present Town of Wheatland. Canal No. 2 diverted water some eleven miles further down the Sybille, flowed over the western and northern portion of the tract and through the Town of Wheatland. (158.)

While the Sybille is approximately fifty or sixty miles in length (103), and has a considerable drainage with a constant flow (39), the promoters of the enterprise realized that the water supply from this drainage was insufficient for the proper reclamation of the project.

Bluegrass Creek forms a tributary of the Sybille, entering about one-half mile above the head of Wheatland Canal No. 1. The drainage area of the Bluegrass near its source is next adjacent to and separated from the drainage of the Laramie by a very narrow mountain range, quite similar to the division of the drainage area of the Cache la Poudre and the Laramie in Colorado. At opposite points on the two streams, the elevation of the Bluegrass is considerably below that of the Laramie, and water is diverted from the Laramie and conveyed to the Bluegrass by means of a tunnel about 2,585 feet long (176) constructed through the intervening mountain. While the diversion of water from the Laramie to the Bluegrass and thence by way of the Sybille to the Wheatland area would result in diversion of water from one watershed through the divide for application upon lands situate in the watershed of another stream (exactly similar to the Colorado diversion by the Greeley-Poudre system), the Wyoming promoters, under sanction of the authorities of that state, constructed a tunnel through this narrow mountain divide and thereupon diverted the water of the Laramie which they have since hitherto used to supplement the supply from Sybille Creek for the irrigation of the original Wheatland area.

January 29, 1898, application for permit was filed with the State Engineer of Wyoming by The Wyoming Development Company for right to construct Wheatland Reservoir No. 2 in the pit or lowest portion of the Laramie Plains area and situate about 16 miles above the western portal of the Wheatland tunnel, so diverting water from the Laramie over into the drainage area of the Sybille. (29, 48.) The application having been granted, actual construction commenced in 1899, and in July, 1901, a reservoir with an impounding capacity of 126,000 feet was completed across the channel of the Laramie River. (48.) The waters impounded in this reservoir are re-discharged into the Laramie and are thence conveyed to and through the Wheatland inter-watershed tunnel and into the Sybille drainage for re-diversion to the Wheatland tract.

During the thirty years following the initiation of the project and prior to the taking of testimony in this case, about 33,544 acres out of the tract had been reclaimed. (168.) Throughout practically the entire period, diversion and storage of water has been governed solely by the desires of The Wyoming Development Company, who have acted on their own motion, helping themselves to the abundant water supply without any supervision by water commissioner or state officials, with the possible exception of the very dry year of 1911. Constant irrigation has caused the underground water-plane to gradually rise so that seepage has already appeared in portions of the area with consequent reduction of demands upon the canal for the irrigation of portions of the area (200-1), and although a considerable portion of the original tract is still unreclaimed, the water supply is sufficiently abundant (94) to have warranted opening two new and collateral enterprises which we shall next consider. (205-6.)

(*y*) *New Projects.*

The Wheatland Industrial Company is formed of members of The Wyoming Development Company. (86.) It was organized for undertaking reclamation of two Carey Act projects lying upon foreign watersheds, but immediately adjacent to the original Wheatland tract and known as the Bordeaux and Sybille tracts.

The reclamation of these tracts is to be accomplished by construction of new and independent enlargements of portions of The Wyoming Development Company's tunnel and canals and also a new and independent canal from Bluegrass Creek. (41, 61.)

(*y-1*) *Bordeaux Tract.*

The Bordeaux tract comprises about 10,000 acres of rough, rolling land (67) lying south and east of the original Wheat-

land tract, within the drainage of a tributary of Chugwater Creek and separated from the original tract by a range of hills. (41.) By construction of a short tunnel through this rocky divide, water flowing in Wheatland No. 1 Canal along the south edge of the Wheatland tract is carried through the divide and into the drainage of this tributary of the Chugwater for irrigation of the new Carey Act project. (41.) The thought of possible future reclamation of this Bordeaux tract by means of a new double inter-watershed system in part built through portions of the original Wheatland system by enlargement, first suggested itself in 1904, but no serious efforts were directed toward its construction until the year 1907.

On *April 18, 1907*, The Wyoming Industrial Company, theretofore organized, made application with the State Engineer of Wyoming for permit to enlarge Wheatland Canal No. 1 for the irrigation of the Bordeaux tract. This application was approved on the same day and permit No. 1681-E was issued to the Company. (3961.) During 1907-8, the inter-watershed tunnel between the Laramie and the Sybille drainages was slightly enlarged at the upper end. (186.) There was a slight enlargement of The Wheatland or Wyoming Development Company's Canal No. 1 to the foot of the rocky ridge between the Laramie and the Sybille, the new tunnel was constructed through the rocky divide (41) and a new canal known as The Wheatland Industrial Company's Canal No. 1 (211) was completed around the upper boundaries of the Bordeaux tract for its reclamation. (108.) In the five years elapsing between completion of the canal and the taking of testimony, about 1,004 acres out of the 10,000 acres of the project have been brought under irrigation. (168.)

That the reclamation of this tract was undertaken long subsequent to the initiation of the Greeley-Poudre project is evidenced by the testimony of M. R. Johnson, for many years general manager of The Wyoming Development Company, who said:

> "*This Bordeaux tract is a separate and new tract of the land added recently.* We contemplate irrigating it through No. 1 Canal. We enlarged No. 1 Canal for that purpose. The tunnel was deepened in later years and the enlargement of No. 1 Canal was made for the purpose of obtaining additional water for the Bordeaux and Sybille tracts.
>
> *These two tracts were not in contemplation when I went in charge of the system in 1888 or when we constructed our Reservoir No. 2 in 1900.*" (41-2.)

(*y-2*) *The Sybille Tract.*

The Sybille or Cooney Hill tract, 30,000 acres of land much inferior to that of the original Wheatland Tract (68, 169), is surrounded on the west, south and east by spur ranges of the Laramie Mountains. Sybille Creek flows between the easterly of these ranges and the original Wheatland tract while the ridge at the south of the new tract forms the northerly portion of the divide of the Bluegrass drainage in that vicinity.

Mr. M. R. Johnson said:

> "The Sybille or Cooney Hill tract will be irrigated out of the canal taken directly from the Bluegrass Creek. *This is a new and independent canal* taking water from Bluegrass before it reaches the Sybille Creek. The Sybille tract lies across the Sybille west from the original tract." (40-1.)

Neither the Sybille nor the Bordeaux tracts were in contemplation at the time of the construction of the original enterprise, nor the Wheatland Reservoir No. 2 (42.)

The idea of developing the Sybille tract occurred to the promoters some two years subsequent to their first contemplation of the Bordeaux tract. (40.) In order to irrigate the tract, it is necessary to make a double inter-watershed diversion from the Laramie River, viz., first, from the Laramie River through a new enlargement of the old Wheatland tunnel into the Bluegrass, and then again from the drainage of the Bluegrass over into the watershed of the Sybille tract by another 900 foot tunnel constructed through the divide at the lower end of a new canal leading from the Bluegrass. (211.)

Surveys for this new canal and inter-watershed diversion from Bluegrass Creek, thereafter to be known as The Wheatland Industrial Company's Canal No. 2, are alleged to have been commenced in 1907 (108), but application for permit was not filed with the State Engineer until *August 7, 1908.* This application was approved and permit No. 8531 was granted on the following day, August 8, 1908. (3961.) Construction began in July, 1910, almost two years subsequent to the approval of the permit (108), and the new 16 mile canal (169) of 300 second feet capacity, together with this 900 foot tunnel through the divide between Bluegrass Creek and the tract, was largely completed in 1911-12 (212), although still incomplete at the time of taking of testimony. (67.) No part of the tract has been reclaimed.

The original Wheatland tunnel was constructed exclusively for service of the original Wheatland tract. Reclamation of the

new Bordeaux and Sybille tracts required the invention of new means of serving these additional lands. This could be more feasibly accomplished by building a new tunnel within the old tunnel, by enlargement of the latter. While some slight enlargement took place in 1907, the principal enlargement for service of the Wheatland Industrial Company's new tracts did not occur until during the fall of 1910 and spring of 1911. (176, 180.) The old tunnel was greatly enlarged, as much as two feet of rock were taken out of the bottom and it was finished to an average width of 8 feet, a cross-section area of 72 feet and a capacity of about 800 second feet, which is somewhat limited by the capacity of the intake canal from the Laramie River to the upper portal of the tunnel.

Storage of water for the Bordeaux and Sybille tracts will occur in Wheatland Reservoir No. 2 (115), save as obtained from the Bluegrass and Sybille or directly from the river from increment below the large reservoir.

All of the old project is prior to August 25, 1902, at least in so far as developed up to that date. Of the new tracts projected, promoted and constructed under the new, The Wheatland Industrial Company, we have the following:

Permit Number	Project	Date of Filing	Acres
1681-E	Bordeaux Enl. Wyo. Dev. Co. Canal No. 1	April 19, 1907	10,000
8531	Sybille Canal and Tunnel (Sybille Canal not quite complete 1913. Bordeaux Canal complete. Only 1,004 acres out of combined 40,000 acres in projects irrigated prior to 1913).	August 7, 1908	30,000

(d) Recapitulation of all Wyoming New Appropriations since 1902.

All large projects constructed or permitted for the diversion and application of water from Laramie River to lands in Wyoming subsequent to August 25, 1902, are summarized as follows:

Date of Survey	Date of Filing	Project	Acreage	Add. Permitted for Storage (Acre Feet)	Portion Completed
'04	Apr. 18, '07	Wheatland Ind. Co. (Bordeaux System)	10,000	.....	Complete
Aug. —, '07	Aug. 7, '08	Wheatland Ind. Co. (Sybille Tract)	30,000	.....	Almost Complete
Nov. —, '07	Dec. 27, '07	Sodergreen Highline	3,400	.....	Complete
Mch. 22, '08	Mch. 27, '08 (et seq.)	Lake James System.....	30,000	.....	Complete
Apr. 16, '08 (et seq.)	Apr. 21, '08	Laramie Water Co or Lake Hattie System	194,753.61	451,019	Partially Completed
	June 3, '09	N. W. Land & Iron Co. (est.)	10,000	.....	Partially Completed
Total acreage for which permits have been granted by State Engineers of Wyoming since August 25, 1902...			278,153.61		

In addition to the above acreage thus granted permits, we have the Bath, Robertson-McConnell and Bell No. 2 Reservoirs of The Laramie Water Company's system showing an additional grant from the river of 451,019 acre feet.

The foregoing are the solemn decrees of the plaintiff State of Wyoming entered through her eminent state engineers, Clarence T. Johnston and A. J. Parshall. They constitute official declarations against interest by plaintiff and are the solemn guaranty to all the world (1) that there was *ample water* in the Laramie River on the date of each respective decree (permit) to supply the appropriation granted permit, *after* having supplied *all prior claims* from the stream, (2) that *no injury* would result to other and prior appropriators by the construction and subsequent operation of each of the series of works thus directed to proceed with construction, diversion and application of water, and (3) that the granting of each of said *permits does not threaten public interest.*

Each of said permits was also the solemn decree of the State that the appropriation thereby granted should have *priority as of the date of the filing* of the application and not theretofore, by reason of the fact that no right, and consequently no priority, can attach until after such application should be granted and permit issued, in which event the statute fixes the priority.

Here we find the plaintiff state solemnly decreeing that *after all* lands then under irrigation, or for the irrigation of which permits and appropriations had theretofore been granted or vested, had been and would forever be supplied with sufficient water for their annual reclamation, there still remained in the Laramie River sufficient water to annually irrigate 278,153.61 acres additional, and, furthermore, that there existed sufficient water in the stream to warrant the construction of reservoirs for the storage of over 450,000 acre feet of water for irrigation of these or still other lands, after having already supplied the enormous reservoirs included within the acreage permits above mentioned.

These decrees were not entered on the spur of the moment or directed by single influences, interests or prejudices. On the contrary, each was deliberately entered after mature consideration and with full knowledge of all conditions. (See time elapsing between time of filing and granting.) Furthermore, we have the benefit of the deliberate, dispassionate judgment of the two eminent experts who successively acted as State Engineers of Wyoming during the years 1907-13, inclusive. The judgment of these eminent men, whose only interest was that of protecting the public and those who might otherwise be induced to invest their money in unfortunate ventures improperly approved, should be of greater weight than that of some mere

hydrographer employed by and responsible alone to one of the promoting companies and representing but one of the several enterprises and not the state or even a goodly number of the interested appropriators.

We fail to reconcile these decrees of the plaintiff state, inferentially to secure the investment of enormous sums of money in construction, with the testimony of hydrographer Meeker of The Laramie Water Company (not the State of Wyoming), who was generally unfamiliar with the territory prior to 1912 and whose radical deductions were confessedly in frequent error, the greater portion of whose testimony had to be discarded, corrected and reconsidered, and who placed his judgment, founded on mere reconnaissances and hasty investigations, against the results of months of field labor by fully equipped engineering parties.

Neither of the eminent state engineers of Wyoming was offered as a witness by Wyoming. Neither of them was called upon to verify the truth concerning the permits by him granted, or to justify the expenditure of private moneys thereby permitted under state approval, which would be but the promulgation of fraud by the state if in truth sufficient water supply did not exist in the stream to satisfy these new diversions (all junior to 1907-8) after having supplied all prior initiated or completed systems.

Wyoming did not even introduce evidence or copies of the several permits above mentioned in order that her own decrees might appear in the record. On the contrary, reliance seems to have been placed entirely upon the confessedly erroneous, shifting and reconstructed testimony of one private-employee witness and upon the introduction of evidence and decrees for old irrigation systems in no way here involved and confessedly so bountifully supplied with water as to permit unlimited waste after each appropriator had taken his full "lion's share" and there still existed sufficient in the stream to supply all others who likewise helped themselves without the service of a water commissioner or other supervising official.

It remained for the defendants to introduce copies of these permit-decrees. By their introduction we have the uncontradicted testimony of the engineers who granted them *that none of the recent large Wyoming appropriations were initiated prior to 1907-8* (this was also universally admitted upon cross-examination of all Wyoming witnesses having knowledge of the facts) and that many of them were not even conceived until about the time of or subsequent to the filing of complaint in this case, and *that Wyoming has officially admitted, declared and decreed that after all prior appropriations from the entire Laramie River and tributaries* (including, of course, the comparatively insignificant diversion by the Greeley-Poudre enter-

prise in Colorado, *there still remains sufficient unappropriated water to justify the granting of permits* authorizing the expenditure of vast sums of private money for the construction of large new and theretofore uninitiated systems for the irrigation of 278,963.61 acres more of land than had theretofore been reclaimed, and that in addition thereto enough water still remained in the stream after supplying Lake Hattie, James Lake and all other reservoirs included within the above acreage, to justify the construction of reservoirs to impound over 450,000 acre feet additional.

This testimony, given through these many permit-decrees by these eminent state officials chosen by the people to examine and pass upon all projects before permitting construction to commence and to decree thereunto the solemn guaranty of the Commonwealth, is conclusive answer to any contention that the Wyoming projects are senior to the Greeley-Poudre project, or that the latter may in any possible manner injure or interfere with any of the older projects in Wyoming constructed prior to August 25, 1902.

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(4) PLAINTIFF'S ERRONEOUS ASSUMPTIONS.

(a) Plaintiff's Exhibit "G."

The record shows, without contradiction, and counsel for plaintiff admit, that only a portion of the lands situate beneath the old Pioneer Canal on the Laramie Plains and but little more than half of the original Wyoming Development Company's tract near Wheatland are reclaimed. The exhibits under which Wyoming claims appropriations for all her new large enterprises, and particularly the James Lake and Laramie Water Company's system on the Laramie Plains, and the Bordeaux and Sybille tracts adjacent to the original Wheatland tract, show conclusively that the Laramie Plains projects were not initiated in the one instance before March and April, 1908, and before 1907 in the other, and that but a very small percentage of the lands under these newer projects had been brought under reclamation at the time of the trial of this case.

R. I. Meeker, the "expert" for The Laramie Water Company, testified that his knowledge of the territory did not begin until May, 1912 (217). He testified at other times to the acreage irrigated under the Pioneer system and the fact that practically none was reclaimed under The Laramie Water Company's new system. He also admitted that the permits which we have heretofore considered in detail are the *sole and only permits* under which The Laramie Water Company's system has

been constructed, or upon which their priorities are predicated, the earliest of which was April 21, 1908 (1070-1).

In the face of the entire record and his own testimony, Mr. Meeker prepared a map marked Plaintiff's Exhibit "G," whereby he would portray and classify as under priorities before and subsequent to 1900 the various lands irrigated from the Laramie River. The selection of the arbitrary date 1900, which happens to be prior to August 25, 1902, would lead the mind to believe that some development took place at about that time, when in truth no new Wyoming development occurred prior to 1907-8. This map, by artful coloring, would indicate priorities as of 1900 for lands still unreclaimed and the construction of works for the irrigation of which did not commence even by survey until about six years after the Colorado project was commenced and prosecuted in good faith, and is a misrepresentation of all the evidence relating to priorities and irrigated areas.

A lengthy detailed objection was made to its introduction (1030-2). It is particularly misleading and false in that: The legend on the map shows that Mr. Meeker had colored in green all lands which he wished to leave the impression had received irrigation development prior to 1900, and in yellow those subsequent to 1900. He erroneously includes all of the land under both the Pioneer and the original Wheatland systems in solid green, thus indicating that they were all reclaimed, and also shows as irrigated certain unreclaimed lands lying between the Pioneer Canal and Lake Hattie. Under the yellow tint he notes as under irrigation since 1900 the great bodies of still unreclaimed lands under the James Lake, Lake Hattie, Sybille and Bordeaux tracts, when the permits for these systems, his own testimony, and the entire record shows that none of the works for the reclamation of these lands were commenced, much less were the lands irrigated, prior to 1907-8, and that the initial surveys on the major portion of them began in the spring of 1908, while the Pioneer Highline Canal, as we shall hereafter observe is still but a fiction, was not granted permit until January 8, 1913, and no part of the same has ever been constructed.

Undoubtedly, these new large projects, particularly that of his client, The Laramie Water Company, were initiated *subsequent* to 1900, 1800, 1700, or any other date before 1907-8. The official records show that the epochs of development on the Laramie Plains naturally occur either before or after the Spring of 1908, and not 1900. This was some six years subsequent to August 25, 1902, when the Greeley-Poudre project was commenced in Colorado, and it is uncontradicted, even by Mr. Meeker, that these Wyoming projects are junior and inferior both in time and right.

No attempt was made by the owner of any of these large

new Wyoming projects to deny that they are all between five and six years junior to the Colorado project, and no tendency to cloud the record was evidenced by the employees of any system save the repeated efforts of Mr. Meeker for The Laramie Water Company, whose constantly changing water data is on a par with the effort displayed by the map, Exhibit "G."

His notations and delineations upon that portion of the map referring to the Greeley-Poudre system in Colorado are equally fallacious. The intent of those having charge of this project in its early stages, their well defined plans at the very outset and their subsequent conduct and that of their successors in directing both engineering and construction, are covered in a long line of uncontradicted testimony. This record shows adherence to the one original plan throughout all the years succeeding August 25, 1902, all leading to the completion of the Greeley-Poudre tunnel system. On Exhibit "G," this witness ignores the uncontradicted evidence and seeks to portray, by ingenious mapping and an unwarranted interpretation, an original plan and intent entirely foreign to the truth as given by all witnesses. In fact, the exhibit is as hopelessly misleading and distorted in this regard as it is in its fictitious priority conclusions.

The entire exhibit seems to have been prepared in the hope of leaving an impression that the Wyoming systems were commenced anterior, rather than subsequent, to the Greeley-Poudre project, and its only evidentiary value lies in its manifestation of the length to which its author would go to cloud the record on the subject of priorities. We are at a loss to know why plaintiff should have caused this fictitious map to be prepared, and the more, why it should have been offered in the face of a complete record of contradictory evidence.

Plaintiff's counsel, on page 37 of their brief, seek to capitalize this and other numerous mistakes of their witness, by stating that this "expert" cheerfully admitted and corrected his mistakes, although such mistakes, in truth admissions of error, were always reluctantly obtained through rigid cross-examination and were usually almost as glaring and incompatible with the facts as are the fictitious assumptions of this "expert" on his Exhibit "G." He was enabled to frequently correct the "mistakes" in his other testimony, but, once introduced, the fallacy of his map, Exhibit "G," could not be so readily corrected, and displays his reckless treatment of the facts, and yet this is the witness whose attempted criticism of the testimony of John E. Field, State Engineer of Colorado (4293), counsel for plaintiff quote for the purpose of discrediting all of the testimony of Mr. Field (page 37). Fortunately, all of Mr. Field's testimony is amply corroborated by such eminent men as Dr. L. H. Bailey, late of Cornell University,

Professor Louis G. Carpenter, Charles R. Hedke, and many other witnesses, and by photographic and other exhibits, while this witness is not only contradicted by all the testimony, both for Wyoming and Colorado, including his own, but is repeatedly compelled to correct his hasty, ill-drawn conclusions and to substitute others in their stead. We may observe that nowhere in Mr. Field's testimony do we find an Exhibit "G" and a long series of errors reluctantly admitted on cross-examination and repeatedly attempted to be remedied, only to be again confessedly in error.

We need but suggest that the permits, decrees and decisions of two state engineers of Wyoming and the frank statements of every other witness who testified concerning these facts, are superior to and predominate over the unfortunate conclusions attempted to be drawn by this witness, whose map, Exhibit "G," should be eliminated from consideration in order that error and confusion may be avoided.

(b) The Mythical Pioneer Highline Canal.

July 11, 1912, The Laramie Water Company filed in the office of the State Engineer of Wyoming two applications for permit to use, by a system of exchange with the river, water from Lake Hattie Reservoir for the irrigation of lands naturally situated beneath a lateral line, then first conceived, and commencing on the inlet canal to that reservoir just before the water drops into the basin and extending with the natural contours of the Plains around the lake basin and to the east. This *exchange* was to be accomplished by diverting water from the Laramie River by means of the inlet canal of the Lake Hattie system (first surveyed April 16, 1908 and later largely completed), and carrying the same from the inlet and thru this new highline lateral for direct application upon lands irrigable therefrom, and, at the same time, returning and discharging back into the Laramie River, at a point lower down on the stream, water in equal quantity with that diverted at the headgate of the new 1908 inlet canal.

A certified copy of this application and the map attached thereto were introduced in evidence as Defendant's Exhibit 160. The map shows the line of this canal, which it designates as the "Pioneer Highline Canal," as commencing, *not at the river* and *not at the old Pioneer Canal*, but, *on the* new inlet ditch just above the point of discharge from that canal into Lake Hattie. This map and the application also shows that it was the *newly* conceived intention of this company to intercept water flowing from the *Little Laramie River* through the new Lake Hattie Supply Canal No. 2, first surveyed in June, 1910, and likewise to compensate for such intercepted water by de-

livery of equivalent amount from the Lake Hattie Reservoir back to the river.

By the express provisions of the application for permit (Exhibit 160, part 2) for this new highline lateral ditch from these two 1908 and 1910 canals, and thus to be constructed at some possible future date, the waters to be by it conveyed are limited as follows:

> "Waters to be diverted from the Laramie River for use under the terms of this application is to be carried through the Pioneer Canal *enlargement* (see permits 8612 and 2113 Enl.). The right is sought for permit for direct use from Big and Little Laramie rivers from lands served by the Pioneer Highline Canal.
>
> (1) *by the use of the waters appropriated under permits 8612 and 2113 Enl.*, directly through the Pioneer Highline Canal instead of being stored in Lake Hattie Reservoir, and then applied to lands described under secondary permit 8613;
>
> or (2) *by returning stored water from Lake Hattie Reservoir* (1372 Res., and 1373 Res.,) to the Laramie River, equal in amount to that diverted from the Big or Little Laramie rivers for the direct use on lands served by the Pioneer Highline Canal;
>
> or (3) *by the use of water appropriated under permit 8518* directly through Bell Supply Canal No. 1 into Lake Hattie Supply Canal No. 2 into the Pioneer Highline Canal instead of being stored in Bell Reservoir No. 1 (permit No. 1331 Res.) and then applied to the lands described under secondary permit No. 8521, primary permits Nos. 1331 Res., 2051 Res., 2052 Res., and 8518, 8519, 2538 En., 11016, 11017, 11018, 11019, 11020, 11021, 11022 and Reservoirs in Colorado many further additional and supplemental supplies."

It will be observed that all of the foregoing permit numbers pertain to appropriations of water theretofore permitted to The Laramie Water Company's system from the Big and Little Laramie Rivers and not otherwise, the earliest of these permits being No. 8612 filed April 21, 1908 and predicated on surveys begun immediately prior thereto (Defendants' Exhibit 159). (See table of Laramie Water Company's permits heretofore appearing.)

In order that the intentions of the claimant might be in no way misconstrued and that no one could ever assert that they claimed the right to use any priority of water earlier than April 21, 1908, the applicant further limits itself as follows:

> *"It is understood that nothing contained in this permit shall be construed as meaning the additional appro-*

priation of any amount of water in excess of the total amount covered by permits heretofore issued as a part of The Laramie Water Company's system."

On January 8, 1913, State Engineer A. J. Parshall granted permit No. 2719 Enl. upon the foregoing application (Exhibit 160) so containing its own limitations relative to the appropriation from which the supply of water was to be derived. But in order that no possible claim could ever be made for water other than that specifically described and limited in the specification, viz.:—beginning with priority 8612 of April 28, 1908, the state engineer imposed the following limitations and conditions:

"*Waters* diverted from the Big and Little Laramie rivers under the terms of this permit *in excess of the amount covered by permits heretofore used, must be immediately returned* in equal amount to the Laramie River from the Lake Hattie Reservoir, *in such manner as to in no way interfere with prior rights on the Big or Little Laramie Rivers.*"

Under the Wyoming law the appropriator must have a permit before he is authorized to enter upon the construction of his canal. No right or appropriation can possibly vest until a permit is granted. The granting of the permit and the vesting of the right are coincident. Hence it is that whatever right is granted by the State of Wyoming in the exercise of its sovereign authority over the waters within its own borders, is limited absolutely by the conditions included in the permit at the time of the grant.

Here we find that this lateral canal, by means of which The Laramie Water Company was permitted to include additional acreage under its system, was limited at its birth to the use of only such waters as were represented by permitted appropriations theretofore granted to The Laramie Water Company and its predecessor since April 21, 1908, *and no more.* In other words, it is only permitted to use water of priority date beginning with permit No. 8612 of April 21, 1908, and including the benefit of the subsequent priorities and permits granted that system up to and including the year 1912, and by the terms of the permit itself *no claim could be made for any earlier appropriation than* that represented by this permit 8612.

Notwithstanding the limitations thus self-imposed by The Laramie Water Company, the appropriator, and by the State Engineer of plaintiff state, this mere lateral canal thus filed July 11, 1912, but granted the benefit of use of water on exchange from appropriations beginning with April 21, 1908, is

used through its name "Pioneer Highline Canal" as the pretender by which The Laramie Water Company and plaintiff state now seek to antedate The Laramie Water Company's claims over those of the Greeley-Poudre system in Colorado. While this permit is regular upon its face and most explicit and definite in its limitations and constitutes the solemn decree and admission of the plaintiff sovereignty as entered by its officer, the state engineer, the ingenious designation of the canal is sought, without the slightest foundation in fact, and in absolute contradiction of the solemn decree of the state, to be coupled with random, disconnected previous acts of parties foreign to the enterprise, in order to obtain semblance of early priority.

It will be recalled that Trowbridge and Niver of Chicago sent their engineer, Mr. Sevison, into the Laramie Plains district to explore, locate and survey the Lake James and Lake Hattie systems during the spring of 1908 (605); that on April 16, 1908, he commenced the first survey on the Lake Hattie system (646); that the whole matter was one of first impression to him and that no old maps or surveys were given to or followed by him (661); that as a result of these surveys the entire new Laramie Water Company's system was inaugurated and in part subsequently constructed, and it is upon faith of these surveys and the permits subsequently filed that this Pioneer Highline permit was granted.

It will be further recalled that after beginning work on Lake James, Mr. Sevison first made a survey of Lake Hattie to see if it could be feasibly converted into a reservoir (653); that having so determined, he sought a proper line for an inlet canal from the Big Laramie to the lake, and in so doing surveyed three preliminary *inlet* canal lines (not highline laterals) from the Big Laramie River to Lake Hattie (652); that by these surveys he found that the old Pioneer Canal occupied in part the natural and most feasible location for construction of the upper portion of a new inlet canal to this natural lake or reservoir (652); that the mountains in this vicinity rise abruptly from the table land of the Laramie Plains; that the natural location of a ditch line follows the toe of these mountains at the point where they leave the plains; that the Pioneer Canal occupied the upper portion of this strategic position and that by building a new canal beside or within the old canal by enlargement from the river to Sodergreen Lake and there diverting and running the new ditch at right angles to the old canal along the toe of Sheep Mountain, the best and most economical line for the new inlet canal would be selected. (652.)

While good engineering dictated that it would be most economical to build the new inlet canal by enlarging the old

Pioneer as far as Sodergreen Lake, the promoters of the Lake Hattie enterprise had no interest in the old Pioneer Canal and it formed no part of their original plan of development (661.) While the construction of the new canal for part of its way through the old line by enlargement would afford the required additional space and need in no manner interfere with the use of the old canal for conveyance of water for irrigation of its lands, nevertheless it was necessary to make satisfactory arrangements before the promoters of the new enterprise could enter upon and enlarge their old canal.

Mr. Sevison's efforts were in nowise directed toward the survey of any canal corresponding to the Pioneer Highline (as improperly asserted on page 77 of the Wyoming brief) for the direct irrigation of any lands, but were directed solely toward the utilization of the Lake Hattie Reservoir as a storage basin for irrigation of lands by means of inlet and outlet canals thereto and therefrom. As he surveyed for the inlet canal around the toe of Sheep Mountain at the western edge of the Laramie Plains along this strategic position so fixed by nature, which every engineer must inevitably follow, by pure accident and without knowledge or information of any previous surveys, he encountered a few old stakes from time to time, but which he in nowise followed or regarded as he proceeded with his new surveys (660-1.) Of these old stakes he said:

> "*No old maps were given me that I followed and no old surveys.* Until I ran into those stakes I didn't know there had been any survey run there. I would think that these stakes had evidently been placed on some preliminary line run from the Pioneer Canal in the neighborhood of Sodergreen Lake. They would indicate a grade line run from Sodergreen Lake (661.)
>
> I do not know by whom these old stakes on the Highline, which Mr. Corthell mentioned, were placed. Judging from their condition they were pretty well weather beaten. I should say they were ten years old anyway.
>
> It is nothing unusual to find stakes of old surveys in running lines. *This was the natural and most feasible line for the continuation of the lateral or highline from the Pioneer Canal.* (660-1.)
>
> I should say *they were indicative of a fly line survey or preliminary survey. They certainly were not final location stakes.*"

Of the Pioneer Canal, the enlargement of which for a short distance along the upper part of its course was most feasible in constructing the new inlet canal for Lake Hattie, Mr. Sevison says:

"It was not a part of the original plan to take the Pioneer Canal (661)."

Accident and natural conditions alone suggested some arrangement with the Pioneer Canal people for increased capacity to make room for the new and foreign water of the new inlet canal without in anywise interfering with the use of the old canal for service of the lands beneath it. An arrangement to this effect was not completed until about one year subsequent to the time of the Sevison survey for the Chicago promoters (662.) The old canal had a capacity of about 300 cubic feet per second and subsequently it was enlarged only in that portion from Sodergreen Lake upward to the river, to a capacity of something over 1,200 cubic feet per second, but this old canal was in no way enlarged or disturbed from Sodergreen Lake to west of Laramie City and it still performs the same and presumably only those functions for which it was originally constructed. (656.)

The new enterprise was being constructed purely under rights obtained by permits granted upon and following the Sevison surveys and the mere fact that this old canal was enlarged had absolutely no bearing and in no way involved the old appropriations of water theretofore and since hitherto used for the irrigation of lands situate beneath and by it served. All enlargement diversions of necessity fall under the 1908 and subsequent appropriations and are governed entirely by the permits authorizing the enlargement.

The old Pioneer Canal was constructed on low grade from the stream to Sodergreen Lake at the edge of the table land. From the lake the canal was constructed, without regard to fall or grade, northeasterly toward and beyond Laramie. In other words, while the canal followed a line or grade conforming to good engineering from the river to Sodergreen Lake, this plan was abandoned beyond that point and a continuation of the grade line of the upper portion of the canal would have followed the base of Sheep Mountain around to the north and then to the east of Lake Hattie Reservoir rather than passing along the direct line toward Laramie.

Any inlet canal constructed from the river to Lake Hattie for the purpose of carrying water to that lake would naturally have followed this grade line around the base of Sheep Mountain after leaving the Pioneer at Sodergreen Lake. Such would be the condition, not by selection, but by necessity, and any inlet canal surveyed from the river to the lake would not necessarily have any reference to or connection with any possible lateral line continued on around the lake to the northeast.

During the early 80's and 90's, some desultory reconnaissances and random, disconnected investigations had been made

by some four or five persons for a possible lateral from the Pioneer Canal at Sodergreen Lake, for possible irrigation of lands from the Pioneer Canal, and not at all for the purpose of utilizing Lake Hattie as a reservoir. All of these surveys, as we shall later observe, were insignificant, preliminary, and were not followed either by filings with the State Engineer or any construction, and all of them passed into the legendary stage long before the Chicago promoters entered the field without knowledge of them, through the Arnold Engineering Company in 1908.

Mr. Sevison was looking for a means of constructing a new inlet canal from the river to Lake Hattie Reservoir, without any reference to the old Pioneer Canal or any of its visionary laterals. He had no knowledge of any previous surveys, and gave no heed to some of the preliminary stakes which he found upon the ground and which had evidently been left by surveyors in these early preliminary reconnaissances.

In spite of these indisputable facts, a fictitious connection is sought between this mythical lateral, dreamed of but never constructed, and the different locations of each of these old random surveys, and at the same time, contrary to all the record, the language used would imply that the construction of the new Lake Hattie inlet, surveyed without knowledge of or reference to this old imaginary lateral, was in fact construction of the lateral. In addition, it is asserted:

> "It is interesting to note that the Lake Hattie system was constructed by the owners of the Pioneer Canal." (Page 76.)

It is true that the promoters of the Lake Hattie system, by necessity, made arrangements whereby they could *enlarge* the old Pioneer Canal for a short distance between the river and Sodergreen Lake and to that end became part owners in that canal long after they had initiated their project and surveyed and obtained permits for their new reservoir and inlet. But to state that the Lake Hattie system was constructed by the owners of the canal is to wrongly imply that the original owners of the Pioneer Canal had undertaken to construct and complete Lake Hattie system. Such was not the case.

Following this false premise, counsel, on page 76 of their brief, then seek to incorporate the several early preliminary reconnaissances made with relation to an imaginary lateral from the Pioneer Canal, with the surveys made by Mr. Sevison, contrary to the testimony of Mr. Sevison and the entire record, including all of the permits under which the Lake Hattie system claims. Notwithstanding the fact that Mr. Sevison positively stated that his surveys for an inlet canal to Lake Hattie had no reference to any so-called Pioneer Highline Canal, they state:

"When Sevison made his survey preliminary to actual construction of the highline canal, he found the stakes of one of these old surveys and followed the line so marked very closely."

In the first place, there never was any construction upon any highline canal or lateral in 1908 or at any other time. Mr. Sevison so stated, and so did Mr. Bishop, the engineer who finally filed the application for permit for a different lateral from a different ditch but with a similar name. Sevison did survey the new inlet canal (not lateral) from Sodergreen Lake to Lake Hattie purely, and only, for carriage of water from the river to the new reservoir, and this inlet was later largely completed, and in following the toe of the mountain he did, accidentally and casually observe some old stakes, but he specifically says that he gave no heed to them and that his survey had no reference to any previous reconnaissance or survey. The so-called "Pioneer Highline" lateral is still a myth. It has not and never has had any existence. It consists, even to this day, of a mere speculative line indicated upon a map.

After having left the erroneous impression that the Lake Hattie system was constructed by the original owners of the Pioneer Canal, and, further, that construction of the new inlet canal under the Sevison surveys for the Chicago parties following 1908, was construction on the mythical Pioneer Highline, counsel then seek to take improper advantage of these former random surveys in the following language:

"That their predecessors had made surveys from time to time commencing in 1886 for a canal substantially identical in location with the Pioneer Highline Canal." (76.)

Counsel then allege an 1886 survey reconnaissance made by Lobach and Bellamy, and another in 1897-8 by Roach and Owen, and finally claim benefit of a 1908 survey made by Roach in an entirely different location upon the Laramie Plains.

Excuse for these claims was first alleged by the false assumption of an 1897 priority of claim for the Greeley-Poudre system, which we have previously discussed in connection with the Colorado diversions. There it was shown that no semblance of any such priority claim was made for the Colorado appropriation, and that while on the contrary, August 25, 1902, was the one and only priority date claimed for that enterprise, it best suited plaintiff to contend for an earlier date for Colorado in order that it might have semblance of excuse for claims on the part of The Laramie Water Company's system.

The apparent fallacy of these fictitious claims in the face of

all The Laramie Water Company's permits and appropriations, and the express claims, conditions and limitations of the Pioneer Highline permit, which was never even initiated prior to 1912, should relieve us from giving them further consideration were it not for the fact that by ignoring them injustice may result, and we shall therefore enter upon a somewhat detailed discussion of the record.

All of these disconnected surveys which we shall consider are doubtless immaterial for the following reasons:

(b-1) The Pioneer Highline Canal has never been constructed, either in whole or in part, and was never surveyed until long after the filing of this suit, and any and all previous reconnaissances or surveys of any canal of similar name but by parties foreign to the new enterprise, have no connection with or bearing upon the new lateral of The Laramie Water Company;

(b-2) Claim for such a canal was never filed with the State Engineer of Wyoming and was never presented to the Board of Control or to the District Court during proceedings for the adjudication of water rights on the Big Laramie River in Wyoming, or the review thereof (which terminated in the decree, Plaintiff's Exhibit "N");

(b-3) Any and all claims for a Pioneer Highline Canal, except those represented by permit No. 2719 Enl., filed July 11, 1912, are forever barred by Section 794 of the Compiled Statutes of Wyoming, 1910, requiring all persons to appear and submit their claims for adjudication before the Board of Control of the State of Wyoming; and

(b-4) Because the State of Wyoming and its appropriator, The Laramie Water Company, are bound and limited by the terms of the permit No. 2919 Enl., filed July 11, 1912, and are precluded by the findings and conditions of said permit-decree from asserting any other or different claim for other or different priority from that set forth in said instrument.

We have already discussed at length the conditions and limitations of the permit issued January 8, 1913, and have covered the objections raised in the last of these subdivisions.

We will discuss the first three in their order.

(b-1) No Such Canal Ever Constructed and no Connection Between Recent Permitted Survey and Other Reconnaissances.

Lyman E. Bishop, resident engineer for The Laramie Water Company, came to Laramie in July, 1910. The idea of making a definite survey of the Pioneer Highline Canal seems to have first occurred long subsequent to the filing of this suit. This survey, *in its entirety*, was undertaken by Mr. Bishop and by

no other engineer preceding him. He made both the preliminary and final surveys and certified the application for permit filed with the State Engineer on July 11, 1912. He says:

> "During 1912 * * * made *preliminary and final* location surveys of * * * Pioneer Highline Canal." (774.)

On cross-examination he further says:

> "The Pioneer Highline has been finally located * * * Practically no construction work has been done. The headgate will be * * * located in Lake Hattie Supply Canal No. 1." (785.) (*Not* on the Laramie River or Pioneer Canal, but on the inlet canal to Lake Hattie Reservoir.)
>
> "If the Pioneer Highline Canal is ever built * * * there will be a crossing over the Lake Hattie Supply Canal No. 2 and the Pioneer Highline Canal will be so constructed that Bell Supply No. 2 water could be run into the Pioneer Highline from that point." (795.)

We have already noted that no previous surveys had any connection whatever with the surveys upon which are predicated the various permits and rights obtained by the Laramie Water Company. (661-3.)

The present new 1908 inlet canal to Lake Hattie Reservoir does not follow any of the lines of earlier surveys. (935, 939-40.)

S. C. Downey, a witness for the complainant, described each of these early reconnaissances. He said:

> "The present canal leading to Lake Hattie Reservoir does not follow the line of the survey as shown by the * * * Bellamy or the Owen survey. * * * The topography of the country would naturally throw them somewhat in the same location." (935.)

Of these early surveys he said:

> "I have produced what purports to be a report made by each of four surveyors, d'Hemecourt, Loback, Anderson and Owen.
>
> Each of these was an individual attempt to promote the scheme which I have outlined. Each report is an engineer's prospectus rather than a report on a definite survey basis. By that I would say it is a general report rather than a detailed report of the survey.
>
> *In each of these reports the Highline Canal is quite evidently located at different places*, and in each instance

is a mere open canal without any difficulties of construction.

The High Line ditches, in any event, in order to irrigate lands situated at the higher levels than those irrigated by the Pioneer Canal, *would of necessity be limited in their location between the base of Sheep Mountain and Sodergreen Lake on the Pioneer Canal.* * * *

Any competent engineer, in running any line for the irrigation by a higher line of ditch than the Pioneer canal would be forced to place his line through the vicinity." (939-40.)

After mentioning in detail the several early surveys, he said:

"*The ditch was not built on that survey*" (927) (referring to the d'Hemecourt survey.) * * * "The survey made by Mr. George C. Anderson * * * in 1890 * * * *was independent from the surveys made by d'Hemecourt.* * * * I am not able to produce a plat of the surveys made by Mr. Anderson, I don't believe one was ever made. * * * The ditch was not *constructed* under the Anderson survey." (929-30.)

"I am unable to produce a plat of the survey made by Mr. Loback. *The Anderson and Loback surveys were never filed for record of my knowledge.* * * * *The ditch was not constructed under the Loback survey.*" (929-30.)

The witness then produced Defendants' Exhibits 16 and 17, designated as the Owen and Bellamy surveys respectively, and states:

"*The ditch was not constructed under the Owen survey. It was not constructed under the Bellamy survey.* The Wyoming Central Land & Improvement Company authorized the Owens survey for the Pioneer Canal. The same people authorized the Bellamy survey. This company had four distinct surveys made at different times in this proposed project. The *last* of these four was the Bellamy survey, in 1893." (931.)

He then speaks of certain disconnected surveys subsequent to 1902, having no connection with those made by Sevison or Bishop and no connection with any former surveys by any other engineers, and again speaking of the Owen survey, says:

"The ditch was never constructed * * * as shown by the Owens survey." (933.)

The witness then admitted that the Owens survey and the Bellamy survey were in no way similar except as thrown in a general vicinity by the topography of the country. (933-5.)

We fortunately have the testimony of Mr. Bellamy who made the last of the four original surveys, terminating in 1893. He says:

> "In 1886, Mr. Loback and myself ran a number of lines west of town and over that country. *It was a* mere reconnaissance." (751.)
>
> "Some reconnaissance work was done in 1886, or '87 relative to the Pioneer. *They did not proceed with the construction.* It was simply to see the possibility of sometime running a ditch there. We started with two buggies and I would get out of one, set up the instrument and send the man ahead where I could take a long sweep and sight with my gradient what the fall of the ditch would be, allowing it to run nearly straight and then allow a little and then have him hold the rod with the target the same height as the instrument. Then I would ride to him and he would go on.
>
> We spent two or three days going over the plains between the two rivers." (769.)
>
> "Mr. Loback did the same in '87, only he staked out a line. *No construction was done.*" (769.)
>
> *"The matter was to take a ditch from the Pioneer and run it at a higher elevation with a little less fall.* The Pioneer there has a very heavy fall, in one place, and we thought by coming out ahead of that and around to see how much more he could take in by making a high line of it and picking up waste fall." (769.)
>
> *"In 1893 I had started to stake this out when the panic came on and everything shut down and they dropped it entirely."*
>
> *"There were no filings made* on my original survey which was incomplete." (771.)

The fallacy of any claim of connection between the Bishop-Laramie Water Company—permit of 1912 for the so-called Pioneer Highline and these old surveys is thus exposed by Mr. Bellamy, who was a witness for the State of Wyoming.

> "The present works are entirely disconnected from my surveys and also the '86 and '87 surveys by Mr. Loback and me, which ended in naught. Lake Hattie was not a reservoir in those days." (771.)

According to the testimony of both witnesses Downey and Bellamy, all the earlier surveys went into oblivion and were

practically forgotten and never revived by the Pioneer People. In 1906 or '08, and more than four years subsequent to the commencement of the Greeley-Poudre project in Colorado, engineers Roach and Stewart made certain similar desultory reconnaissance surveys which came to naught. Mr. Roach had assisted Mr. Owens in one of the early surveys which passed into oblivion and states that the 1906 reconnaissance began at a still different point on the Pioneer Canal than that taken by all previous engineers. He says:

> "R. G. Stewart was consulting engineer * * * I had orders either from him or Mr. Corthell" (referring to N. E. Corthell, counsel in this case) *"to go out there and start one or two places and run a line.*
>
> *I ran a line independent of any survey.* I did not run across any surveys made at that time by the original company or their representatives. *I consumed about six days in the field making this survey.*
>
> Mr. Corthell and I had a dispute as to who got the map or plat of this survey. I do not know what became of it." (972.)
>
> I have been unable to give any definite location of my old High Line survey.
>
> *No canal has been built following the line of that survey.*
>
> If the *Lake Hattie supply canal* is correctly shown on the map attached to defendants' answer, then *my line was different.* We started at several places from the Pioneer Canal. I did not tie to anything there, everything was done with angles. * * *
>
> *The present Lake Hattie Supply canal* was built very close to one of my surveys. *It was not built from my survey."* (974-5.)

The applications filed with the State Engineer of Wyoming beginning with April 21, 1908, and upon which permits were granted for the various units of the system now owned and projected by The Laramie Water Company furnish the most conclusive proof that no Pioneer High Line, or any other similar canal, was ever contemplated by the promoters of any of the several units of that system prior to the survey commenced long subsequent to the filing of this suit and immediately preceding the filing of application for permit for the Pioneer Highline lateral on July 11, 1912.

The Statutes of Wyoming (Section 734, Compiled Statutes, 1910, and section 5, Ch. 45, Laws 1895), require:

> *"Each application* for permit to appropriate water for beneficial uses must be accompanied by a *map* or plat

in duplicate, showing accurately the location and extent of the proposed works * * * the course of the river, stream or other source of supply, * * * the *location of the intersection with all other ditches, canals, laterals or reservoirs which are crossed by this work with which connections are made;* and all streams not connected with the proposed work must be represented in ink of different color from that used to represent the proposed work." etc. (3913-14, original record.)

In other words, if any such canal or survey as the Pioneer Highline lateral had been known to Engineer Sevison at the time of making his 1908 survey, or to his successor, or had been seriously contemplated by his employers or any of their successors, including The Laramie Water Company, it would have been proper and *necessary* for Mr. Sevison and succeeding engineers to have noted *on the maps* which accompanied each application for permit the *location of the line and point of intersection* of the canal for which permit was requested, with that of the imaginery Pioneer Highline canal. *Failure to so note the line of this imaginery lateral on any and all of the maps accompanying the several applications for permits is evidence of the fact that such canal was neither known nor contemplated at the time of preparing such maps and filing such applications.*

An inspection of the certified copies of the maps accompanying the several applications so filed (Defendants' Exhibit 159 et seq.) shows that the maps and plats filed with each successive application for permit, from the first (filed April 21, 1908), to and until that for the high line lateral from the new Lake Hattie inlet (not Pioneer Canal), filed July 11, 1912, *are conspicuous for their entire omission of* any notation either by line, words or figures, whereby the slightest inference may be drawn that the Pioneer Highline Canal was ever known or contemplated.

The first permit, No. 8612, filed April 21, 1908 (Defendants' Exhibit 159), shows merely the location of the Lake Hattie Supply or new inlet canal from the river to Lake Hattie Reservoir and the upper contour of the reservoir. At no place on this map portraying in detail the new inlet canal for Lake Hattie Reservoir (which counsel, on page 77 of their brief, erroneously designate the Highline canal) is there any notation indicative of any reference to or connection or intersection with any such Pioneer Highline lateral, real or imaginary, and at no place in the permit or the granting clause thereof is there any reference to any such canal or any permit, filing, survey, claim or application for or on its behalf.

The same observation obtains with relation to permits 8613,

1372 Res., and 1373 Res., for the Lake Hattie Reservoir, and 1939 Enl. for the enlargement of the new inlet canal (permit 8612) from the river to Lake Hattie Reservoir, and the maps accompanying each thereof.

If the Pioneer Highline Canal had been in contemplation on December 5, 1910, the point of crossing and intersection between the new inlet canal from the Little Laramie River to Lake Hattie, known as Lake Hattie Supply Canal No. 2, would undoubtedly have been noted on the map accompanying the application for this canal. An inspection of the map accompanying the application for permit (No. 10363, Defendants' Exhibit 166) reveals the fact that no such point of intersection or crossing is noted and indicates the entire absence of notation of any prospective line of canal situate in the vicinity of or designated as this imaginary lateral. It is apparent that The Laramie Water Company had not, even at that late date conceived the idea of constructing such a lateral, and apparently did not know of its evidentiary possibilities.

Even more positive becomes this conclusion upon examination of the map attached to application for permit No. 2720 Enl. (Defendants' Exhibit 167) applying for right to enlarge this same inlet canal from the Little Laramie River, for even on this map there is no indication of any such canal as the Pioneer Highline Canal, or of any intersection with any canal similarly located.

All these maps confirm and corroborate the evidence of Engineer Bishop, already referred to, that he made both the preliminary and final surveys of the Pioneer High Line lateral during 1912, and not theretofore, and confirms the fact that the idea of constructing this canal is an after-thought, first conceived by The Laramie Water Company and its predecessors during 1912, and long subsequent to the filing of the bill of complaint herein. They likewise confirm the conclusion that the selection of the name "Pioneer Highline" was either a fortunate accident or an unwarranted attempt to capitalize legendary accounts of "visions" of other persons, in nowise bearing upon the new lateral thus so recently projected.

Counsel, on pages 76-7 of their brief, make the erroneous statement that all of the Sevison work, beginning in April, 1908, had some connection with these former and wholly foreign investigations made many years previous by different parties with different interests and objects, and that the construction which commenced in the year 1909 was upon this Highline lateral, when in truth the only construction ever undertaken in this vicinity by The Laramie Water Company or its predecessors was that of the new inlet canal to Lake Hattie, having no relation whatever to any previous ideas of the Pioneer Canal

people and not having in contemplation any extension beyond the point of discharge into the reservoir.

No color of foundation exists for any such assumption. The entire record discloses its fallacy. Even the new lateral permit, the only one ever granted for this or any other Highline canal or lateral, specifically and affirmatively denies their assertion and specifically states that the water to be by it used relates exclusively to the new and not to the old system.

For Wyoming and her appropriators to make such an assertion is as preposterous as would be the assertion or claim by Colorado that her Greeley-Poudre project—in truth commenced August 25, 1902—is nevertheless entitled to assert a claim as of the date of the "wounded deer" incident of Wallis A. Link, to which we have heretofore at length referred, or to assert that she is entitled to priority of the late seventies or early eighties because, perhaps, certain railroad surveys along the Cache la Poudre River included a tunnel for transportation and water diversion at the present location of the Greeley-Poudre tunnel, or, John Zimmerman, of Home, Colorado, made preliminary-survey of this same tunnel line for irrigation diversions, neither of which were ever communicated to Wallis A. Link or A. I. Akin prior to April 25, 1902, but the truth of which they later accidentally discovered. Any such evidence would be fictitious, irrelevant and immaterial and pure sham and its offer improper by reason of the fact that these early acts have no direct bearing upon the Greeley-Poudre project, and could not be legitimately connected with its initiation and construction, even though the early surveys did occupy the exact position of the present tunnel.

Fictitious as any such claims would be, they are on a par with those now solemnly asserted by plaintiff, and are as abandoned and long since completely dead and forgotten as were the early reconnaisances on the mythical Pioneer Highline canal.

Even though the "wounded deer" incident aroused the imagination of Mr. Link, who later initiated the construction of the Greeley-Poudre tunnel, it would be insufficient upon which to predicate a priority constituting the basis and principal value of the title to a great water system. All such early visions, reconnaissances and ideas have some pleasant historical interest, but, like the dreams of inventors or of prospectors seeking for precious metals, are no basis for patent or title, which alone can vest upon open, well-directed efforts, followed with such diligence and compliance with formalities of law as the circumstances and good faith toward other inventors and miners, as well as to the state, may require of those who would thus claim as their own that which theretofore was the property of everybody and yet of none but the sovereign.

We believe further discussion unnecessary to show that the new lateral from the new inlet canals to Lake Hattie, first surveyed in 1912, and whose possibility seems to have been discovered long after the filing of this suit, has nothing in common with any previous reconnaissances made long years since by different persons, at different times, in different localities and with different objects; that it is simply a survey of a mere lateral for carrying water to be diverted from the Big and Little Laramie rivers by new canals constructed since 1908, under authority of new permits, none of them earlier than April 21, 1908, and has no real or imaginary relation to the old Pioneer Canal or its appropriation of water, but on the contrary, is specifically prohibited from carrying any of the same; that it is not to be constructed along the line of or pursuant to any previous survey for any similar canal to carry water of the Pioneer Canal or of any other ditch or stream, but is a new and independent idea in no manner related to any former theories; that the adoption of the name "Pioneer High Line" is a misnomer in that the newly surveyed lateral bears no possible relation to the Pioneer Canal or the carriage of its waters, and that any argument seeking to connect either this lateral or the principal canals, the new Lake Hattie inlets, with the Pioneer Canal or any "early" survey of any lateral line from that canal is wholly unwarranted by the evidence, and cannot conceal the fact that all the new Laramie Water Company's projects are six years and more junior to the Greeley-Poudre project in Colorado.

(b-2 and 3) No Claim of Appropriation for any Such Canal Ever Filed with State Engineer of Wyoming or Made Before the Board of Control or District Court at Adjudication of Priorities on Laramie River.

It is not only necessary under the laws of Wyoming that any person desiring to acquire right to the beneficial use of public water shall make application to the State Engineer for a permit before commencing the construction and enlargement or extension of any ditch or performing any work in connection with any canal (3910. Sec. 724, Comp. Stats. Wyo., 1910), but it is also imperative that such persons thereafter appear before the State Board of Control where the rights of the various claimants to the use of water upon the stream are adjudicated and determined (3917, Sec. 794, Comp. Stats. Wyo.).

The statute reads:

"Whenever the state board of control shall, as provided by law, proceed to adjudicate and determine the

rights of the various claimants to the use of water upon any stream or other body of water, *it shall be the duty of all claimants interested in such stream, to appear and submit proof of their respective appropriations, at the time and in the manner required by law.*"

The same statute then continues:

"*and any such claimant who shall fail to appear* in such proceedings and submit proof of his appropriations shall be barred and estopped from subsequently asserting any rights theretofore acquired upon the stream or other body of water embraced in such proceeding, and *shall be held to have forfeited all rights to the use of said stream theretofore claimed by him.*" (Wyo. S. L. 1901, Chap. 67, Art. 2, Comp. Stats. Wyo., 1910, Section 794).

An adjudication of priorities to the use of water from the Laramie River in Wyoming was had before the Board of Control and an appeal from decision of the board was taken, prosecuted and perfected to final judgment and decree prior to the filing of this suit. (1042, Plaintiff's Exhibit N.)

It accordingly appears that all claims for any "Pioneer High Line Line Canal" must have either been presented at this adjudication proceeding or forever barred and forfeited.

No evidence in this behalf was introduced by Wyoming, and it became necessary to ascertain the truth by thorough search of all official records.

This search (3930-2) revealed:

That no application for permit or filing (other than that made by Engineer Bishop for The Laramie Water Company on July 11, 1912) had ever been filed or made with the State Engineer or Board of Control or other officer of the State of Wyoming for any "Pioneer High Line Canal" or any other similar canal by another name, or for any lateral ditch from the old Pioneer Canal or the new inlet to Lake Hattie for the service of the lands to be served by such a lateral if ever constructed;

That no claim in behalf of any such canal under the name of the "Pioneer High Line Canal" or otherwise had ever been made in the proceedings for the adjudication of priorities of water rights from the Laramie River before the Board of Control or in the proceedings on appeal for review of the decree of the Board of Control to the District Court and terminating in the decree (Plaintiff's Exhibit N); and,

That the application of July 11, 1912, is the first and only filing or claim ever made or asserted of record in behalf of any such a canal or lateral, before any of the officers of the State

of Wyoming having to do with the administration and distribution of the waters of that state.

The above facts are in no way controverted by the complainant and it therefore conclusively appears that no claim for or previous assertion of right in behalf of any such lateral canal was ever made by any person or at time prior to July 11, 1912.

By failure to make any previous claim, The Laramie Water Company and plaintiff state are forever barred from now and here claiming the benefit of any of the disconnected and abandoned previous reconnaissances at length described in the previous section (b).

(b-4) Permit No. 2719, Enl., Filed July 11, 1912, Limits Claims and Bars Assertion of Any Prior Rights.

This topic has been sufficiently discussed at length in the preceding paragraphs. There we observed that by the terms and conditions set forth both in the application filed July 11, 1912, and permit granted January 3, 1913, no claim or assertion is made for use of any water to be diverted from the Big Laramie River by the old Pioneer Canal, but, on the contrary, the only claim made or right granted is for use exclusively of water to be diverted from the Big and Little Laramie Rivers under authority of Permit 8612, filed April 21, 1908, and permits subsequently granted to the Laramie Water Company and its predecessors, and that even as to such, no increased diversion shall be made in excess of that authorized by such recent permits of April 21, 1908, and subsequent.

The appropriator having thus made no assertion or pretense of claim of benefit or advantage of the few desultory investigations with relation to the old Pioneer Canal many years ago and inferentially waived and admitted the worthlessness of any such, and having specifically limited his claim for water to that permitted for diversion six years and more junior to the Greeley-Poudre enterprise, and the plaintiff State of Wyoming having accepted and approved the limitations self-imposed by the appropriator, and having further limited the right to the effect that *the use of this new canal shall "in no way interfere with prior rights on the Big and Little Laramie Rivers"* and that the exclusive function of this new lateral shall be that of carriage (rather than diversion) of a portion of the water so permitted as of 1908 and subsequent, neither the appropriator or the state can now be heard to assert any other or greater rights or privileges than that contained in the application and permit.

(b-5) Conclusions In Re High Line Lateral.

The foregoing exhaustive review of the evidence relative to the mythical High Line Canal, demonstrates:

(1) That no such canal ever has or does now exist;

(2) That the only record claim in behalf of any such canal bearing that or any other name, is for a mere lateral, subsidiary to the new Lake Hattie system and included within the application of July 11, 1912, and not before, and making no claim from the river;

(3) That this new lateral and all other units of the new Lake Hattie system have no connection whatever with any prior reconnaissances made for or on behalf of the Pioneer canal people or for use of appropriations of water of that canal;

(4) That adoption of the name "Pioneer High Line Canal" was a misnomer for that this new survey bears no relation to the old Pioneer Canal or any survey for any high line lateral for use of waters appropriated by it;

(5) That any and all such prior acts relating to the old Pioneer Canal were forgotten and abandoned long prior to April, 1908;

(6) That all appropriations pertinent to the entire new Lake Hattie system, including this new lateral from its inlet ditches, began not earlier than April 21, 1908;

(7) That no claim of appropriation was ever previously recorded or made for or in behalf of any Pioneer High Line canal or lateral or any similar canal by any other name, either with the State Engineer of Wyoming or before the Board of Control or District Court of Wyoming;

(8) That plaintiff is barred by her statutes and by the terms of the permit for the new lateral so designated, from asserting or claiming any benefit of any early investigations looking toward possibility of future construction of some canal in the same general vicinity; and

(9) That the terms and provisions of the permit for this new lateral and the whole record justify the conclusion that all assumptions with relation to this so-called Pioneer High Line Canal are wholly without foundation and in no manner contradict or conceal the fact that all new Wyoming projects are upwards of six years junior to the Greeley-Poudre project in Colorado.

(c) Other Errors.

Among the many other errors appearing in plaintiff's brief, we desire to call attention to the following:

On page 47, counsel state that the appropriators of the plaintiff state had actually used all of the water of the Lar-

amie River prior to the initiation of the Greeley-Poudre project in Colorado, during 1902, which, nevertheless is several years senior to the new projects in Wyoming. The State Engineers and proper authorities of Wyoming disprove this assertion and have granted appropriation to new Wyoming projects for the irrigation of more than 278,000 acres of land in addition to that covered by all ditches prior to the Colorado diversion, and have also granted right for additional storage of 450,000 acre feet of water.

Notwithstanding construction of the large new James Lake and Lake Hattie reservoirs in Wyoming, all of which were initiated long subsequent to the Colorado project, counsel on page 55 of the brief, complain of the fact that they cannot store their surplus water because "the Wyoming appropriators do not have such reservoirs" for their conservation. We are wholly at a loss to understand this statement which is wholly inconsistent with the one last before mentioned. If ditches senior to the 1902 Colorado project had already consumed the water, there would be no surplus in the river and none to be stored. If there was a surplus and the Colorado project had diverted it, it would leave none for the several enormous new reservoirs begun in Wyoming in 1908, and when in turn, these reservoirs have actually been completed and are ready to conserve water, we are at a loss to see where Wyoming can claim that she is short of capacity unless, which we assert, there is more than enough water to supply all appropriations, senior and junior, both in Colorado and Wyoming.

On page 70, it is asserted that Cooper Lake is a natural lake and that its waters do not flow into the Laramie River. James Lake was allowed to continue in just such a condition up to the year 1908-9, when but a slight cut was required to enable the waters, naturally impounded and wasted, to be used for irrigation of lands tributary to the Laramie River. Cooper Lake is quite similar to James Lake, and Wyoming should not be heard to complain when she permits water to flow into this and numerous other natural basins, there to waste and evaporate, when, by slight diligence, the same water could be made available for irrigation.

On page 78, counsel describe the work on the Greeley-Poudre project as "desultory" and point with pride to the rapidity of construction upon the James Lake and Lake Hattie projects. We have already shown that the Lake Hattie reservoir is but the smaller part of the Laramie Water Company's scheme, and that these two reservoirs constitute that portion of the work most easily constructed. We suggest development might be "desultory" when more than thirty years have been consumed in trying to complete the Pioneer and Wheatland projects, and yet only about fifty per cent of the acreage under

either has ever been reclaimed, and when on the Bell Supply canal, quite similar to the Greeley-Poudre project, only fifteen per cent of the work has been completed during a period of five years and none whatever performed on the Bath, Bell, Robinson and McConnell reservoirs. The destruction of the market for bonds of the Greeley-Poudre system by acts of plaintiff and her appropriators might also have some bearing (Camfield, 2163-5; Iliff, 3661-2, 3665-70, 3682-7).

On page 79 it is asserted that 400,000 acres are "now being and proposed to be irrigated in Wyoming under ditches far older than, or at least contemporaneous with the Greeley-Poudre project." The James Lake, Lake Hattie and other new 1907-8 projects in Wyoming are included in the acreage enumerated. Under the rule of priority, a difference of the smallest division of time is sufficient to give superiority. Projects initiated six years junior to another certainly cannot be either "older than" or "at least contemporaneous with" the former projects. This statement is as wholly foreign to the record as the statement on the previous page to the effect that the Lake James and Lake Hattie schemes were commenced before "final plans of the Greeley-Poudre project were made." It will be recalled that the work had been proceeding upon the Greeley-Poudre project, as at present planned, continuously from August 25, 1902, down to and after the time the Greeley-Poudre Irrigation District contract was made in September, 1909, and especially during the year 1907, and it would be just as reasonable to assert that the appropriation for the old Pioneer canal dates as of 1909 or 1910, at which time the Lake Hattie people acquired control of the affairs of the canal in order to enlarge it as it would be to say that the priority of the Colorado project dates from the irrigation district's contract of September, 1909. The Greeley-Poudre Irrigation District simply took over a project which had been in process of construction for more than seven years, and no changes were made in the original plans. Of course, it would be both pleasing and profitable to plaintiff if nothing had been done on the Greeley-Poudre project prior to September, 1909, but we believe that an expenditure of more than $296,000 on a project during six short working seasons is sufficient evidence of diligence to have justified the District Court of Colorado in decreeing priority of August 25, 1902, to the Greeley-Poudre project. Very evidently the new Wyoming projects, all initiated in 1907-8 and subsequent, are neither "far older than" nor "at least contemporaneous with the Greeley-Poudre project."

V. GENERAL CONCLUSIONS.

The following general conclusions may be drawn from the record:

(a) That the Greeley-Poudre project in Colorado, including its tunnel and collection ditches and reservoirs, was initiated August 25, 1902, and that work proceeded with diligence and continued in conformity with well defined plans from that date until prevented by the filing of this suit;

(b) That more than $296,000 had been expended upon the system prior to the Spring of 1908, and that construction had been open, notorious and well known to citizens and officials of Wyoming;

(c) That in Wyoming, surveys first began on the James Lake system March 22, 1908; on the Lake Hattie system April 16, 1908, and on the Sodergreen Highline during November, 1907; that on the Wheatland Industrial Company's projects, while preliminary survey began on the Bordeaux tract in February, 1904, final surveys were made just prior to filing on April 18, 1907, and survey commenced on the Sybille tract in August, 1907, and that none of said or other new Wyoming projects were initiated or work commenced thereupon prior to said dates;

(d) That the Greeley-Poudre project in Colorado is between five and six years senior to any and all of the new larger Wyoming enterprises;

(e) That during 1907 and 1908 and subsequently, new permits have been issued for new enterprises for irrigation of 278,153.61 acres of unreclaimed land in Wyoming and more than 450,000 acre feet appropriations for storage in addition thereto have been granted these new projects, thus initiated, beginning with 1907-8, for all of which new projects the State Engineers of Wyoming have found and thereby declared, that there is ample water after supplying *all* earlier and preferred appropriations on both the Big and Little Laramie Rivers.

(f) That the Greeley-Poudre project in Colorado can do no injury to any senior appropriations in Wyoming and that after diverting but a part of the flow of the one branch of the stream which rises in Colorado, more than ample will remain in the stream to supply the needs (without waste) of both senior and junior appropriators in Wyoming.

VI. WYOMING'S DISREGARD OF COLORADO PRIORITIES.

In concluding the discussion of diversions and use of water from the interstate stream in Colorado and Wyoming, it may

not be amiss to observe that some of the tributaries of the Colorado stream, the Cache la Poudre, have their source in the Green and Laramie mountains along the southerly border of the Laramie Plains in Wyoming and flow out of that State into Colorado, where these waters have long since been appropriated to beneficial use; and that, notwithstanding the prior Colorado diversions, Wyoming has proceeded to officially sanction and decree junior appropriations in Wyoming for irrigation of lands at the headwaters of these interstate streams so arising within her borders. (See map, Plaintiff's Exhibit 1.)

Under the subject of "Inter-watershed Diversions," we discuss at length certain diversions of the waters of Fish Creek, as that stream rises and flows in Wyoming, by which injury is occasioned the earlier Colorado appropriators on the Cache la Poudre, of which Fish Creek is a tributary, and reference is made to that portion of the brief to here avoid unnecessary repetition.

Professor L. G. Carpenter, in his exhaustive discussion of the diversions in the two states, says:

> *"There are instances, other than those I have mentioned from Fish Creek, where citizens and residents of Wyoming are diverting and using waters originating in that state to the detriment and injury of citizens of Colorado.*
>
> There are a great many such diversions on *Crow Creek and Lone Tree Creek in Wyoming*, which are tributaries of the South Platte and have quite a long list of appropriations in Wyoming, and in addition to that, there are a good many appropriations or decrees which have been adjudicated to rights on *Dale Creek*, and various tributaries of the Cache la Poudre other than Fish Creek.
>
> * * * There are a good many rights on Crow Creek for irrigation and other purposes. * * * There are a good many acres that are irrigated from Crow Creek in Wyoming and I know also that in *Colorado Crow Creek has practically no water.*
>
> A number of rights for diversion of water, within Wyoming, from Dale Creek have been granted by authorities of that state. *These rights have been granted and use is made of waters of this creek in Wyoming, notwithstanding shortage of water in the Cache la Poudre river.* * * * Dale Creek is a tributary of the North Poudre and both the North Poudre and the Poudre River have been short of water for a portion of the year for many years. That is especially true of the North Poudre. Dale Creek * * * is a flowing stream throughout its length and the water that is used and taken out in Wyoing undoubtedly depletes the stream in Colorado where

there are existing rights. The adjudicated rights in Wyoming on that stream not only run back for a number of years, but are continually increased, and adjudications are being made from year to year up to the present time. I believe there were some rights adjudicated last year. *By adjudicated I mean certain water rights were quieted and confirmed in owners by the Board of Control of Wyoming, even as late as last year.* I mean users have conformed to laws of Wyoming and their water rights have been so confirmed.

I have in my hand a list of adjudicated rights on Dale Creek and tributaries in the State of Wyoming, obtained from the secretary of the Board of Control of that state. *111 ditches are mentioned in this list of adjudicated rights as having been given decreed water rights out of Dale Creek and tributaries.* This does not include those ditches which have permits but have not gone to final adjudication. There are a good many such permits which have been issued and are outstanding but upon which final proof has not been made.

Diversion of this interstate stream continues in Wyoming notwithstanding shortage on the same stream in Colorado.

Fish Creek is a tributary of Dale Creek and the diversions on the former are included in those just given. On Fish Creek, Wyoming appropriators have not only appropriated water for irrigation of lands within the drainage area of Fish Creek, but even more, they have diverted waters from Fish Creek for irrigation of lands lying outside of its drainage area and in the drainage area of the Laramie River as shown on Defendants' Exhibit 50.

Water is diverted from the Cache la Poudre drainage basin over into the Laramie River basin in Wyoming.

The dam for the reservoir of the water system of the City of Cheyenne, furnishing water for Fort Russell and Cheyenne, was constructed within the last three or four years. Use of water by Fort Russell, I believe has been enlarged and connected. These diversions are from Crow Creek and tributaries. They are from one of the tributaries of the South Fork of the Platte, which tributary joins the South Platte in Colorado at a point a little east of Greeley." (3899-3901.)

It thus appears that while Wyoming would here complain that Colorado, by her *senior* appropriation, is diverting water from the Big Laramie River within her own borders to alleged depletion of water supply which would otherwise be available

to *junior* appropriators from the same stream in Wyoming, she nevertheless has officially permitted, confirmed and decreed *junior* diversions from Dale, Crow and Lone Tree Creeks in Wyoming to the detriment of senior appropriators in Colorado. If the rule of priority of appropriation obtains regardless of state lines, it would follow that the senior Colorado appropriator is doing no violence to the junior Wyoming appropriator whose rights are inferior, and that Wyoming appropriators are only entitled to assert a right to use the residuum of the stream *after* the senior appropriator in Colorado has been fully supplied. But Wyoming is not content to follow the doctrine of priority when the appropriation is made at the headwaters of streams arising within *her* borders, but, on the contrary, deliberately permits her citizens to take Cache la Poudre waters from that portion of its tributaries arising in Wyoming, by means of *junior* ditches, to the *detriment of senior ditches* in Colorado, and quiets, confirms and decrees the right of these late appropriators to continue so to do.

We do not here contend that Colorado has the right to compel the junior Wyoming appropriators to desist from these diversions so injuring senior Colorado appropriators, because the rule of priority of appropriation obtains *only within* the boundaries of each state for the regulation of her own streams in such manner as she may elect, and does not obtain upon interstate streams regardless of state lines, but it would seem that Wyoming should not here complain of the senior Greeley-Poudre diversion from the Laramie River, when Wyoming is not even content to abide an administration of the distribution of water in accordance with the doctrine of priority of appropriation, but officially permits her citizens to violate the rule to the detriment of Colorado appropriators on those portions of the Colorado stream which are in Wyoming.

THE LAW OF APPROPRIATION.

In Volume I of this brief we have considered at length the sovereign rights of each state to exercise supervision and control over the waters within her borders, in such manner as she may elect, and it would seem unnecessary to make another and extended review of the same subject.

Counsel for complainant (pages 94-109) assert that "The universal holding is that priority of appropriation gives priority of right on interstate streams the same as on streams within one state" and cite as authority: Hoge vs. Eaton, 135 Fed., 411; Taylor vs. Hulett, 15 Ida., 265; Conant vs. Deep Creek, etc. Co., 23 Utah, 627; Willey vs. Decker, 11 Wyo., 496; Farm Inv. Co.

vs. Carpenter, 9 Wyo., 110; Howell vs. Johnson, 89 Fed., 556; Anderson vs. Bossman, 140 Fed., 14; Morris vs. Bean, 146 Fed., 423; Bean vs. Morris, 159 Fed., 651; ibid., 221 U. S., 485, and Rickey Land & Cattle Co. vs. Miller, 152 Fed., 11; 218 U. S., 258.

It will be unnecessary for us to enter into a discussion of these cases. In none of them do we find an issue between sovereign states, neither are these decisions in so far as they support the contention of complainant, consistent with the decisions of this court. Two of these cases were certified from the Circuit Court of Appeals to this court: Rickey, etc. vs. Miller and Lux, 218 U. S., 258; Bean vs. Morris, 221 U. S., 485.

The decisions in these two cases in this court have been reviewed in Volume I of this brief. Suffice it to say that in each this court takes a position which is undeniably inconsistent with the doctrine of priority of right regardless of state lines, except upon the assumption that both states assented to an arrangement whereby rights might be acquired by appropriators in one state as against appropriators in another. In Bean vs. Morris, particularly, the court assumes that the upper state, Montana, was willing that such rights might be acquired by appropriators in the lower state, Wyoming. Colorado expressly, by her constitution, her legislation and the decisions of her Supreme Court (Stockman vs. Leddy, 55 Colo., 24), denies to Wyoming appropriators such a right as against appropriators in Colorado. We believe that the cases cited by counsel for the complainant in support of its contention must yield to the decisions of this court in Bean vs. Morris and Rickey vs. Miller and Lux. Furthermore, in Kansas vs. Colorado, 206 U. S., 46, the decision of this court is unquestionably inconsistent with the theory that priority of right, regardless of state lines, is the law. It may be argued that such a question was not directly in issue, but the decision cannot be read as an authority upon any other theory than that each state is sovereign and as such is entitled to the unrestricted diversion and beneficial use of its waters in such manner as it may elect, provided there be an equitable division of benefits, depending upon the circumstances, from an interstate stream.

Furthermore, we find that the Supreme Court of the State of Wyoming has denied to a Colorado user the right of eminent domain for condemnation of a right of way for a ditch heading within the State of Wyoming for the irrigation of lands within the State of Colorado. Grover Irr. Co. vs. Lovella Ditch Co., 21 Wyo., 204, 255-63.

This decision seems to overrule, in part at least, the doctrine announced in the Wyoming and other cases cited by counsel for the complainant.

The cases cited by counsel all involved controversies between individual appropriators in different states and none

of them were between the states in their sovereign capacities. The rights of the citizen in such cases and the limitations of his authority to bind the sovereign, either by his acts or omissions, as well as the rights of the sovereign irrespective of those of the citizen, have been determined by this court:

> Georgia vs. Tennessee Copper Co., 206 U. S., 230.
> Hudson Water Co. vs. McCarter, 209 U. S., 349, 355.
> Kansas vs. Colorado, 185 U. S., 125; 206 U. S., 46.

Each sovereign state stands on an equality with every other state, as announced in Kansas vs. Colorado, *supra:*

> "One cardinal rule, underlying all the relations of the states to each other, is that of equality of right. Each state stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none."

Colorado was so admitted to the Union. Section 1 of the Enabling Act provides:

> "Which state, when formed, shall be admitted into the Union upon an equal footing with the original states in all respects whatsoever."

If the rights of each state are in all respects equal with those of every other, it follows that any doctrine cannot obtain between the states which denies or does violence to this underlying principle of equality. By neither the common-law doctrine of riparian rights nor the arid region doctrine of appropriation can this equality be maintained in the regulation of irrigation from interstate streams.

The common-law rule is founded upon accident of physical location of lands upon the banks of the streams to the exclusion of all other lands and its application between one state, whose arable lands are non-riparian, and another, whose lands are riparian, must needs deny use of the waters of an interstate stream to the one for the exclusive benefit of the other, and destroy the equal right of the first state to use and enjoy her own natural resources. The same result would follow an interstate application of the doctrine of appropriation for, while the state may, as between her citizens, decree that an absolute inequality shall exist by reason of the fact that only a portion of her lands may be reclaimed by the very limited water supply within her borders, and that he who is first in time shall thereafter be first in exclusive right to the use of the waters of her streams to the extent of his necessities, even though it be to consume all the waters of the stream, nevertheless, the very

inequality and exclusiveness of such a doctrine forbids its application between states with equal sovereign rights, and the rule of inequality which necessity compels between citizens of each state *inter se* cannot apply between states where a contrary rule obtains.

Intra-state Application of Doctrine of Appropriation.

In Part I of this volume, we have given extended consideration to the doctrine of appropriation as applied within, but not between, the arid states of Colorado and Wyoming, while considering the law of inter-watershed diversions. There we discussed the fundamental principles of the doctrine of appropriation as distinguished from the common law rule of riparian rights and the many decisions of this and other courts, including those of Colorado and Wyoming, uniformly declare that the common law rule of riparian rights has been entirely abolished in both Colorado and Wyoming and that each of those states have adopted the arid region doctrine of appropriation for intrastate regulation and control of the streams. A review of the many decisions there cited and quoted is here unnecessary, but a brief reference to some of the rules of application of the doctrine of appropriation may be of some value in construing the testimony introduced respecting the relative priority rights of the appropriators within the two states.

An appropriation is the intent to take the water, accompanied by some open, physical demonstration of the intent, and for some valuable use.

> Fort Morgan Land & Canal Co. vs. South Platte Ditch Co., 18 Colo., 1, 4.

The true test of appropriation of water is the successful application thereof to the beneficial use designed.

> Thomas vs. Guiraud, 6 Colo., 530.

If the construction of a ditch be prosecuted with reasonable diligence, the water right relates back to the time when the first step was taken.

> Sieber vs. Frink, 7 Colo., 148.
> Wheeler vs. Northern Colo. Irr. Co., 10 Colo., 582.
> Kinney on Irrigation, 2nd Ed., Vol. 2, Chap. 40.

The work of construction must be prosecuted with reasonable diligence from the first initial act and until the ditch has been finally completed. The diligence required is that constancy and steadfastness of purpose and labor which is usual

with men engaged in like enterprises and who desire a speedy completion of their plans. As to what constitutes reasonable diligence is a question of fact and must be determined from all the circumstances surrounding each particular case. The *climate* of the part of the country where the appropriation is attempted is a proper subject, upon the question as to whether the work should be prosecuted during all or for only a portion of the year; also the *topography* of the country where the works have to be constructed and through which they run, as to whether the same be level or rough, and whether the soil is easy to work or whether rock and the like are encountered. So, also, may be considered the difficulty of obtaining labor, tools or material and the extent and magnitude of the works themselves. The term "reasonable diligence" is a relative one and what may be reasonable diligence in one case might be a great lack of diligence or unreasonable delay in another, and the fact as to whether there has been reasonable diligence depends upon the facts of each particular case.

Kinney on Irrigation, 2nd Ed., Vol. 2, Chap. 39, pages 1266-83 and cases cited.

While the priority of appropriation relates back to the time when the first step was taken, in Colorado (Sieber vs. Frink, 7 Colo., 140), in Wyoming the priority relates back to the time of the filing of the application for permit with the State Engineer.

Wyo. Comp. Stats. 1910, Sec. 739.
Whalon vs. North Platte Canal etc. Co., 11 Wyo., 313, 344.

The water right of the appropriator is limited both in time and volume by his needs.

Thomas vs. Guiraud, 6 Colo., 530.
White vs. Nuckolls, 49 Colo., 170, 177.

The prior appropriator of water of a certain stream or other source of supply is entitled to the exclusive beneficial use of the water up to the amount embraced in his appropriation, even if it cuts off the right of valid subsequent appropriators and even where this includes all of the water of the stream, and this right continues so long as he applies all of the waters appropriated to some beneficial use or purpose. The water right acquired by a valid, prior appropriation gives the owner thereof an absolute, exclusive property right and he has an absolute right to the use of the water to the full extent of his appropria-

tion and may maintain this right unimpaired by subsequent appropriators of the waters of the stream.

2 Kinney on Irrigation, 2d Ed., Vol. 2, Secs. 780-2, pages 1355-63, and cases cited.

The rights of a prior appropriator being fixed by the extent of his appropriation, others may later appropriate all of the surplus water that is left flowing in the natural stream, provided that no interference with or injury to the rights of the prior appropriator is thereby caused. These later appropriators are termed, under the law, subsequent or junior, and are themselves prior appropriators as regards those whose rights are still subsequent to theirs. Each successive appropriator acquires a right to the surplus water flowing in the stream and each takes all that is required for his needs.

Kinney on Irrigation, 2d Ed., Vol. 2, Sec. 783, pages 1363-6.

If the prior appropriator has no present or immediate need for the full quantity of water which he may divert and use, *he cannot waste it,* but it is his duty to allow such portion as he may have no immediate use for to *remain in the natural stream.*

Burkart vs. Mieberg, 37 Colo., 187, 190;
Nichols vs. Hufford, 21 Wyo., 477, 490;
Kinney on Irrigation, 2d Ed., Vol. 2, Chapter 49, pages 1541-1624.

Water users are not allowed an excessive quantity of water to compensate and counterbalance their neglect or indolence in the preparation of their lands for the successful and economic application of water.

Nichols vs. Hufford, 21 Wyo., 477, 494;
Farmers' Co-operative Ditch Co. vs. Riverside Irr. Dist., 15 Idaho, 525.

Under the doctrine of priority of appropriation, the new 1907-8 Wyoming projects take only whatever surplus remained in the stream after all senior and prior appropriations have been supplied to the extent of their needs (but not for waste), and had the Greeley-Poudre project been in Wyoming, all such new enterprises subsequent to August 25, 1902, would have been junior and inferior thereto and could have no claim upon

the river until after the needs of the Greeley-Poudre system had been satisfied.

Respectfully submitted,

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APPENDIX

LIST OF DEFENDANTS' EXHIBITS.

The complainant's exhibits are designated by the letters of the alphabet. The defendants' exhibits are numbered.

Exhibits:

1. Map of the Laramie and Cache la Poudre Rivers, attached to the answer of the corporate defendants.
2. Map showing irrigated lands, Wheatland, Bordeaux and Sybille tracts.
21. Sketch Map, drainage area of Western States.
22. Sketch Map, Jumna Western and Eastern Canals, India.
23. Map, Punjab Project, India.
24. Map, United Provinces of Agra and Oudh, India.
25. Map, Periyar Project, India.
26. Map, Madras Presidency, India.
27. Map, Bouches du Rhone, France.
28. Map, Carpentras Canal, France.
29. Map, Gap Canal, France.
30. Photograph, Aqueduct, Pont du Gard, France.
31. Photograph, Tunnel, Aqueduct Pont de Gard, France.
32. Photograph, Masonry Aqueduct Craponne Canal, France.
33. Photograph, Aqueduct Carpentras Canal, France.
34. Photograph, Aqueduct Carpentras Canal, France.
35. Sketch Map, Cavour Canal, Italy.
36. Sketch Map, Villoresi Canal, Italy.
37. Sketch Map, White Mud River Project, Canada.
38. Sketch Map, Elbow River Project, Canada.
39. Sketch Map, Red Deer Project, Canada.
40. Photograph, Head-works Cavour Canal, Italy.
41. Photograph, Intake, Cavour Canal.
42. Photograph, Naviglio Grande, Italy.
43. Sketch Map, Strawberry Valley Project, U. S. Reclamation Service, Utah.
44. Map, Milk River Project, Montana.
45. Sketch Map, Los Angeles Aqueduct.
46. Sketch Map, drainage areas, Colorado, Montana, Wyoming.
47. Map, Powder River Project, Wyoming.
48. Map, irrigated land, Powder River Project.
49. Three Sketch Maps, Inter-watershed diversions, Wyoming.
50. Sketch Map, Inter-watershed diversion, Wyoming.
51. Copy of map and statement, Laramie-Poudre Tunnel and collection ditches, filed in office State Engineer, Colo., October 6, 1904.

52-72. Photographs of early work on Greeley-Poudre System on the Laramie River, 1902-1904.

73. Photograph, Skyline Canal.
74. Copy of map and statement, Link Lake Ditch and feeders, filed in State Engineer's office, Colo., Oct. 15, 1902.
75. Copy of map, East Fork Ditch and Reservoir, filed in State Engineer's office, Colo., May 9, 1904.

76-85. Photographs of upper works of Greeley-Poudre System on Laramie River, 1907-1912.

86-104 Blue print diagrams, based on Census Reports, decades 1870 to 1910, inclusive, comparing Larimer and Weld counties, Colorado, with Laramie and Albany counties, Wyoming,—size, population, rural population, agricultural production and live stock.

105. Plat showing minimum temperatures, 1893 to 1912, inclusive, Greeley, Colo., and Laramie, Wyo.

106-112. Photographs showing crop and soil conditions, Laramie Plains, Wyoming.

113. Tabulation, flow of water from Cache la Poudre River to South Platte River, 1909-1913.

Exhibits:

114. Plane table survey plats, Laramie Plains.
115. Album of Photographs of diversion works on Big and Little Laramie Rivers, Laramie Plains, Wyoming.
116. Album of Photographs, farm and ranch improvements, Laramie Plains, Wyoming.
117. Tabulation, irrigated area classified, Little Laramie Valley, Wyoming.
118. Tabulation, irrigated area classified, Big Laramie Valley, Laramie Plains, Wyoming.
119. Album of Photographs. Improvements under Larimer County Canal, Colorado.
120. Album of Photographs, Improvements under Larimer and Weld Canal, Colorado.
121. Album of Photographs, Agricultural Industries, Poudre Valley.
122. Album of Panoramic Photographs, Wheatland and Laramie Plains areas in Wyoming, and Poudre Valley area in Colorado.
123. Table, discharge, Cache la Poudre River at mouth of canon, 1881-1913.
124. Table, discharge, Cache la Poudre at mouth of canon, showing additions and diversions above gauging station.
125. Table, discharge Laramie River at Glendevey, Colo.
126. Table, discharge Laramie River at Decker's and Boswell's (State line).
127. Table, run-off, Laramie River at Wood's Landing, Wyo., and Skyline and Divide Canal diversions.
128. Table, discharge, Laramie River, Wood's Landing, Wyo., 1889-1913.
129. Table, discharge, Laramie River at Boswell's (State line) and Wood's Landing, showing inflow between stations.
130. Maps of irrigated area, Laramie River Valley in Colorado.
131. Table, discharge, Little Laramie River at Hatton, Wyo.
132. Diagram, Laramie River, Skyline Ditch to Wood's Landing, 1912.
133. Diagram showing flow and use, Little Laramie River, Hatton to Two Rivers, Wyo., 1912.
134. Diagram showing flow and use, Laramie River from Two Rivers to Look Out, Wyo., 1912.
135. Mass diagrams, Wheatland Reservoir, Wyoming, 1912.
136. Mass diagram, supply and use, Big and Little Laramie Rivers, 1912.
137. Mass diagram, supply and diversions, Laramie River, Skyline Canal to Wood's Landing, Wyo., 1913.
138. Diagram, supply and use, Little Laramie River, from Fillmore to Two Rivers, 1913.
139. Diagram, Laramie river, supply and use, Two Rivers to Look Out, Wyo., 1913.
140. Mass diagram, Wheatland Reservoir, Wyoming, 1913.
141. Mass diagram, Big and Little Laramie Rivers, supply and use, 1913.
142. Diagram, flow and diversions, Laramie River to State line.
143. Table, discharge, Big Laramie River at Two Rivers, Wyo., 1909-1913.
144. Table, discharge, Little Laramie River at Two Rivers, 1909-1913.
145. Table, discharge, Laramie River at Uva, Wyoming.
146. Tabulation showing sugar beet industry in Colorado.
147-153. Letters to and replies from State Engineers of various Western States, inter-watershed diversions.
154-155. Soil Maps, U. S. Soil Survey, Laramie Plains, Wyo.
156. Photographs showing snow-fall, Medicine Bow Range, Colorado and Wyoming.
157. Chart, discharge, Little Laramie River at Fillmore, Wyo., 1912.
158. Chart, discharge, Laramie River at Boswell's (State line), 1912.
159-178. Certified copies applications and permits for irrigation projects diverting water from the Laramie River in Wyoming, 1908 and subsequent.
179. Copy, Decree adjudicating priorities, Water District No. 48 (Laramie River, Colorado).

NOTE.—Exhibits 3 to 20, inclusive, consist of various data produced on cross-examination by witnesses for the complainant. These were identified but not introduced.

Exhibits 22 to 50, inclusive, show inter-watershed diversions in India, Italy, France, Canada and United States.

NUMBER 3 ORIGINAL.

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JAMES D. MAHER
CLERK

In the Supreme Court of the United States

October Term 1917

In Equity

THE STATE OF WYOMING,
COMPLAINANT,
vs.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoir and Irrigation Company,
DEFENDANTS.

SUPPLEMENTAL BRIEF ON BEHALF OF DEFENDANTS

Volume II

The Facts

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In the Supreme Court of the United States

October Term 1917

In Equity

THE STATE OF WYOMING,
COMPLAINANT,
VS.
THE STATE OF COLORADO, The Greeley-Poudre Irrigation District, and The Laramie-Poudre Reservoirs and Irrigation Company,
DEFENDANTS.

SUPPLEMENTAL BRIEF ON BEHALF OF DEFENDANTS

Volume II

The Facts

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PART II

THE FACTS

(VOL. I OF THE BRIEF DEVOTED TO THE LAW.)

PRELIMINARY STATEMENT.

The State of Wyoming in this cause seeks to enjoin the State of Colorado and its citizens from diverting water from that branch of the Laramie River, an interstate stream, which rises within the borders of Colorado and flows thence into the State of Wyoming, by means of a tunnel to the Cache la Poudre River (the Poudre River) for the irrigation of certain arid lands included within The Greeley-Poudre Irrigation District. The case was submitted upon the briefs and oral argument of counsel for the respective parties in December, 1916. Thereafter the Court entered an order directing that the case be restored to the docket for re-argument. (See Page 10, Vol. 1 of this brief.) It is pursuant to this order that this brief (in two volumes), which we term the "Supplemental Brief" of the defendants, is submitted.

Volume I is devoted to discussion of the law—Volume II, the facts.

The cause is an original proceeding in this court and the evidence is voluminous. In their original brief the defendants endeavored to collect and classify the evidence pertaining to the more important features of the case in order that the court might with less labor reach its conclusions of fact. There is so much local geography involved that we fully appreciate the difficulty of describing in a manner which will be intelligible to a person unfamiliar with the territory, the various features necessary to an understanding of a case of this nature. We have been served with a copy of the brief submitted pursuant to the order of re-argument, by the plaintiff and with due deference to counsel, we respectfully suggest to the court

that our original brief is almost a complete answer to this supplemental brief of the plaintiff, or, to be more exact, this supplemental brief is an attempt to reply to the original brief of the defendants.

It will of course be immediately recognized that Wyoming, the plaintiff in this case, is not suing as an appropriator of water from the Laramie River, but rather as a sovereign state, she sues in behalf of her citizens, some of whom are appropriators from this stream. In other words, she sues in her sovereign capacity and seeks by an action against the sovereign State of Colorado, to control the State of Colorado and her citizens. Conceding, that she has named two corporations as parties defendant, nevertheless her prayer for relief is based upon a broader ground than the acts of these two corporations alone, that is to say, that she recognizes that the citizens of Colorado can be controlled through an action affecting the sovereign state. The case therefore assumes the status which is defined by the language of this Court in the opinion written by Mr. Justice Brewer in Kansas vs. Colorado, 206 U. S., 46-99: "The controversy rises, therefore, above a mere question of local private right and involves a matter of state interest, and must be considered from that standpoint." The plaintiff in its bill of complaint, complains of the diversion of water from the watershed and also complains that prior appropriations in the State of Wyoming will be deprived of water for irrigation if the Colorado diversion be not prohibited.

The defendants proved that the diversion of water from one watershed to another, where necessity required it, was the universal practice where irrigation obtained, and that this practice has been recognized by the law of the

arid states, was followed by the Reclamation Service, and was even in vogue and generally recognized by the law of the State of Wyoming (Page 181 Plaintiffs' Supplemental Brief, also Vol. II, p. 1 to 48 incl. Defendants' Original Brief.)

It is a practice entirely consistent with the theory upon which the doctrine of appropriation is founded. To complain of it in this case and in the same breath insist upon the application of the doctrine of priority as between appropriators of water in the States of Colorado and Wyoming, is, in short, to mix two theories or two legal principles, which are inconsistent and directly opposed one to the other.

In the original brief of the plaintiff, the defendants were at a loss to understand upon what principle the plaintiff relied and after hearing the arguments of counsel we still were unable to distinguish any specific theory of principle upon which the plaintiff based its claim for an injunction against the defendants, prohibiting them from making the diversion of which complaint is made. Since receiving plaintiffs' reply brief, we are still in doubt as to the position taken by Wyoming. On page 189, the concluding statement of the brief contains the following:

> "Second. That there is not here any right in Colorado to a so called equitable diversion of the waters for the purpose of the diversion threatened because (a) the threatened diversion interfering as it does with the Wyoming appropriators and depriving them of necessary water *is contrary to every principle of prior appropriation;* (b) the diversion threatened taking the water as it does from the watershed so that it canont return to the stream is *contrary*

to every principle and doctrnie of riparian rights; (c) that there is no rule or principle governing the depletion of streams *in invitum* excepting the doctrine and principles of prior appropriation and the doctrines and principles of riparian rights and combination of these two, etc."

The defendants, on the other hand, while we answered the bill of complaint to the effect that Colorado as a sovereign state, had the right to the use of the waters rising and flowing within the state, as against the claims of lower states upon the same streams, alleged nevertheless that Colorado and its citizens would not take by means of the diversion complained of, more than an equitable portion of the Laramie River, and that in any event, the diversion sought to be enjoined, was prior in point of time to many large diversions both completed and contemplated, from the same stream in the State of Wyoming. Upon the oral argument, we distinctly stated to the Court, that Colorado's position in this case was that natural barriers prevented Colorado from taking what might be under all facts and circumstances, a reasonable portion of the stream; that we were limited to diversions already existing and not complained of by means of two ditches which had been in operation for many years, of a quantity of water which would average 20,000 acre feet per year, and that by means of the diversion herein sought to be enjoined, we contemplated and additional diversion of 56,000 acre feet, with a possibility that this 56,000 acre feet might be enlarged to 71,000 acre feet; but that the total amount of these diversions, 91,000 acre feet ,was the total average amount which Colorado might make from the Laramie River and that it defined the beneficial use which the State of

Colorado might make of this stream which contributed, or rather, in the absence of these diversions, would annually contribute not less than 250,000 acre feet of water to the State of Wyoming, and that in addition to this supply numerous and important tributaries entered the stream below the boundary line between the two states and further augmented the supply which was available to Wyoming. In other words, we insisted upon the right of the State of Colorado to enjoy the beneficial use of 91/250 of the amount of water which rose within its own borders, or 91/470 of the total supply of the Laramie River in both states. Furthermore we contended that the diversion sought to be restrained, was prior in point of time to many large diversions now existing in the State of Wyoming which had recently been in use, and also prior to many proposed diversions for which permits had been issued by the authorities of the State of Wyoming. We therefore contended that regardless of the principle which may properly control a case of this nature, that the State of Wyoming had failed to sustain her burden and that the case should be dismissed.

Since the argument of this cause, the order of court restoring the case to the docket directs that attention be given to the rule which counsel deem should properly be applied to the solution of this controversy, that is, whether the rights asserted are to be tested and determined solely by the application of the general principles of prior appropriation without regard to state boundaries, or whether, on the contrary, the general principles of prior appropriation are subject to be restricted or their operation limited in this case by state lines, and if so, by what principles, under that assumption, the case is

to be controlled. Volume I of the brief is devoted to a discussion of this portion of the order, and as there concluded, *we respectfully state the contention of the defendants to be, that the doctrine of priority of right in the appropriation of water for irrigation or other purposes, is one of intra state law and has no application in controversies between states, but on the other hand that each state as a sovereign, has the right to utilize the waters of its streams to an extent rendered necessary by the conditions under which the use is made, with just regard for the sovereign rights of the lower states into which the streams may flow; and that this right the state is entitled to in the exercise of its sovereign powers subject to be questioned therefore, in this court in a proper proceeding, as to whether it be reasonably exercising those sovereign powers.* In such a proceeding the Court, sits, as it were, as an international, as well as a domestic tribunal, and applies federal law, state law, and international law, as the exigencies of the particular case may demand: Kansas vs. Colorado, 185 U. S. 125-147.

In Volume I of this brief we have exhaustively discussed the law of state jurisdiction of waters. We there observed that the general doctrine of appropriation like the doctrine of riparian rights, is at best but a rule of usufructuary private property law *intra state* in its application and varying in its interpretation with the laws of the several states in no two of which is the application of the general principles the same. We further observed that the general principles of prior appropriation are such that they cannot apply without regard to state boundaries and are inapplicable to controversies between states; that the doctrine would violate the sovereign rights of states standing upon an equality one with

another; that its application would be to impose an exclusive perpetual servitude upon the natural resources and domain of one state, without consent, for the sole benefit of another state and its citizens and would be equivalent to the taking of property of one sovereignty without compensation or consent, for the exclusive and perpetual benefit of another sovereignty and its citizens; that the general doctrine would be incapable of administration if sought to be applied without regard to state lines and inequitable in its operation; that many of the rivers of the arid region rise in the mountains but disappear as they flow out across the plains and that the enforcement of the doctrine to such streams would be to consume and waste the greater portion of the stream in order to satisfy the claims of the users upon the lower reaches of the watercourse; that on rivers, such as the Colorado, it would be impossible to administer the doctrine and at the same time protect the rights of all the appropriators upon the stream and all its tributaries; that it would be impracticable if not impossible to determine and adjudicate the relative rights of appropriators upon streams irrespective of state lines; that the rights of the appropriator are limited to his necessities, which vary from day to day and year to year and cannot be definitely determined save to fix the maximum amount of his diversion and that such rights are subject to the laws, rules and regulations varying according to the necessities of each particular community where irrigation obtains and that in no two of the communities, districts or states are the conditions and necessities or the laws or rules thereof the same; that any attempt to administer the distribution of waters of interstate streams under the doctrine of appropriaion would involve insurmountable conflict

of laws, rules and regulations and such a variance of conditions as to make its enforcement impracticable; that the conflict of jurisdiction and administration of laws is well illustrated by the waste of water which obtains in Wyoming but is prohibited in Colorado; that administration in such a manner as to obtain the highest use of all the waters of the stream, by exchange and other systems necessary thereto, would be practically impossible; and that the many difficulties and obstacles which confront application of the general principles of appropriation to interstate streams, demand that some other principle must govern controversies between states.

Of the many cases which we discussed we particularly desire consideration of Stockman vs. Leddy, 55 Colo., 24, wherein the position of the State of Colorado is judicially declared by the Supreme Court of the State, and of the two principal cases decided by this Court, Missouri vs. Illinois, 200 U. S., 496, and Kansas vs. Colorado, 206 U. S. 46, wherein the rights of one sovereign state in its relation to another state over the use of rivers common to the two, were determined. We also desire to refer to the case of Rickey Land & Cattle Co. vs. Miller & Lux, 218 U. S. 285, and Bean vs. Morris, 221 U. S. 485, wherein the rights of the states irrespective of the citizens of either are pointed out, especially in cases where, as here, extra-territorial servitudes are denied by both litigant states. We believe that the law announced in *Missouri vs. Illinois* and *Kansas vs. Colorado* should control the decision of this case, that is to say, that each state has a sovereign right to utilize the waters of its streams under such system of law as it may choose and according to its local conditions and necessities either present or future, and that in each controversy between states

all the facts and circumstances are to be so construed as to recognize and preserve the equal sovereign rights of both states and at the same time establish justice between them.

Without further reference to Volume I or further discussion of the law we shall pass to the consideration of the facts here involved.

THAT THE FACTS DISCLOSED BY THE EVIDENCE IN THIS CASE PROVE THAT NO DAMAGE WHATSOVER WILL RESULT TO THE STATE OF WYOMING OR ITS CITIZENS BY REASON OF THE DIVERSION COMPLAINED OF AND THAT THERE WILL REMAIN AN ABUNDANCE OF WATER FOR THE IRRIGATION OF WYOMING LANDS NOW IRRIGATED AND A SURPLUS FOR ADDITIONAL DEVELOPMENT; THAT THE APPROPRIATIONS MADE BY THE GREELEY-POUDRE SYSTEM HEREIN SOUGHT TO BE ENJOINED ARE PRIOR IN TIME AND RIGHT TO MANY VERY LARGE ENTERPRISES, BOTH STARTED AND IN CONTEMPLATION, WITHIN THE STATE OF WYOMING AND DIVERTING WATERS FROM THE SAME STREAM; THAT COLORADO IS, IN ANY EVENT, TAKING LESS THAN A REASONABLE PROPORTION OF THE WATERS OF THAT BRANCH OF THE LARAMIE RIVER WHICH RISES AND FLOWS WITHIN HER BORDERS AND THAT THE EQUITIES ARE ENTIRELY IN FAVOR OF THE DEFENDANTS, BOTH UPON THE FACTS AND THE PRINCIPLES OF LAW INVOLVED, AND THAT THE CASE SHOULD BE DISMISSED.

We believe that under any principle of law which might govern a controversy of this sort, Colorado was entitled to be dismissed for the reason that Wyoming had not shown that she would be damaged by the diversion sought to be restrained, but rather that the evidence proved that even after the total amount capable of being diverted had been taken from the stream for irrigation in Colorado, there was more than a sufficient amount left for the irrigation of the lands now under irrigation in Wyoming and even an abundance of water for future development and though it were contended that it

was questionable as to whether or not sufficient water would remain for the future use of Wyoming, that nevertheless the benefit to the country from the use of this water upon the lands in the Poudre Valley proposed to be irrigated by it, would be many times what it otherwise would be if the diversion were enjoined and the water used for the irrigation of the Laramie plains. We sought to present this case in its broadest possible scope believing that the Court would desire, not the mere academic questions of priority of right or sovereign ownership, but rather that it would wish to know all the circumstances and the probable results which would follow the decision of the case. To that end we reviewed the evidence pertaining to the more important questions presented, and, in that portion reviewed in Volume I of the brief, summed up our conclusions of fact in this manner:

"That the total flow of the Laramie River and its tributaries in both Colorado and Wyoming is something in excess of 470,000 acre feet per annum, and of that amount 431,200 acre feet is the normal average flow of the river available above and including the Wheatland tract.

Of this total flow, Colorado furnishes at least 250,000 acre feet per annum, the evidence varying from 220,000 acre feet according to one Wyoming witness, to 250,000, 300,000 and 320,000 acre feet according to the Colorado witnesses.

Of the 250,000 acre feet furnished by the State of Colorado, we are now diverting for irrigation 20,000 acre feet per annum, and seek to divert 56,000 acre feet in addition, with a probability that at some time this 56,000 acre feet may be enlarged to 71,000 acre feet. Assuming this contingency, Colorado seeks

to divert 91/250 of its own water, and this amount marks the limit to which Colorado can go in the diversion of water from the Laramie River. The rest of the water must for all time remain in the stream for the benefit of Wyoming if she needs it.

That irrigation methods and irrigation systems in Wyoming have been and still are primitive; that necessity has never required the officers of that state to make any definite attempt at the diversion of the water of the stream acording to the respective rights of the appropriators; that wasteful methods have prevailed and still do prevail over a large portion of the Laramie plains area, and that the amount of water used has been far in excess of the amount actually needed, and that Wyoming has most excellent natural storage facilities which have been, to a certain extent, utilized at a remarkably low cost.

That the only expert testifying for the State of Wyoming says that the duty of water on the Laramie plains area is one acre foot per acre.

That the total amount of land under irrigation from the Laramie River and its tributaries in Wyoming is 108,073 acres, including 29,074 acres in the Wheatland tracts and 78,999 acres on the Laramie plains.

That while the Wheatland area is a relatively fair agricultural district, it has an ample water supply for many times the amount of land now under irrigation, and has, in fact, diverted more water than the law of the State of Wyoming permitted or necessity required; that the Laramie plains is an area where climatic conditions are so adverse that its agricultural development has been and will be limited to the production of hay and a few other hardy crops, capable of resisting the severity of the climate.

That the lands of the Greeley-Poudre District are dependent for reclamation upon water from the Laramie River, which, when supplied, will bring about a development within the district equal to the development in the adjacent lands in the Poudre Valley; that the development already reached in the Poudre Valley is one wherein the highest agricultural production obtains, with a possibility of still further development in the future, supporting many times the number of people per unit of area as can be or have been supported by the Laramie plains; that the same quantity of water, applied for irrigation upon the Poudre Valley will produce from five to ten times the amount that could be produced by the application of the same amount of water upon the Laramie plains.

That even, for the sake of argument, assuming a shortage of water in the Wyoming territory effected because of the diversion to the Greeley-Poudre District, nevertheless a far greater benefit to mankind will result from the application of that water in the Poudre Valley rather than upon the Laramie plains.

That after the diversions have been made by Colorado, there will remain available for irrigation in the State of Wyoming in the watershed of the Laramie River, far more than sufficient for its present needs, and even a surplus amount for vast increase in the amount of land under irrigation.

That the prior diversions from the stream, under the laws of the respective states, are in Colorado, and

That the diversion by Colorado from the watershed is consistent with the highest economic use permitted the world over where irrigation is a necessity.

Therefore, the defendants contend that their diversion from the Laramie River into the Poudre by means of the Greeley-Poudre system, will in nowise injure the State of Wyoming, and that the equities between the two states are such that this use is in nowise an unreasonable exercise of the rights of the State of Colorado as a sovereignty."

Defendants' Brief, Vol. 1, pp. 123-125.

We still contend that under the facts as disclosed by the testimony, the suit should be dismissed; and that so far as the merits of this particular case are concerned, Wyoming has failed to make a case upon upon any theory which she might advance.

The evidence relating to the more important features of the case was carefully collated and reviewed in our former brief. The supplemental brief of the plaintiff is largely an answer, to which we will reply by a more condensed review of the evidence with reference to the conclusions which the plaintiff seeks to draw by its supplemental brief.

Questions propounded by certain members of the Court at the argument of this case in December, 1916, suggested that the terms "equitable" or "reasonable amount" did not fix any rule by which the Court could determine this controversy. May we suggest that this principle does not demand any fixed rule, on the contrary, it leaves each case open for determination upon its own merits. Possibly at the moment the question was asked it was not in mind that this is an original proceeding wherein the Court must determine the facts as well as the law. Colorado contended that she is not exceeding her sovereign rights and will not divert more than a reasonable amount of the waters of the Laramie River. No fixed rule could be laid down which will determine

the "reasonable amount" in another case. It is, however, nothing but a question of fact to be determined as any other question of fact.

In the determination of this question of the reasonable exercise of sovereign powers by a state, we believe it pertinent to consider as factors: The development and future possibilities of development in the respective areas affected, and to some degree the relative prioritis of the diversions involved in the different states; the value not only to the persons or localities more directly involved in the controversy but more particularly the value or benefit to the state and its citizens and to all mankind in the application of water to one district rather than to another or, to put it bluntly, to weigh and compare the returns and to consider the highest economic value to which the water can be put; the water supply—this being of course the fundamental question under any principle—and the amount which will remain to the lower state after the diversion complained of has been made; waste or economy of use in the affected areas; the amount of land to be irrigated and what, if any, surplus of water remains; the possibilities of conserving flood waters by available storage; the damage or lack of damage which will be sustained by the respective persons or localities affected, and last, but not least, the effect of a decision upon future controversies wherein the state of facts may radically differ or wherein future development or necessities may prove matters now unknown in the science of irrigation.

It has been said that irrigation does not lend itself to academic treatment. This is true not only from the standpoint of the engineer, but also of the lawyer. The law of irrigation is not yet exact, and probably never will be. It is still in its formative

state. It varies with each state and locality according to prevailing conditions and necessities and will continue to vary with new and future necessities, varying with each state and community. Irrigation statutes have frequently been enacted designed to bring about beneficial results where the conditions contemplated coincide with those in the mind of the legislature, or in other words, where the condition is ideal. But actual conditions in irrigation rarely are ideal, as there are so many influences which affect them one way or another and with such varying results that the application of a statute based upon an ideal condition is difficult indeed, and while the law, like irrigation engineering, is a progressive science applied to varying natural conditions and is gradually developed in the full course of events, there is bound to be and always will be an inability to apply fixed rules for academic treatment. To a great degree each case must be determined upon its own merits.

In our first brief (both volumes) we devoted much time to a review of the evidence, believing that the evidence justified the conclusions of fact which we reached and which, in part, we have reiterated here.

Under the head of "Water Supply" we reviewed the evidence to the effect that the Poudre River did not furnish a sufficient supply of water for the irrigation of lands in the Greeley-Poudre Irrigation District, although that system contemplated the construction of at least one enormous reservoir in the channel of the Poudre River and other smaller reservoirs at available sites; that it was necessary, in order to irrigate these lands, to obtain a supply from some other watershed and that the Laramie River was the only available source of supply of this character.

We contended that the evidence proved that the normal supply of the Laramie River at the State line, including the appropriations now made, is, according to the Wyoming hydrographer, the only witness of the plaintiff upon the subject, 220,000 acre feet, and according to the three Colorado witnesses, is as follows: John E. Field, state engineer, 250,000 acre feet; Charles R. Hedke, 300,000 acre feet; Professor L. G. Carpenter, 320,000 acre feet; and that the total amount of water, including the amount diverted above, in the Laramie River and its tributaries, available for irrigation of lands in Wyoming, including the lands in the Wheatland tract, is more than 431,200 acre feet per annum. If the inflow below the Wheatland diversion be added the total is in excess of 470,000 acre feet per annum. The various investigations and hydrographic data upon which these conclusions were based were carefully reviewed, including this, that the evidence introduced by Wyoming herself showed that in the year 1912, there was stored in four reservoirs alone, that is, Lake James, Wheatland No. 2, Wheatland No. 3 and Lake Hattie, a total of 156,000 acre feet in excess of the use and evaporation from those reservoirs in that year. (3488)

We reviewed the evidence showing the amount of land irrigated in the Poudre valley, approximately 300,000 acres, and in Wyoming 108,073 acres, of which 29,074 acres were in the Wheatland area and 78,999 acres in the Laramie Plains; that the duty of water in the Poudre valley was approximately one acre foot per acre, measured at the headgate of the lateral leading from the canals to the land; that the amount of water heretofore applied on the Wyoming lands was in excess of this amount, although the Wyoming expert, R. I. Meeker, placed

the duty of water on the Laramie Plains at one acre foot per acre, whereas his own measurements showed distributions inconsistent with this statement; that the amount of water applied in the year 1912, for illustration, to the Wheatland lands was 2.6 to 2.7 acre feet per acre, measured at the head of the laterals, and that the amount actually distributed to that tract alone in that year was by 15,000 acre feet in excess of the maximum amount permitted by the laws of Wyoming for the most extreme cases in that State. We reviewed the evidence showing that in the Poudre valley the highest systematized method of administration for the distribution of water and the elimination of waste, had developed; that on the Laramie Plains there was practically no administration whatsoever; that ditches were without adequate means of diversion, that large quantities of water were there annually wasted (1288-9, 2741-3) and the officers of the State as a rule had not been called upon to perform any duties whatsoever concerning the distribution of water according to the priorities; that during the year 1912, concerning which complaint was made by certain witnesses under small ditches, that they were short of water, two large reservoirs on the Laramie Plains, Lake Hattie and Lake James, had continued to store water during the whole irrigation season, and it was proved by the water commissioner that none of these small ditches were so constructed that they could divert water (1276-89). That a comparison, or rather a contrast of the Laramie Plains and the Poudre valley showed that the production available from a like amount of water on the same unit of land was from five to ten times more in the Poudre valley than on the Laramie Plains; that The Greeley-Poudre system was prior in point of time to several large enterprises now constructed in Wyoming, notably the

Lake James system, Lake Hattie system, Sodergreen Highline and the extension of the Wheatland system to the Bordeaux tract and to the Sybille tract (see Part II, Vol. II defendants' orig. brief, and table on p. 228 thereof), of which Lake Hattie has a capacity of 110,500 acre feet, 68,500 acre feet being active or available capacity, and Lake James has a capacity of 41,100 acre feet. That in addition to these, the extension of the Wheatland system called for the irrigation of 10,000 acres in the Bordeaux and 30,000 acres in the Sybille tract; and that other later junior systems were authorized. We also reviewed the evidence showing conclusively that inter-watershed diversions were the rule in all irrigation countries where necessity demanded and economic conditions permitted it. (See Part I, Vol. II, defts. orig. brief.)

The supplemental brief of plaintiff seeks to answer our review of the facts, and in reply to this supplemental brief we shall endeavor to recondense the evidence outlined in our original brief, classifying it in such manner that the Court will be able to consider the various phases of the case separately. We shall follow the order of discussion adopted in plaintiffs' supplemental brief.

I. AMOUNT OF WATER DIVERTED BY COLORADO.

Under the heading, "Amount of Water to be Taken by Colorado," the plaintiff contends that the estimate of the Colorado engineers of the amount of water now diverted by Colorado from the Laramie River is low by at least 6,000 acre feet, and also that the constantly increasing pressure for water in the Poudre valley will certainly cause added efforts to divert water from the Laramie both earlier and later in the season and with less loss, so that even in the

average year the amount diverted by the Greeley-Poudre system would be much more than 75 per cent of the flow of the various streams intercepted by the system (that being the estimate of our engineers), and that the amount diverted would probably be 95,000 acre feet or more, rather than the 91,000 estimated. That in years of low flow, these diversions may amount to 100 per cent of the stream flow at the diversion works.

In order that the Court may understand the situation, let us recall again the geography of the Colorado diversion. The branch or tributary of the Laramie River here involved rises in Colorado in a high mountainous area, flows northerly for a distance of approximately 27 miles to the Colorado-Wyoming line, this length of stream being confined to a high mountain valley averaging from one-half to one mile in width. There are tributary streams entering the river from the east and from the west, more particularly from the west. The Poudre River rises in the same general locality, in fact the small tributary sources of the two streams are interlaced, the real head of the Poudre being Chambers Lake, from which the Poudre runs for a few miles almost parallel with the Laramie, being separated from it by one range of mountains, and then turns almost at right angles and flows easterly.

High on the head waters of both streams a ditch has been constructed and in operation since 1891, known as the Skyline ditch, diverting from some of the headwaters of the Laramie into Chambers Lake, or, in other words, into the Poudre. The testimony shows that this ditch, judging from actual experience, is to be expected to divert about 16,000 acre feet per annum from the Laramie watershed. Another diversion existing for a number of years, called

the Deadman, sometimes the Divide ditch, and at other times the Wilson Supply ditch, diverts water from another tributary of the Laramie River, by a circuitous route, into the Poudre watershed and has and is expected to divert about 4,000 acre feet per annum, making a total of 20,000 acre feet per annum now diverted by Colorado, but by persons not directly complained of in this proceeding. However, in order that we might be justly charged with the benefits which we are endeavoring to derive from this stream, we have in our consideration of this case, charged the State of Colorado with 20,000 acre feet on account of these two diversions.

The plaintiff contends that this is too low by at least 6,000 acre feet, basing this contention upon evidence introduced by the defendants showing the flow of the Poudre River with the accretions through the Skyline and Divide ditches (Ex. 124), and contends that this table shows that in the year 1901, when the normal flow of the Poudre River was 114 per cent of normal, the Skyline alone diverted from the Laramie, 23,801 acre feet; in 1902, when the supply in the Poudre was 51 per cent of normal, the Skyline diverted 22,124 acre feet; in 1903, when the Poudre supply was 116 per cent of normal, the Skyline diverted 26,114 acre feet; in 1904, when the supply of the Poudre was 106 per cent of normal, the Skyline diverted 23,434 acre feet. It was also argued from the record of other isolated years that it appears that the percentage of diversion through the Skyline ditch, assuming, as had been contended by defendants, that the years of high water and low water naturally concur in a large degree on both the Laramie and Poudre rivers, that the Skyline will divert a greater percentage of the supply of the Laramie River in years of low flow than it will in years of high flow.

May we state that the conclusions based upon this table (defendants' Exhibit 124) by plaintiff, appear to us to have been based upon a rather narrow review of the table. It will be noticed, however, commencing with the year 1905, the amount diverted by the Skyline ditch was materially less than the amount diverted in the preceding years, and at least a portion of plaintiff's conclusion is based upon the higher records. The manifest difference in these amounts, which is illustrated by the difference between the years 1904 and 1905, 1904 showing 23,434, and 1905 showing only 13,291 acre feet, diverted by the Skyline, is explained in this, that in the year 1905 Professor Carpenter, then being the state engineer of Colorado, caused this Skyline canal to be re-rated. This re-rating disclosed that the earlier rating had been excessive, the result was that the amount of water which the owners of the Skyline canal were permitted to divert from the Poudre because of the accretion to the stream through the Skyline canal was greatly reduced. Up to the year 1904, the company had been receiving from the Poudre more than it was justly entitled to receive. This was corrected and the table clearly shows a material reduction in the amount of the discharge of the Skyline ditch in the years subsequent to 1904 over what had been credited to that company in prior years. (1431 and 2209.)

There is, however, no nice question of fact involved here. It is conceded that The Greeley-Poudre Irrigation District seeks to obtain as much water as it is possible for it to divert from the Laramie River, inasmuch as all the water available from that source is necessary for the irrigation of the land in the district. This project, costing millions of dollars, was not undertaken because of any whim, but because of absolute necessity, and we, of course, admit the de-

sire and intention upon the part of the Greeley-Poudre District to take as much of this water as circumstances will permit. We do, however, contend that it is impossible to divert more than 74 per cent of the water of the Laramie River flowing at the point of diversion. The reason that we do not contend for 100 per cent of this amount is because it is impossible to obtain it (3424). The collection ditches diverting water from the tributary streams of the Laramie River are situated on the slopes of mountains of very high altitude; they are in every way comparable to the Skyline ditch and the history of that ditch gives us an indication of what will occur on these diversion ditches of the Greeley-Poudre Irrigation System. The Skyline canal is located at an altitude of from 9,300 to 9,500 feet above sea level, along a steep mountain side. (2206) It is impossible to keep the ditch in operation during the winter, and every spring it is necessary to dig a trench through the snow within it. This work is commenced at the lower end and proceeds upward. The ditch is usually open between May 10 and July 1. (2210, 2211) It is therefore apparent that the water, in addition to the heavy amount of seepage from a ditch of this character located as it is, which is not intercepted during the winter months, passes down the stream. The Greeley-Poudre diversion ditches being, as stated, very similar to this, will have a similar history. We therefore believe that the engineers for defendants have not under-estimated the amount of water which has been or will be diverted from the Laramie River for use in Colorado; but assuming for the sake of argument that this contention on the part of Wyoming is correct, nevertheless, as we will show later, it will not make any material difference in the result, because these diversions are made upon the upper

reaches of the stream at a point where the Laramie itself and also the tributaries intercepted are very small streams.

II. AREA OF LAND RECLAIMED.

The Court has requested, in the order for reargument, that the facts showing the extent of the uses of water in both States when the work complained of was begun and when this suit was commenced, be stated.

Inasmuch as the evidence introduced by the plaintiff of the amount of land irrigated and the diversions of water by the various ditches was very general, it is difficult to draw any lines of demarcation as to the extent of the use of water before and after any specific date. The evidence showed the nature and character of the Colorado project, of which complaint is made. The same is true of the lands in the Wheatland tracts, that is, the original Wheatland tract; and also the Sybille and Bordeaux tracts, of a later consideration. On the Laramie Plains there had been such a commingling of projects involving older diversions with the newer systems that we are unable to state with anything even approaching exactness what (for illustration the system of the Laramie Water Company which we generally term the Lake Hattie system) each consists of or includes, nor can we tell what is included within the project which we term the Lake James system. In other words, if these are definite, well defined projects having definite areas or boundaries, the evidence introduced by Wyoming fails to disclose it, and being unacquainted with the history of these developments, these defendants cannot attempt an exact definition of these systems.

We did, however, make a careful survey of a very material portion of the Laramie Plains, mapping or platting this survey in such way that not only were the irrigated lands shown, but also the crops to which these lands were devoted. This survey was made by plane table and a reduced photographic copy of the plats is introduced in evidence. (Exhibit No. 114).

The defendants claim August 25, 1902 as the date of priority of the diversion of water from the Laramie River by means of the Greeley-Poudre tunnel and the collection ditches designed in connection with it. (See defts.' orig. brief, Vol. II, pp. 133-188.) This suit was commenced on May 29, 1911. These, then, are the dates concerning which the Court desires a comparative statement of the development.

The Laramie River valley in Colorado has been frequently described by the witnesses and may be defined as a narrow mountain valley. It was, in part, surveyed in April, 1910, by an engineer named J. A. Whiting, who was introduced as a witness by the plaintiff. This witness described the valley as being from three-quarters to a mile in width, with the irrigated portion consisting of strips of meadow down through this valley on each side of the stream, the irrigated land extending generally 500 to 600 feet from the stream (1267-1271). Whiting made a survey of part of the irrigated land in this valley and found 1,856.64 acres, of which 567.6 acres was land largely covered by willows (1275). A complete survey was also made by Engineer Wortham (3454), employed by The Greeley-Poudre Irrigation District, who made a plat of the irrigated lands along the Laramie river and its tributaries in Colorado, and found a total of 4,250 acres (Exhibit 130).

These lands lying adjacent to the stream, devoted to the production of native hay, are the only lands capable of being irrigated in Colorado within the watershed of the Laramie River. The testimony shows that by reason of their location and the character of the soil, together with the slope, the use of water on these lands is not largely consumptive, but there is a very quick return from irrigation back into the stream; much more than would be true of lands of different character and location (3458). Similar conditions pertain on the upper reaches of the Little Laramie in Wyoming, the region being called the Centennial Valley (1110). This being recognized by both parties to the suit, no charge was made either against Wyoming or Colorado for the irrigation of these areas just described, and the measurements of water had been made as though no such irrigation had been practiced. However, it is pertinent to call attention of the Court to the fact that this insignificant area is all that Colorado can irrigate in the watershed of the Laramie River. Now in order to question the accuracy of the plane table survey made by the defendants of lands on the Laramie Plains in Wyoming, counsel for the plaintiff uses the variance in the amount of land disclosed by the two surveyors mentioned of these Colorado lands, as an argument to the effect that whereas the Wyoming engineer was unfamiliar with the lands irrigated, he failed to find 2,404 acres which the Colorado engineer showed to be irrigated, and that a similar lack of knowledge explained the wide variance between the amounts of irrigated land found by the Colorado survey over the amount claimed to be irrigated by the State of Wyoming in the Laramie Plains.

The argument is not very convincing. In the first place Whiting, the Wyoming engineer who sur-

veyed the Colorado lands, testified that he went only to a point three miles above Glendevey (1270). He also testifies that this same point, Glendevey, is about three miles below the tunnel of the Greeley-Poudre system. In this he was in error. Glendevey is about nine miles below the tunnel (see Exhibits 1 and 130), and it is quite obvious that Mr. Whiting did not make a survey of all the irrigated lands in Colorado. That is not material here, except to show that counsels' argument is not well taken. The incomplete abstract of the record (1266-75) doubtless leads to some confusion. The survey by Engineer Whiting was limited to a certain specific list of ditches, which are set forth on page 1269 of the original record (Vol. III, p. 291), and on page 1275 of the record he says: "I took these certain ditches I mentioned." In other words, Mr. Whiting merely measured the acreage irrigated by the specific ditches set forth on page 1269 and made no attempt to ascertain the total irrigated acreage in the valley.

All of these Colorado lands, that is 4,250 acres, were under irrigation by means of various ditches diverting water from the Laramie River and its Colorado tributaries prior to the initiation of work on the Greeley-Poudre system. So, also, were the diversions hereafter mentioned, made by means of the Skyline canal, which was constructed in 1891-1893 (2206), and the Divide canal or Wilson Supply, constructed somewhat later (1398). Since the work of construction of the Greeley-Poudre system was commenced, there has been no further diversion from the Laramie River within the State of Colorado, although one or two projects subsequently initiated by various persons in Wyoming contemplate not only the construction of a reservoir at Glendevey, but also a reservoir at the State line, neither of which

have been constructed, although a permit was issued for a reservoir at the State line, so far as it lay within the territorial limits of Wyoming (Exhibit 177).

Passing to the consideration of the amount of land irrigated in the Laramie Plains in Wyoming, counsel for plaintiff endeavor to classify it in this manner: (a) Area irrigated under ditches prior to the Colorado diversion (The Greeley-Poudre Irrigation District); (b) Area not yet irrigated but for which rights are claimed under ditches of conceded priority, and (c) areas under ditches of disputed priority. It is of interest, before reviewing this discussion in plaintiff's brief, to note that it is contended that the total amount of land irrigated from the Laramie River in Wyoming is 97,855 acres, from the Little Laramie River 48,344 acres, and from Sand Creek 5,989 acres, or a total of 152,097 acres. (p. 21)

No definite survey or measurement of these lands was made in behalf of Wyoming except as to some isolated areas which will be considered later. However, the defendants did make a survey of most of the irrigated lands—unfortunately time did not permit the completion of this work—and in every instance where lands were testified to be under irrigation by Wyoming witnesses and of which the defendants had made no survey, we accepted without question the Wyoming testimony, and adding these amounts to the amounts shown by the survey, we reached the conclusion that the total amount of land under irrigation in Wyoming is 108,073.75 acres. Counsel for plaintiff in their supplemental brief, giving due credit for good faith in this survey, ingeniously contend that the surveyors not being as familiar with the land, were not as capable of arriving at the true amount under irrigation as are per-

sons familiar with the land, giving as an illustration the failure of their engineer, Mr. Whiting, to find all of the irrigated lands in the Laramie valley in Colorado as before described. But the testimony of Mr. Whiting shows the weakness of this testimony (see pp. 1269, 1275 original record, but not in abstract; also pp. 26-7 *infra*). In the absence of a definite survey, the plaintiff introduced numerous witnesses who testified, not from surveys, but from what purported to be a general knowledge of the irrigated lands under the various ditches, and these statements, although mere rough estimates, are set out against the actual measurements made by defendants' survey.

Let us review very briefly a portion of this Wyoming testimony in order to see how indefinite it is as evidence contradictory to a survey. On page 13 of the supplemental brief it is stated that the amount of land under the Riverside Ditch No. 1, ditch, Riverside Ditch No. 2, and the Caldwell & Gardner ditch is 13,500 acres. This statement is based upon the testimony of a witness named Winkler, a ranchman who had lived in that vicinity for a number of years. He testifies to being acquainted with the Riverside ranch, irrigated by means of these ditches and says the land irrigated by these four ditches was about 13,500 acres (279). And the testimony of a witness Benson, a ranchman, who had also resided in the vicinity for a number of years, and who at one time had been foreman of the Riverside ranch, to the effect that 13,500 acres were irrigated in the Riverside ranch. Neither of these witnesses so much as mention a survey of this land. The testimony was a mere general statement and we do not believe was intended to be a statement of more than a general estimate on behalf of the witness.

It is next contended that the Murphy ditch irrigates about 80 acres. This statement is based upon the testimony of the witness Sodergreen, a ranchman, who also testifies in the same general way, and he also testifies in the same general manner concerning the Last Chance, Fisher and Sodergreen ditches. As to them, he says he irrigated about 800 acres. Concerning the Mansfield ditch, he says it irrigates "near a section" (411). Concerning the Hammond North and South ditches, he says, "it irrigates 160 acres, may be more" (412). Concerning the Smith ditches numbers 1 and 2, he says they irrigate 80 acres (412). Of the Lund ditch, it irrigates "about half a section" (412). Burg's ditch "irrigates perhaps over 200 acres," (413) Central ditch 50 acres; Sodergreen ditches numbers 1 and 2 "irrigate 300 or 400 acres." O. G. ditch "irrigates a section" (415). Sodergreen South ditch, 40 or 50 acres (415). Island ditch irrigates 80 acres (416). The Heidrick ditch irrigates 160 acres (416). Parker ditch irrigates 1,650 acres (416). The Popp & Pahlow irrigates "about 1,120 acres" (418). Sodergreen Highline ditch, built about 1910, "irrigates 4,000 to 5,000 acres" (418). Thus we find that one ranchman, being, according to his own testimony, familiar in a general way with these various ditches and the approximate dates of their construction, makes the statement of the amount of land under irrigation from twenty different ditches; but there is not even an intimation from this witness that he knew of any survey having been made of the amount of lands under irrigation, and his conclusions can be nothing more nor less than a general statement such as would come naturally from a witness familiar in a general way with conditions such as these.

We might review practically all the Wyoming testimony, but the examples which we have just given illustrate all the testimony introduced in this regard, with certain exceptions which we will discuss later.

On pages 15 and 16 of the brief, the Pioneer Canal, being the older of the larger canals on the Laramie Plains, is referred to, and it is said that the superintendent of the canal, a witness by the name of Titus, testified that ten or twelve years before 1913, he had made a map of the irrigated area under this canal which was then 17,000 or 18,000 acres, and that this amount had been irrigated up to the year 1912, when 19,000 to 20,000 acres were irrigated, although the arable area under the canal was from 35,000 to 50,000 acres.

After the defendants had commenced their survey, the engineer, Meeker, who was making various investigations for Wyoming as to water supply, areas, etc., made a reconnaissance of the lands under the Pioneer canal (827). This reconnaissance was made for the purpose of ascertaining more definitely than had been previously done, the amount of land under this canal. The measurements were taken in some instances by pacing the distance, and was not an accurate survey; but this Wyoming expert arrived at the conclusion and testified that the total amount of land under irrigation under the Pioneer canal was 11,556 acres (824, 844), although he said that he found evidence of at least 2,000 acres having been at some time previously irrigated, but not then in use. Contrast these two witnesses for the plaintiff, Titus, the superintendent of the ditch, previously testifying to the amount being from 19,000 to 20,000 acres—and by the way, he was the assistant who later helped Meeker make the measurements—where-

as Meeker, after making his reconnaissance, with Titus' assistance, found only 11,556 acres.

This lack of accuracy merely illustrates our contention that the witnesses as to the amount of land under irrigation in the Laramie Plains were making a most general estimate and their testimony is not conclusive as against a definite survey such as the defendants made. It is further significant, as showing a lack of accuracy, that the decree adjudicating the rights to the use of water from the Laramie River in Wyoming, Exhibit N, to which objection was made by the defendants and which the plaintiff now concedes is not binding or conclusive as against us, decrees the number of acres irrigated under the Pioneer canal as being 49,030, whereas in truth there had never been over 13,500 acres.

The original Wheatland tract comprises 60,000 acres and was initiated in 1884. At the date of taking of testimony, witnesses for Wyoming testified that of this, about 50 per cent was irrigated. The figure was first placed at 33,544 acres in the original tract (168), and 1,004 acres in one of the new tracts known as the Bordeaux tract, this later project including 10,000 acres. But the defendants caused a survey and plat to be made of this area. This plat (defts. Ex. 2), was shown to this same Wyoming witness, who, after examining it, testified that it was substantially correct (195). It shows a total amount under irrigation in the original Wheatland tract and the Bordeaux tract of 28,623.75 acres.

Passing now to the Little Laramie, the plaintiff contends in its supplemental brief that there is irrigated upon that tributary stream a total of 48,344 acres (983). This statement is based upon an estimate of these lands made by the same engineer pre-

viously referred to, Mr. Meeker. However, this amount includes lands irrigated above the point of measurement on the Little Laramie river. It includes the lands in the Centennial valley which we have previously described, for the irrigation of which no charge was made in stream flow against the State of Wyoming. This will be more definitely referred to later.

All this portion of plaintiff's brief appears to be in answer to the discussion of the same subject in the original brief of defendants, where, under the heading, "The Amount of Land Irrigated," commencing on page 68 of volume 1, we discuss at length this subject, and which we will briefly review here. We showed in that discussion that the total amount of land irrigated in the Poudre valley was approximately 300,000 acres. This is not questioned by the plaintiff. We then show that in order to ascertain the total amount of land under irrigation in Wyoming, a plane table survey was made by defendants, commencing at the upper end of the Laramie Plains at a point where the river leaves a narrow canon or valley and enters the high plateau area comprising what is commonly known as the Laramie Plains. This survey proceeded down the stream to a point below the junction of the Big and Little Laramie rivers, thence up the Little Laramie River to the point of measurement on the stream commonly called Filmore. Time did not permit of the completion of the survey of the entire area, consequently, as previously stated, wherever land was testified to be under irrigation which the defendants' survey had not included, the amount of that land was accepted without question in arriving at our conclusions as to the total amount irrigated. The results of this survey were definitely tabulated and are now before

the Court. The major portion of the land surveyed was platted and a photographic reproduction of the plat is in evidence (Exhibit 114). The portion of the survey not platted, includes the irrigated area for about six miles below the point termed Filmore on the Little Laramie River.

It is contended, as we have stated, that this survey, although honestly made, does not compare in accuracy with the statements of witnesses who were familiar with the land. However, the plaintiff endeavored to attack the accuracy of this survey on rebuttal, but apparently was able to find only four instances in which there were any inaccuracies, and these inaccuracies were so slight as to be almost unworthy of notice. In this connection plaintiff introduced in evidence four exhibits, S1, S2, S3 and S4, directed to the plane table survey and the plats thereof in four isolated places; but no additional testimony was introduced which in any wise discredited this survey which counsel for plaintiff had had under consideration for several months. We therefore believe this survey to be a more accurate determination of the irrigated lands than that adopted by plaintiff of introducing testimony of various witnesses who as a rule were only generally familiar with the amount of land irrigated and who did not attempt to base their statements upon surveys, but merely upon rough estimates.

As we have stated, the evidence was not taken with a view of differentiating as to the amount of land under irrigation before or after any particular date, but was designed to show the amount of land under irrigation at the date on which the suit was commenced. On page 34 of the supplemental brief plaintiff concedes that aside from a few small projects enumerated, which are insignificant, the only

Wyoming projects undertaken between 1902 and 1911 are the Bordeaux and Sybille units of the Wheatland tract, the Lake Hattie system, the King ditch and the Hutton lake, the Lake James system and the Sodergreen Highline ditch (see detailed discussion, pp. 198 to 234, Vol. II, defts. orig. brief).

Of these the Bordeaux and Sybille units of the Wheatland tracts are definite. They were apparently an afterthought occasioned by the fact that the Wheatland system had a greater amount of water available for irrigation, particularly from Reservoirs Numbers 1 and 2, than the original Wheatland tract of 60,000 acres, even assuming it to be entirely reclaimed, would require. At any rate, the original surveys of the Bordeaux tract, which includes 10,000 acres, of which only a small portion (1,004 acres according to the contention of the plaintiff), was under irrigation, were stated to have commenced in February of 1904, although application for permit was not filed until April 18, 1907 (3961), and the original surveys for the Sybille tract, which includes 30,000 acres, none of which were irrigated at the date on which testimony was taken, were commenced in August, 1907 (108). These were to be irrigated from water already provided by the Wheatland system.

Then in addition to these was the Lake James system, for which the surveys were begun on March 22, 1908 (638). This reservoir has a capacity of 41,100 acre feet (631), and water had been stored to the capacity of the reservoir (635-636); but we are absolutely unable to learn of any new reclamation which had been made by means of this storage over and above the insignificant acreage which were already under irrigation, although plaintiff contends on page 40 of its brief, "That some 1,500 acres have been irrigated out of this system of which 515 acres

were in tillage in 1913, pp. 991, 992." A reference to this evidence, however, discloses that the witness was talking of lands under what was termed the Talmadge-Buntin project, and the relationship between the Talmadge-Buntin project and Lake James is not explained.

The original surveys for the Lake Hattie system were begun April 16, 1908 (646, 774). This reservoir has a total capacity of 110,500 acre feet, of which only 68,500 acre feet is active or available. We are absolutely unadvised as to the amount of land reclaimed by means of this storage, although water had been stored to the capacity of the reservoir. Plaintiff states in its supplemental brief that 700 acres of new land were irrigated by means of this system in 1913 (p. 39).

The surveys for the Sodergreen Highline ditch were commenced in November, 1907 (445). The capacity of this ditch is not shown, but the owner of it testified that it was built about 1910 and that he irrigated from it 4,000 to 5,000 acres (418). The Hutton Lakes reservoir was a system of reservoirs designed to be filled through the enlargement of an old ditch known as the King ditch. The date of original surveys is not shown, except that it appears that an application was made to the state engineer for a permit on June 3, 1909.

At the date upon which the testimony was taken, it appears that the enlargement of the old King ditch to these Hutton, or sometimes called the Hutton and Creighton, lakes, had never been completed and that no water had been impounded in these reservoirs from this source (284), although the surplus water above the amount actually diverted from Sand Creek instead of flowing through its natural channel into

the Laramie River, flows into these lakes from which there had previously been no means of diversion and from which it wastes by evaporation (321).

It therefore is apparent that of all the land under irrigation in the watershed of the Laramie River in Wyoming, the amount reclaimed since 1902 is merely nominal and that the projects which have been undertaken since that date, of which the more important are these last six above enumerated, are prospective. Development under them is entirely for the future. Therefore, for the consideration of the suggestion of the Court in its order for re-argument, it may be said generally that there has been no reclamation of any material amount of land in Wyoming since the work complained of was begun, and we believe none whatever since this suit was commenced, although, as we will show later, of these new projects Lake James and Lake Hattie both stored enormous quantities of water. If we accept as correct the statement of the plaintiff to the effect that there has been practically no reclamation by either Lake Hattie or Lake James, then the theory which has been consistently advanced by the defendants, that these two reservoirs have been filled or partially filled for several years and that this water has been merely wasted, all to the detriment of other ditches on the Laramie River, is confirmed (see Woodhall 2741-5).

As against the plaintiff's contention that there are 152,097 acres under irrigation in the Laramie watershed in Wyoming, let us review the defendants' evidence upon this point. All the evidence on this question is summarized in our original brief under the head, "Amount of Land Irrigated," commencing at page 68, Volume I. Considering first the Wheatland tract, as we have previously stated, the Wheat-

land tract consisted of an area of 60,000 acres, approximately 50 per cent of which is reclaimed. There is no serious conflict in the testimony concerning the amount of land under irrigation in this tract. M. R. Johnston, for many years superintendent of the company, placed the amount at from 35,000 to 40,000 acres (5). J. A. Elliott, who succeeded Johnston as superintendent, first placed it at 33,544 acres (68). This, however, included 1,004 acres in the subsidiary tract known as the Bordeaux. The defendants platted the area and submitted to Mr. Elliott their map, Exhibit 2, showing a total in the original Wheatland and the Bordeaux tracts of 28,623.75 acres, Elliott testifying that this map "is substantially correct." (195). The second subsidiary tract, called the Sybille, is not yet reclaimed, the ditch leading to it being still incomplete, in that the diversion headgate, laterals and siphons are yet to be constructed (169). Later in this brief we will have occasion to comment upon the apparent relationship between these two subsidiary tracts, that is, the Bordeaux tract, containing 10,000 acres, and the Sybille tract, containing 30,000 acres, to the available water supply which has been provided ostensibly for the irrigation of the original Wheatland tract of 60,000 acres.

Turning now to the Laramie Plains area, we find more difficulty in arriving at the exact acreage under irrigation. The testimony of plaintiff, as we have explained, was very indefinite as to this. Realizing the necessity for accuracy, the defendants undertook the survey which we have described. It commenced at the point on the Laramie River known as Woods Landing, that being the head of the irrigated area on the Laramie Plains area, and ran from this point down the river to a line five miles north of the junction of the Big and Little Laramie and thence

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fendants' su
(Ex. 117, pp.

these two statements is explained in part by this: The tabulation made by the Wyoming witness, Meeker, showed that he included lands lying above Filmore, the point of measurement on the Little Laramie River. This means about 11,611 acres, which we contend must not be considered for the reason that the water for the irrigation thereof was not measured or charged to the stream by either party this action, it being, as we have previously described, land similar to the 4,250 acres above the State line in Colorado on the Laramie River, although it will be readily seen that the State of Wyoming gets the better end of this elimination. Nevertheless the situation was tacitly conceded in that manner by both parties to the suit, except as Meeker includes this land in his Exhibit E. However, after eliminating this amount, we find that Meeker's reconnaissance shows 37,942 acres, as against Woodhall's 31,431, but in this Meeker included 2,445 acres on Four Mile and Seven Mile creeks which Woodhall puts into a different classification. The discrepancy, therefore, between the two is 4,156 acres.

Passing now to the Big Laramie, as the Court is already advised, plaintiff attempted no definite survey and offered no definite evidence of the total amount of acreage irrigated. Engineer Meeker made a reconnaissance of the lands irrigated by the Pioneer Canal. This reconnaissance occupied five days. He was assisted by the superintendent of the Pioneer Canal, one Titus, who had previously testified that the amount of land irrigated by the Pioneer Canal was from 19,000 to 20,000 acres. Meeker's reconnaissance was not a survey, measurements being sometimes made by pacing the distance (827). By this method he arrived at the conclusion and testified that the total amount under irrigation under

the Pioneer Canal is 11,556 acres, which is to be contrasted with the previous claims made by his assistant, Titus, and is startling when considered in connection with the decree wherein the appropriation of the Pioneer Canal had been adjudicated, awarding that ditch a priority date of April 19, 1879, for the irrigation of 49,030 acres.

One definite survey seems to have been made by the plaintiff and engineer Sevison testified to the number of acres under the Oasis ditch. The plane table survey did not extend to the extreme limits of irrigation under this ditch, nor to the extreme limits of another ditch known as the Boughton ditch, both of these ditches irrigating lands below the junction of the Big and Little Laramie. Neither does the plane table survey include the Gillespie, Dunn and McGill ditches, which are still further down the river. In reaching their conclusions of the total amount under irrigation, the Colorado engineers accepted as a basis the amount which their survey disclosed, and to this amount was added the amounts as given by the Wyoming witnesses for each tract or parcel of land not included in this survey.

These areas and the locations thereof were carefully checked by the engineers who made the plane table survey (2788), and the conclusion reached that the total amount of land under irrigation in the State of Wyoming from the Laramie river and its tributaries between the Colorado-Wyoming line and the canon of the river below the Laramie Plains was 90,610 acres (2792). But this amount includes the amount shown by Mr. Meeker in his Exhibit E, above Filmore, 11,611 acres, which we insist must be eliminated from consideration, leaving the *net amount on the Laramie Plains below Filmore on the Little Laramie and below Woods Landing on the Big Laramie, irrigated from the Laramie River, including its*

s Sand Creek, Soldier Creek, Seven Mile,
*trib*e, Willow Creek, Cooper Creek and any
Fources of supply, 78,999 acres. Included in
otheof 78,999 acres are 31,341 *acres on the Little*
this and 29,279.3 acres *on the Big Laramie,*
Lar Exhibits 117 and 118, which were covered
showne table survey and classified according to
by t to which the land was devoted.
the rence is made to pages 2761 to 2792, inclu-
a review of the evidence of the witness,
sivel, who made the critical analysis of the Wyo-
Woidence and checked the same against the
minple survey.
planummarize, the irrigated land in the Wheat-
a is 29,074.75 acres, and on the Laramie
land8,999 acres, or a total of a total of 108,073.75
Plais being the amount for which the total flow
acrearamie River, together with its main tribu-
of t Little Laramie, and the smaller tributaries,
taryreek, Willow Creek, Four Mile, Five Mile,
SanMile and Cooper Creek, Blue Grass, Sybille
Sevnd other tributary sources is demanded, ex-
Creonly the average annual diversion of 20,000
ceptt through the Skyline and Divide ditches in
acrlo. This amount represents the area of both
Colld old development. We contend that the evi-
newvhich Colorado introduced based upon these
denes is obviously more accurate than the general
survents of a number of Wyoming witnesses, and
statis figure, 108,073.75 acres, should be consid-
thatather than the amount contended for by the
erecff, 152,097. Manifestly 11,611 acres of the
plait contended for by plaintiff in its supplemental
amcs included within the irrigated area testified to
brieeker, being a part of the area shown in Ex-
by hibi C, and lies above Filmore, the point of measure-
mer on the Little Laramie River.

III. WATER SUPPLY.

This question was the subject of much evidence introduced by both parties. In the main, however, only four witnesses testified concerning the supply of water available for Wyoming lands, one of these, Mr. R. I. Meeker, testified for the plaintiff, the others, Professor Carpenter, Charles R. Hedke, at one time engineer of The Laramie-Poudre Reservoirs and Irrigation Company, and John E. Field, State Engineer of Colorado, were introduced by defendants. We reviewed this evidence exhaustively in our original brief, and inasmuch as nothing will be gained by again reviewing it in its entirety, may we respectfully beg the attention of the Court to this discussion appearing in defendants' brief, volume 1, pages 16 to 68, inclusive. The subject is technical and the sources of information vary, with numerous measurements and other hydrographic data considered.

The defendants in this connection sought primarily to establish the normal flow of the Colorado branch of the Laramie River at the state line. This, of course, would represent the amount of water which Colorado was contributing to the total flow of the river. And, secondarily, to establish the total amount of water in the Laramie River, including its tributaries, available for the whole area, including the Wheatland tract, or in other words, the total flow of the Laramie River and its tributaries measured at a point which would include the diversions for the Wheatland tract. This would include in addition to the flow at the state line, the flow of such tributaries entering the stream in Wyoming as Johnson and Beaver creeks, Sand Creek, Willow Creek, Soldier Creek, the Little Laramie, Four Mile, Five Mile and Cooper creeks, Blue Grass, Sybille and other tribu-

taries and sources of supply within the area mentioned. The tributaries entering the stream in Colorado are of course included in the measurements of the stream at the state line.

No evidence was introduced by the plaintiff seeking to establish definitely the amount of flow of the river, in the presentation of the evidence in chief. However, the one witness upon this subject for the plaintiff, Mr. R. I. Meeker, produced tables purporting to give the flow of the stream at the Pioneer dam. This dam is about nine miles below the state line and about three or four miles below the point known as Woods Landing, where measurements were also taken, Woods Landing being, as we have stated, the head of the Laramie Plains. There are several diversions between Woods Landing and the Pioneer dam, one of which, the Sodergreen Highline, is, according to the contention of the plaintiff, used for the irrigation of from four to five thousand acres. It is therefore apparent that the total flow of the river at the state line is not correctly represented by measurements taken at the Pioneer dam. This witness, Meeker, however, on rebuttal based his conclusions of the total flow of the stream at the state line upon measurements made at the Pioneer dam, as we will show later.

In the presentation of the evidence in chief, Meeker introduced a table, Exhibit B, purporting to give measurements of the flow of the river at the Pioneer dam from April to December, inclusive, in the year 1912, and from January to August 18, 1913. Another table was later substituted for this one, purporting to show additional measurements taken, the second one being Exhibit I, which in turn was supplemented by Exhibit T-7 on rebuttal. On Exhibit T-7, which gives Mr. Meeker's measurements

at the Pioneer dam for the short period of the months of April to December, inclusive, in 1912, all of 1913 and from January to the 15th day of May, 1914, Mr. Meeker has arrived at the conclusion that the run-off of the Laramie River at the Pioneer dam near Woods Landing, Wyoming, January 11 to December 31, 1912, was 207,000 acre feet; run-off at the same place January 1 to November 30, 1913, 109,593 acre feet. The figures showing the monthly discharge upon this table are stated to be, in large measure, the result of actual measurements made by Mr. Meeker. Therefore it is obvious that the diversions above this point both in Colorado and Wyoming, have been deducted, and this is the net flow at the Pioneer dam.

In order to arrive at a conclusion as to the toal amount of water included within the Laramie River flow at this point, there must of necessity be added the amounts of these diversions. We have admitted an average diversion of 20,000 acre feet by the Skyline and Divide ditches. As a matter of fact, in that particular year, it appears from defendants' table, Exhibit 124, that these two ditches diverted 23,143 acre feet, so without including the amount of the Wyoming diversions above the Pioneer dam, the total flow, according to Meeker himself, at the Pioneer dam would be 230,143. We do not intend to overlook the fact that the Wyoming diversions above this point are considerable and must be charged against the flow of the stream. The same allowance must be made in considering the conclusions of the witness concerning the flow for the year 1913.

Much has been said as to what is meant by the term "normal flow." The term "normal" as used is synonymous with the word "average." As we understand it, this is the basis taken by all hydrographers. It is likewise the basis taken for determining the

normal precipitation. It is objected to by the plaintiff, but there can be no misunderstanding of the term. The defendants were endeavoring to ascertain what was the normal or average flow of the stream.

As we have just stated, the only evidence upon this point introduced by the plaintiff was the testimony of Mr. Meeker, and his first two tables, that is, B and I, purporting to give measurements at the Pioneer dam on the Laramie River, which were introduced in evidence during the presentation of the plaintiff's case in chief. The defendants introduced the three witnesses mentioned. It is argued by the plaintiff in the supplemental brief that the evidence given by Mr. Meeker, based upon his own actual measurements, is entitled to greater weight than the evidence of the three Colorado witnesses, the contention being made that of all these three Colorado witnesses, no personal investigations or measurements were made by any of them with the exception of a few taken by Professor Carpenter in the year 1912 (101). This statement, however, is radically at variance with the facts. Professor Carpenter while director of the experiment station at Fort Collins, succeeded in establishing, through the United States Geological Survey, various rating stations on the Laramie River, commencing with the year 1902 (3789-3790). After the Geological Survey ceased taking these measurements, Professor Carpenter furnished an automatic gauge to the water commissioner, Mr. Decker, who continued taking measurements at the state line (3791). Then later Professor Carpenter was employed as consulting engineer by the Greeley-Poudre District and made a report concerning the water supply available for that district based upon a long

series of investigations, including the Poudre and Laramie rivers, supplementing the records previously taken by the United States Geological Survey and by the water commissioner, above mentioned (3933, 3946). These were followed by a long series of measurements by him and his assistants on the Big Laramie and tributary streams in the year 1912, as well as upon the Little Laramie and tributaries (3792). In one of these measurements by Professor Carpenter, it was discovered that there was a very grave error in all the records taken at the state line in this, that at high water, an overflow occurred through certain channels which had not been measured or considered in the previous records (3792 to 3816, 3940, 3946).

These measurements were also supplemented by snow measurements taken under most difficult circumstances on the range of mountains to the west of the Laramie River, which is the chief source of supply of that river and its tributaries. These snow measurements were taken for the purpose of aiding in the stream measurements and also for the purpose of determining the relative supply of Wyoming and Colorado areas (3816, 3824). Two hundred or more observations of the depth of snow on this water-shed were made at different places. Photographs showing these conditions were taken and many of these introduced in evidence. They are contained in Exhibit 156. We respectfully submit that Professor Carpenter was so amply qualified to testify upon this subject, that it is absurd to contrast his qualifications with those of Mr. Meeker, whose conclusions were based, according to his own admission, upon measurements taken in part of the year 1912, all of 1913 and the first three or four months of 1914, and without previous knowledge whatsoever of the Laramie River or the area in controversy.

Charles R. Hedke had been engineer for the construction company, that is, The Laramie Poudre Reservoirs and Irrigation Company and was an irrigation engineer of wide experience (1723 to 1734). He designed and was in charge of the major portion of the engineering work connected with the Greeley-Poudre System and co-operated with Professor Carpenter in 1909 in collecting the data as to the available water supply for the Greeley-Poudre District (1850 to 1853).

John E. Field was State Engineer of Colorado at the time the evidence in this case was taken and had been previously in the employ of the Reclamation Service of the United States Government, and had made numerous investigations on the Laramie River. Still earlier he had been State Engineer of Colorado and also Deputy State Engineer. His duties as State Engineer required him to supervise the distribution of water from the streams of the state and the taking of measurements (1377-1380). His conclusions as to the flow of the Laramie River are based upon an analysis of all stream data pertaining to the Laramie River; measurements taken by the United States Geological Survey, others taken by the State of Colorado, others taken by the State of Wyoming, measurements taken by Professor Carpenter and in fact all sources of information including a critical analysis of the tables and conclusions reached by Mr. Meeker, the Wyoming engineer (3387 to 3453; 3465 to 3510; to 3862).

The conclusions of these three expert witnesses as to the total flow of the Laramie River at the Colorado-Wyoming line, may be given as follows: Professor Carpenter testifies that the amount, after deducting the 20,000 acre feet diverted by means of the Skyline and Divide ditches, is in excess of 300,000

acre feet per annum (3956). Adding the flow of the Skyline and Divide diversions we therefore have according to this expert, testimony that the gross amount of the Laramie River flow at the Colorado-Wyoming line is in excess of 320,000 acre feet per annum. Charles R. Hedke concluded that the total average amount which might be diverted through the Greeley-Poudre System from the Laramie River was 70,000 acre feet per year, that amount being twenty-five per cent of the flow of the river at the state line (1823-1852). Adding to this the 20,000 acre feet diverted by means of the Skyline and Divide ditches the gross amount according to this witness, is 300,000 acre feet at the state line. Mr. Field after making a critical analysis of all records and measurements as above stated, testified that his conservative conclusion from all records is, that the average total flow at the state line, including the Skyline and Divide diversions, will exceed 250,000 acre feet per annum (3477).

These conclusions were based upon so many measurements and upon so much engineering data, that it is extremely difficult to condense the evidence. In fact, it is difficult to understand the details unless one is familiar with not only the circumstances under which the measurements were made, but also the place where the measurements were made and the topography of the country. We have condensed this evidence into narrative form in our original brief. It will be found under the head of "Water Supply", at pages 16 to 68, of volume 1. May we ask that our treatment of the subject there be considered in connection with this supplemental brief.

As we have stated, the Wyoming measurements made by Mr. Meeker from the time he commenced in 1912, were continuous up until the close of the period

devoted to the taking of evidence. On rebuttal Meeker's previous figures were modified, enlarged and in some instances corrected after criticism by the Colorado witnesses, and at almost the close of his testimony, he stated in answer to a question as to his opinion relative to the amount of flow in the years 1912 and 1913 on the Big and Little Laramie:

> "Based on review of the flow records taken in a general way, and other hydrographic information, I have concluded that the year 1912 was slightly above normal in the Laramie River basin, and that, roughly, the normal at Woods Landing station or Pioneer dam is approximately 200,000 acre feet, the year 1913 being a trifle above 50% of normal" (4296).

This conclusion is based upon Meeker's own measurements and yet, according to his Exhibit T-7, the net flow after deducting the Skyline and Divide diversions of 23,143 acre feet and after unknown diversions had been made in Wyoming above his point of measurement, the net amount obtained by him was 207,000 acre feet for the practically normal year of 1912. If 1913 was, according to Meeker, a trifle above 50% of normal, it would then appear that inasmuch as he gives the 1913 flow at the Pioneer dam as being 109,593 acre feet for the period from January 1 to November 30, the normal flow at that point after deducting both the Colorado and Wyoming diversions above, would be in excess of 219,186 acre feet. In that particular year (contrary to the contention made by the plaintiff in their supplemental brief, that in years of low flow more water would be diverted by Colorado from the Laramie

River than in years of high flow), only 14,693 acre feet was diverted by the Skyline and nothing by the Divide Ditch (Exhibit 124). Adding the 14,693 acre feet, we would have according to this basis, 233,879 acre feet as the normal flow of the river at the head of the Pioneer Canal after deducting the unknown amount of the Wyoming diversions above. It therefore appears that the criticism indulged by Mr. Meeker of Mr. Field's conclusions is scarcely justified; neither do we believe that counsel for Wyoming are justified in their attempts to discredit the Colorado witnesses in favor of Mr. Meeker.

It must be born in mind that the amount of the Colorado branch of the Laramie River at the state line, by no means defines the total amount of water available for the irrigation of the Wyoming lands down to and including the Wheatland tracts. The other principal source of supply is the Little Laramie which all witnesses seem to agree carries about one-half the amount of water discharged by the Big Laramie at the state line, according to ratings at or near the station called Filmore, that being the point at which the Little Laramie River emerges from the mountains onto the Laramie Plains. The Wyoming witness, Mr. Meeker, in his table T-8, gives this flow as 93,667 acre feet for the year 1912 and 59,637 acre feet for the year 1913 at this station. It must be borne in mind that in taking measurements of the flow of the Little Laramie, no attempt was made by any witness to charge to the stream the water diverted for the lands above the station, that is, for the irrigation of what is generally called the Centennial Valley (3469). Witness Field concludes that the total flow of the Little Laramie, less diversions above, at or near Filmore, was 120,700 acre feet per annum, as an

average or normal (3472). Hedke did not testify concerning this tributary stream.

In the year 1912, Professor Carpenter in addition to his snow measurements took gaugings of the Little Laramie at Filmore and kept daily records. At that point the drainage area of the Little Laramie is about 163 square miles or 104,000 acres. The run-off for the month of June as found by Professor Carpenter was 76,632 acre feet, and for July, 27,676 acre feet, or a run-off for these two months alone equal to practically one foot in depth for the entire drainage area. In other words, the run-off for June and July alone in the year 1912 amounted practically to 104,000 acre feet (3894). This is to be contrasted with Meeker's statement given in his Exhibit T-8, wherein he says that the total run-off for the entire year 1912 at this point was 93,667 acre feet. Counsel for Wyoming in their Supplemenal Brief conclude that the flow of the Little Laramie as an average is 110,000 acre feet per annum (p. 115).

The witness, Field, summed up all of the data, not alone for the flow of the Big Laramie at Woods Landing, but also all data concerning the river and its tributaries, and he arrived at the conclusion that the *total amount of the normal flow of the stream* after deducting the amount available for all irrigation in Wyoming, including the Wheatland tracts, is in excess of 431,200 acre feet per annum (3476), and that this is by no means the total flow of the river, inasmuch as it does not consider the supply received from a tributary not heretofore mentioned, called the North Laramie, nor from the Chugwater, both of which, however, join the main stream generally below the Wheatland tract. Their water, however, is available for the irrigation of lands lying along them and also for irrigation through a number of ditches

diverting ater from the main stream below that point, incl ling the Cross T. Ditch No. 2, Scissors Ditch, Lar mie River Ditch No. 1, Cross T. Ditch No. 1, A. N Spencer Ditch, Phillips Ditch, Uva Ditch, Yates Ditc McCormick and Bright Ditch, Gallagher Ditch, Rei Ditch, Thompson Ditch, Ryan Ditch and Combinati Ditch. All seepage and return water from the V eatland tract is also available for these ditches. I is to be noted, however, that the lands irri ted by means of these ditches last mentioned re included within the total contended for by W ning (See 17, 18 and 21, Supplemental Brief). If ould seem fair, therefore to include the water of t North Laramie and Chugwater in our calculation

May v refer to the conclusion as to the water supply sta by counsel for Wyoming in their supplemental f. On page 115, they state:

"nual f conclusion is that the average anceed : of the Laramie River is not to exnual 000 acre feet, and the average an-110,00 of the Little Laramie is about constire feet, and that these two sources able f the entire supply of water availthe twe irrigation of the lands served by reams."

And a same page the small tributaries, they say on the

"As creeksatter of fact all of these small small utilized for the irrigation of which dows along them, the area of lands ot included in the tabulation of the ex ated from the Laramie River but dicati of which is indicated by the adjucrees hereinbefore abstracted."

However, these lands on the small tributary streams, insofar as they lie within the general area known as the Laramie Plains, are included within the amount of land which they claim to be irrigated. Note their own brief, wherein on page 21 they tabulate the total amount of irrigated land according to their contention, including "Total irrigated from Sand Creek 5,898 acres. Total irrigated from Little Laramie River 48,344 acres." Then turn back to the bottom of page 18 wherein under the heading, "Ditches from Tributaries", they say: "The area irrigated from Sand Creek and its tributaries under ditches constructed prior to 1902 (p. 902) is 5,898 acres, (pp. 898-9)."

The engineer of the plaintiff determined the irrigated area upon the Little Laramie River *and its tributaries* below the mountains, the mountain ditches not being included, by a reconnoissance made in October, 1913, as follows: The Little Laramie River, 45,899 acres; Seven Mile Creek, 1,527 acres; Four Mile Creek, a tributary of Seven Mile Creek, 918 acres, total 48,344 acres, (pp.982-3). "The lands found to be irrigated are listed in the schedule commencing p. 995." The schedule commencing on page 995 is plaintiff's exhibit E, above referred to and includes not only the lands on Seven Mile and Four Mile Creeks, but also includes, as we have heretofore stated, 11,611 acres lying above Filmore, as an examination by sections and townships of Exhibit E discloses.

It therefore becomes apparent that the plaintiff is seeking to charge against Colorado, the irrigation of lands on tributary streams without making allowance for the inflow from those streams. May we reiterate this is not a suit by individual appropriators. The State of Wyoming is suing the State of

Colorado and we are not concerned with the location of these lands, except that they be within the Laramie River drainage area in Wyoming. Obviously this stream and the land within its watershed cannot be divided to suit the convenience or the argument of counsel. We contend that these Wyoming lands must be treated as a whole and that the total water supply available for them must be considered.

It was ingeniously stated in the original brief filed by the plaintiff at a portion referring to the tributary streams: "As has before been stated, Sand Creek is not in reality a tributary of the Laramie River. A large part of its supply is diverted into the Poudre Valley through the Divide Ditch and the balance is used along its course, so that only in unusual years does any part of its water reach the river." And now, in the supplemental brief we find that there is an admission that in Wyoming 5,898 acres are irrigated from Sand Crek.

This stream is naturally a tributary of the Laramie River and the reason that the waters do not reach the Laramie River, even after the irrigation of the 5,898 acres, is this: All of the water remaining after irrigation above, was diverted from Sand Creek through a ditch known as the Hogue Ditch, thence into a stream called Antelope Creek. The surplus above Hogue's irrigation passed down Antelope Creek into either Creighton or Hutton Lake from which there was no outlet and where the water was merely wasted by evaporation (320-321). This is the same Hutton Lake mentioned as being one of the new Wyoming projects now proposed to be utilized as a reservoir. Upon this statement of facts Wyoming contends that Sand Creek is not a tribuary of the Laramie River.

The plaintiff further contends that theoretical measurements of the Laramie River cannot prevail against the experience of irrigators in that state who testified to a shortage of water (when invariably it was ascertained, upon examination of the witnesses themselves and the water commissioner, that the alleged shortage was occasioned by so-called "two-story" ditches, unable to divert available water, 509-10, 1283-4, 1288-9); that the normal flow of the stream is not a proper criterion of the question, inasmuch as the Wyoming lands cannot be irrigated in years of low flow by water which was available in years of high flow, etc.; that the seasonal distribution of the flow of the river is such that Wyoming must surely be damaged by the Colorado diversion which will be made at a point where the flow is more constantly than it is on the lower river; and that the position of reservoirs by Wyoming for the conservation of flood waters which reservoirs, it is contended, are unprofitable. It is said in the brief: "But no wheat is raised by the use of water that flowed two years ago, and the high flood of 1912 would be of no possible value to the farmer in 1913, unless by the construction of reservoirs, that flow was conserved for use in the subsequent year."

This argument is ingenious. In the first place, what is normal flow of this stream? If Colorado should contend for the maximum flow, obviously Wyoming would have a right to complain at any attempt at a division on this basis. No enterprise could be undertaken based upon the expectation of diverting water according to the flow of abnormally high years. This is clearly explained by Professor Carpenter (3946) a portion of whose testimony is quoted on p. 93 of

Plaintiff's Supplemental Brief. *Had the preliminary discussion of the subject been also quoted,* counsel could not have drawn from it the conclusion they seek. On the other hand, it would be manifestly unfair if the Colorado distribution were to be limited by a consideration alone of the minimum flow. This would overlook the possibilities of procuring water for necessary irrigation during years producing a flow of more than the minimum. No such test would be just, therefore it appears entirely logical that the average flow is the only one which can properly be taken into consideration, unless the defendants be required to refrain from all diversion when the flow of the river is not up to normal. Apparently this is what the plaintiff is contending for. It amounts to this: That they wish to be insured by prohibiting any diversion whatsoever in Colorado, that the minimum flow of the river will be retained. Naturally we do not believe that they are entitled to any such condition. Years of low flow will occur as well as years of high flow, and all irrigators of necessity must take the chances of a short supply of water in occasional years.

The contention of counsel that Colorado by reason of the location of its diversions, is in a better position to insure itself against a low flow than Wyoming appropriators because the stream flow at the point of the Colorado diversions is more uniform throughout the year than lower down, is based upon a fear more imaginary than real. The tunnel itself, as the evidence discloses, diverts water from what are termed the East and West forks of the Big Laramie River, and at the point of diversion this stream is very small. In order to supplement this amount, three collection ditches were designed to bring to the tunnel the water from some of the tributary streams.

The collection ditch on the east, known as he East Side Collection Ditch, taps a tributary of the Laramie known as Deadman, about nine miles below the tunnel and carries the water along the side of the mountain forming the eastern wall of the Laramie valley, up the valley to the tunnel. The West Side Collection Ditch in the same manner taps several small creeks and Rawah Creek, another tributary. This may in time extend to intercept a portion of the waters of a third tributary known as McIntyre Creek. In this manner the estimated 15,000 acre feet is to be added to the 56,000 now contemplated to be diverted through the tunnel. And the Upper Rawah Ditch intercepts waters of the same stream at a higher elevation.

As we have explained, these collection ditches, based upon the history of the Skyline ditch, cannot be operated in the winter time, and all of the winter flow of these tributary streams must pass down into the Laramie (1825 and 3423). Moreover, the engineers in charge of the project, frankly stated that it would be impossible, in the first place to intercept all the water of the tributary streams, and in the second place to convey it through the ditches to the tunnel because of the very heavy loss from ditches located as these are (1664, 1669-1674). This water, though lost to the ditches, contributes to the supply of the river. Furthermore the streams intercepted are merely a small percentage of the total number of tributary streams supplying water to the Laramie River.

The snow investigations taken under the direction of Professor Carpenter and before referred to, were made in part for the purpose of disclosing the relative value as a source of supply of the range of mountains to west of the Laramie River in both states. These investigations disclose that, while a

few of the peaks immediately at the head of the Colorado branch of he Laramie River are somewhat higher than the peaks in Wyoming, nevertheless the precipitation along this range of mountains in Colorado and Wyoming is substantially uniform and the higher elevations at the southerlymost extremities of the Laramie River drainage area are off-set by a greater width of the range in Wyoming (3818-3823; 3883, 3892 and Exhibit 156). The mountain area included within the Laramie River drainage which can be intercepted by the Skyline ditch is only 151½ square miles. The additional drainage which can be intercepted by the Greeley-Poudre system is only 63.5 square miles, whereas the total Laramie River drainage within the State of Colorado is 393 square miles (1398). To the answer of the defendants The Greeley-Poudre Irrigation District and The Laramie Poudre Reservoirs and Irrigation Company, there is attached a large map showing the Laramie River and the Poudre River drainage areas. On this map, which is known as Exhibit 1, the drainage area which can be in part intercepted by the Skyline Ditch is colored yellow and the drainage area which can be intercepted by the Greeley-Poudre system, is colored purple. The total drainage area of the Laramie River in both states is something in excess of 4,000 square miles.

All the stream flow records show what we may term a flood season. This usually occurs in the latter part of May and the first of June. At this stage the streams carry very much more water than at any other period of the year excepting only unusual floods. As a rule this high water comes at a season of the year when irrigation is not yet as urgently needed as later in the season, and any irrigation system based entirely upon the amount of water which

can be diverted during the summer season from streams such as are the Poudre or the Laramie River, will be limited to but a small proportion of what is possible if these flood waters be stored for later use. This is clearly illustrated by the development in the Poudre valley. A number of witnesses testified to this development which is typical of practically all irrigation districts. This development of the Poudre Valley was reviewed by Professor Carpenter at length. He described the conditions prior to 1870 when small ditches applying water close to the river were the rule, stating that at that time, there was under irrigation in the Poudre Valley perhaps 10,000 acres; that in the decade from 1870 to 1880, larger or community ditches were constructed and that the irrigated area was enlarged to possibly 80,000 acres, at which time there was constant complaint of a shortage of water. The witness says at one place: "There was a lack of water under each of these canals in the beginning. There was an acute situation under these canals. The pressure for water was felt at that time. When I first came to Colorado to reside permanently in 1888, the situation was more acute than it has been since." The fourth period of development which the witness describes as being that of reservoir construction, started about 1880 and has continued up to the present day. With the construction of reservoirs came the effort to obtain water where available from other watersheds. In 1890 there was perhaps 135,000 acres irrigated in the Poudre Valley. This amount has increased until today there is approximately 300,000 acres. (See testimony of Professor Carpenter 2259 to 2294). Similar testimony was given by the witness John L. Armstrong who had been for many years water commissioner of Water District No. 3, of Colorado, which

includes the Poudre Valley. He describes at length the irrigation system which has been developed in that area; the method of exchange between reservoirs and ditches in order to secure the highest possible use of the available water and the wonderful returns accomplished by agriculture under irrigation in that valley (2454, 2584). In the year 1912, the total amount of storage capacity in these reservoirs of the Poudre Valley was 146,665 acre feet (3721), This is much less than the aggregate capacity of the Wyoming reservoirs. It is apparent that the storage of water in these reservoirs coupled with the more systematic method of distribution accomplished largely by the practice of exchanging between ditch and reservoir and between reservoir and reservoir in order to secure the most advantageous use of the available water, has resulted in the irrigation of approximately one-half of the land now irrigated in the Poudre Valley with less complaint between the various users of water and with less danger from a shortage in the supply. But the Poudre River supply has been so diminished that more water must now be obtained from other streams.

The Laramie River area in Wyoming is more fortunate in its storage facilities than the Poudre Valley. The country being in part mountainous, lends itself to reservoir construction at very little expense. It is of interest to note the capacity of some of the reservoirs mentioned in the evidence. The Wheatland system has two, one situated near the center of the original Wheatland tract, known as Wheatland Reservoir No. 1. This reservoir can receive water from the Laramie River through the tunnel diverting water from that river into Blue Grass Creek, thence into the Sybille, from which it is diverted by the ditches of that system. In addition to

this source of supply it is able to receive water flowing naturally in both Blue Grass and Sybille creeks. The capacity of the reservoir is 7,000 acre feet (166). Wheatland Reservoir No. 2, is a channel reservoir located just above the canon where the Laramie River passes through the range of mountains forming the eastern edge of the Laramie Plains. It has a capacity, according to the survey thereof on file in the State of Wyoming and according to the witnesses introduced for the State of Wyoming (particularly M. R. Johnston, for many years superintendent of the system), of 126,000 acre feet (6, 66), although the hydrographer for the State of Wyoming, Mr. R. I. Meeker, by his own process of reasoning, places its capacity at 83,400 acre feet (4309). We understand that there was a controversy in the adjudication proceedings resulting in the decree on the Laramie River, between the owners of the Wheatland Reservoir No. 2 and the owners of Lake Hattie. Mr. Meeker was an employee of the latter and was primarily engaged in an investigation of the Laramie Plains area and we believe that his determination of the capacity of the reservoir at 83,400 acre feet, the same being materially less than the capacity established by the survey of the reservoir by the owners thereof, was due to the fact that according to his tables of stream flow, he did not have a sufficient amount of water with which to account for the capacity of 126,000 acre feet, although it is admitted that this reservoir has not only been filled many years, but at times escaped destruction only by a narrow margin because of the surplus amount of water coming down the river which of necessity entered the reservoir because of its location, the dam being across the river channel. By this statement we do not desire to be understood as

challenging Mr. Meeker's honesty. We feel rather that he was so impressed with the accuracy of his own measurements of stream flow that he felt the capacity of the reservoir must be less than shown by the survey, otherwise he could not account for the extra amount of water stored in it. In the original brief filed by the plaintiff, it is interesting to note the attempt to explain the discrepancy upon the theory that 83,400 acre feet was the active capacity, the remainder being inactive or unavailable storage (p. 20). There is not, however, a suggestion in the testimony of any witness that any material portion of the 126,000 acre feet in this reservoir was inactive or unavailable. In their supplemental brief, counsel say on page 78: "The Wheatland project has had the advantage of a reservoir with a capacity of more than 80,000 acre feet."

The next reservoir which we wish to consider, is Lake James, with a capacity, according to Wyoming testimony, of 41,100 acre feet (632), and the fourth, Lake Hattie, with a capacity, according to Wyoming testimony, of 110,500 acre feet of which 42,000 acre feet is inactive or unavailable, leaving 68,500 acre feet available to be withdrawn from the reservoir (786,787). Lake Hattie is so situated as to be able to receive water from both the Big and Little Laramie Rivers. Both enterprises have been constructed since 1908. There was no controversy between the various interested parties in Wyoming as to the capacity of Lake Hattie and Lake James.

There are other reservoirs besides these which we will not take the time to consider, but these four alone have a total active capacity of 242,600 acre feet, almost 100,000 acre feet more than the combined capacity of all reservoirs in the Poudre Valley (3921).

The plaintiff in its supplemental brief has very kindly given us some intimation of the cost of construction of a portion of the system for the irrigation of the Wheatland tracts. It is stated on page 17 of the brief that the expenditure prior to 1902 on Reservoir No. 2, was $115,541.56. We are not given any intimation concerning the cost of Reservoir No. 1, but inasmuch as Reservoir No. 2 is the larger reservoir with the capacity of 126,000 acre feet, it is apparent that this reservoir, exclusive of the diversion system, cost less than $1.00 per acre foot of storage. This cost, in comparison with either large or small reservoirs throughout all the irrigated sections of the country, is merely nominal. This reservoir was built, according to the contention of the plaintiff, to furnish water to the settlers on the original Wheatland tract at a time when, although only a small portion of the tract was irrigated, complaint was made that there was a shortage of water in the direct flow of the stream. In the face of this illustration, Wyoming contends that the construction of reservoirs for the stortage of flood waters is not profitable in Wyoming; in other words contending that they do not have a sure and certain supply for their early appropriations from the Laramie River (which in itself is contradicted by their own contention and which supply will not be interferred with by the diversions in Colorado), but that they are not called upon to spend money for the purpose of conserving flood waters. Now, which is correct? Did they have a sure and certain supply without storing, or not? If they did, why were these reservoirs built?

So important to the whole country is the conservation of flood water supply and winter flow in all irrigated areas—and of this the Court will take judicial notice—that immense sums of money have

been expended in the construction of reservoirs. Some of those of the United States Reclamation Service need only be brought to the attention of the Court. For illustration, that enormous reservoir constructed on the Rio Grande, commonly known as the Eagle or Elephant Butte Reservoir, with a capacity so great as to be astounding, it being given as high as 2,638,860 acre feet, for the construction of which, together with the diversion system under it, $10,000,000 was appropriated; the Pathfinder reservoir on the North Platte River in Wyoming, impounding approximately 1,070,000 acre feet; the Roosevelt reservoir on Salt River in Arizona, capacity of 1,367,300 acre feet; the Shoshone reservoir in northern Wyoming, capacity 456,600 acre feet, and many others, both government and private projects which might be mentioned. Why were these reservoirs constructed? Why the expenditure of enormous sums of money in this manner? Obviously for the purpose of impounding flood and other waters in order that the needs of mankind might be supplied through the food which is produced upon the areas brought under cultivation by the use of this water for irrigation. To argue that reservoirs are unprofitable, except possibly under peculiar conditions, is to admit, either that there is a surplus of water for the irrigation of the area in question and that the low flow of the stream in itself is sufficient for this purpose, or that the returns from the irrigation of these lands is not sufficient to justify the expense. That can be true only where the lands are not suited for agriculture. The conservation of the natural resources of the country demands that flood waters be impounded and that these impounded waters be made to perform their natural duty in the irrigation of land in order that our people may be fed.

The plaintiff further contends that the Wyoming prior appropriators have already experienced a shortage in water, which any diversion by Colorado will necessarily increase, citing the evidence of several witnesses, under some of the smaller ditches on the Laramie Plains which the water commissioner says are "two-story" ditches—too high to draw water (1282-4, 1288-9), which is also admitted by the witnesses (509-13), and also the statement that even since the construction of the Wheatland reservoir, farmers under that reservoir have not had as much water as they wanted. It is argued that regardless of the normal flow of the stream and the duty of the water, that the condition thus established by the actual experience of these irrigators proves that the water in the stream has already been appropriated in Wyoming. It is not surprising that individual users of water occasionally find themselves without adequate supply—more frequently without what they consider an adequate supply—for it is the experience of all irrigators that there is a tendency on the part of farmers, particularly those new to irrigation, to seek to apply more water than is reasonably required (2322-2324 and 2497). We have heretofore shown that as early as 1880, when there was only 80,000 acres of land irrigated in the Poudre valley, there was frequent complaint of lack of water (2280 and 1403), and it was thought that the limit had been reached in the reclamation of that area. Later development has shown conclusively that there was not a general shortage of water at that time, nor was the ultimate reclamation attained. More systematic methods of distribution with more adequate means of diversion and storage of flood and winter waters has brought further reclamation. As the evidence in this case, more particularly the various

tables of st ow, discloses all of the streams, such as the e and the Laramie Rivers, are low during t summer and fall and if that flow alone be dep upon for irrigation, then the area must be lim very narrow margins. It is not surprising ome individual appropriator or some indiv ditch may have experienced a shortage of w That is to be expected, particularly in view of th that some of these witnesses referred to in iff's supplemental brief admitted that their dit ould not divert water owing to the fact that the re "two-story" (1282-4, 1288-9, 509-13) and ed to conditions in the year 1913, which, accord to the Wyoming witness, Meeker, was a year of tly more than 50 per cent of normal stream fn the Laramie River. Moreover, there were v ew ditches in the Laramie Plains with adequate ans of diversion. These systems were of the m rimitive construction. Dams were made as occa required them, constructed frequently of pil manure, rubbish, brush wood or any other ava le material. Headgates are testified to as bei bove the bottom of the river bed. In fact, with exception of a few of the newer projects, a mo rimitive system of diversion works could hardly magined. So deficient were these diversion work hat defendants caused photographs to be taken each one on the Laramie Plains, with the excepn of two or three which could not be found (Exhit 115). This set of photographs shows more clely than we can describe the conditions prevail there.

If Wyomi experienced a shortage of water, it is remarkab that no definite system of distribution by adinistrative officers has been followed. The sitation is well illustrated by a state-

ment made by the witness, M. R. Johnston, superintendent for some time of the Wheatland system. In speaking of the diversion dam by means of which the water is diverted from the river into the tunnel of that system, he said: "We aimed to take about all we could get, except what filtered through. Of course, we had to let some go down when the fellows below on the river 'hollered' too loud, be we aimed to use most of the water. Never knew the water to run over the top of the diversion dam except in cases of water-spouts on one or two or three occasions."

The law of Wyoming, similar to the law of Colorado, provides for an officer termed the State Engineer, who has general jurisdiction of this matter. Immediately under him are the superintendents of irrigation, called Division Engineers in Colorado, and under the superintendents are the water commissioners, who have jurisdiction over the irrigation districts. The plaintiff placed upon the stand Mortimer N. Grant, a witness who had been water commissioner in the district including the Laramie Plains in Wyoming. His testimony appears at pages 1276 to 1289, and was so conclusive of the contentions made by the defendants that the diversion systems in Wyoming were of the most primitive sort and that there was no definite administration of the water there, that this testimony was set out in full in our original brief (pages 95 to 99). It may be summarized as follows: Witness was water commissioner in the year 1913 on the Big and Little Laramies and their tributaries; that complaints were made about water in that year in the latter part of May or the first of June, by The Wyoming Development Company (the owner of the Wheatland Reservoir), and complaints were made about July and August by four or five ranchmen. Considerable

trouble was encountered in distributing the waters of the Little Laramie because of the low flow. During July and August the witness made trips from his headquarters at Laramie, going up the Little Laramie, thence crossing over and down the Big Laramie, making possibly seven round trips. There was one complaint made against Lake Hattie. The witness testifies further that in 1912 a man named Wilson was acting as water commissioner on the Little Laramie. He understood there was a commissioner on the Big Laramie, but iddn't know the person; that previous to 1912 there had been water commissioners appointed, but they had "never been out in the field to amount to anything. The water commissioner as a rule only goes out in the field when called." The witness states further that it is the practice all over the State for water commissioners to act only when complaint is made. He describes the inadequacy of the diversion systems and lack of measuring weirs, testifying that the ditches had to be rated with the use of a current meter; that most of the ditches on the Big Laramie River were above the bottom of the stream; in high water they got all the water they needed, at low stages a dam is required. "At such times the user goes to the head and throws some obstruction into the stream to suit his desires," which the high water flow washes out. "On both the Big and Little Laramie rivers it is practically physically impossible for any water commissioner to properly apportion the waters with the appliances that exist at the present time. * * * Everything is so crude on both rivers that an apportionment according to the legal rights of the parties is practically out of the question, unless one has a current meter to measure it, and then it is a matter of a good deal of labor to try to regulate the water.

ating consumes considerable time and ex-
Each rating c So that for the orderly administration of that
pense. So tha upply the conditions are not there."
water supply Elliott, the superintendent of the Wheatland

Mr. Elliot testified that none of the officers of the State
system, testifi ming had ever interfered with the Wheatland
of Wyoming storage or distribution of water (194). Al-
in the storag his predecessor, Mr. Johnston testified that
though his p ear 1911 the Wheatland people had been re-
in the year 1 to allow some water to pass their diversion
quired to all t is therefore apparent that if any shortage
dam. It is tr existed, it had not been sufficient to arouse
of water exis inistrative officers into seriously active duty,
the administ it brought about the construction of diver-
nor had it b tems sufficient to permit of definite distri-
sion system
bution. thermore, it is not at all surprising that

Further these ditches experienced a shortage of
some of the We are indebted to the plaintiff for tables
water. We the amount—according to Meeker—stored
showing the s reservoirs. Exhibit K, introduceed by the
in various r, purports to give a resume of stored water
plaintiff, pu tland Reservoirs numbers 1 and 2, Lake
in Wheatla nd Lake Hattie in the years 1912 and 1913.
James and le was criticized by the defendants in many
This table but it is interesting to note that concerning
respects, b ttie, this table states that in 1912, storage
Lake Hatt Big Laramie commenced April 8, and ceased
from the B 5 and December 26, and storage from the
October 5 aramie commenced June 4 and ceased August
Little Lara ther words, this reservoir continued to store
10. In oth l through the irrigation season. In that
water all ar, 1912, the table shows, concerning Lake
same year hat storage from the Little Laramie com-
James, th bout April 21 and ceased August 3. Now
menced a 1912 was a year of practically normal flow.
the year 1

It is the year concerning during which some of the witnesses complained that they were short of water, nevertheless these two large and junior reservoirs continued to store throughout the irrigation season and apparently no complaint was made against them, at any rate, they were not interfered with. In the year 1913, that being the year concerning which Water Commissioner Grant testified, it being a year when the flow of the river was only about 50 per cent of normal, we find from Exhibit K, concerning the Lake Hattie reservoir, that storage from the Big Laramie commenced April 25 and ceased June 13. As to Lake James, that storage commenced April 19 and ceased May 25. Now in the year 1913, it appears that this storage occurred only during the flood season; but no such statement can be made concerning the year 1912. Wheatland Reservoir No. 2 is a channel reservoir; there would, therefore, be no record as to when storage commenced or as to its continuance, and we are given no information concerning the time of storage in either year as to Wheatland Reservoir No. 1. However, Exhibit K states that on April 29, 1913, Wheatland Reservoir No. 2 contained 76,000 acre feet of water. It will be remembered that Meeker, who made the table shown on Exhibit K, contended that Wheatland No. 2 reservoir held only 83,400 acre feet. Apparently the reservoir was filled to a point approaching capacity very early in season of 1913.

Mr. Field, State Engineer of Colorado, reviewed or analyzed at length the various tables and measurements produced by the witnesses for the plaintiff, particularly those of Meeker, concerning or relating to the storage in these four reservoirs (3482, 3489) from which it appears that in the year 1912 there was stored in these four reservoirs *in addition*

to the amount withdrawn for use and in addition to the loss by seepage and evaporation, the total of 156,000 acre feet, divided as follows: Lake James, 18,400 acre feet; Wheatland No. 2, 47,000 acre feet; Wheatland No. 1, 10,500 acre feet; Lake Hattie, 80,700 acre feet. May we emphasize that this represents the amount of water stored in excess of the use, waste and the loss (3488). It is furthermore remarkable to read the testimony of two witnesses, W. L. Ayres and W. A. Baker, farmers on the Wheatland tract, referred to in the plaintiff's supplemental brief at pages 78 and 79, that they were short of water, Ayres testifying: "There have only been one or two years that the farmers had all the water they wanted," and to compare this with the testimony of the superintendent of the Wheatland system, Mr. Elliott, to the effect that in the normal year of 1912, after 100,000 acre feet had been used on that area, 40,000 acre feet of water was left in Reservoir No. 2 at the close of the irrigation season (107). M. R. Johnston testifies to the history of the Wheatland reservoir, describing the threatened destruction of the reservoir at least upon one occasion, through inability to discharge the water from the reservoir as rapidly as it entered, and showing that as a rule water was carried over from one irrigation season to another, although occasionally in dry years the water was all withdrawn (51 to 60).

When we further remember the fact that the Wyoming appropriators annually needlessly waste enormous quantities of water and deliberately run great quantities of water into sunken areas, the only escape from which is evaporation, even during the winter months, it would seem that any claims of shortage are ill-founded (94, 858, 1280-4, 1288, 2733-50, 3562-75).

IV. DUTY OF WATER.

Counsel for plaintiff in their supplemental brief, after discussing what they term the theoretical duty of water, which they contend leads into a maze of opinions, assumptions and surmises, state that they believe "there is a more satisfactory method of determining the adequacy of the water supply of this stream, viz: by showing that in fact the entire flow had been used without waste. This method requires no consideration of stream flow records leading necessarily to an unsatisfactory conclusion, nor any determination of the exact acreage of land irrigated, nor any conclusion as to the theoretical duty of water." Had the testimony shown that the full flow of the stream had been appropriated *without waste* and that there had not been a sufficient amount of water for the irrigation of the Wyoming lands, it might have been of little value to have gone into these so-called theoretical discussions of stream flow and duty of water. However, such is not the case. Enormous quantities are wasted (1280-4, 1288, 2733-50, 3562-76). Lake Hattie, the surveys of which were commenced in the year 1908, that being its date of priority, stored water during the irrigating season of 1912, from both the Big and Little Laramie rivers. Lake James, also dating from 1908, stored water during the whole season of 1912 from the Little Laramie River. That year the managers of the Wheatland system distributed 100,000 acre feet and carried over 40,000 acre feet in their Reservoir No. 2 at the close of the season. As a matter of fact, they did worse than this, for Elliott, the superintendent of the system, testifies that the amount stored in Reservoir No. 2 alone, from the close of irrigation in 1911 to the close of irrigation in 1912, was about 140,000 acre feet (170). They had additional storage in Reser-

voir No. 1, and some suplpy from Sybille and Blue Grass creeks. Adopting the language of the former superintendent, M. R. Johnston, it was their habit to divert all the water from the Laramie River unless the appropriators below "hollered too loud."

Manifestly all the water of the stream was not appropriated to beneficial use, therefore the so-called theoretical duty of water becomes of intense interest. As we said in our original brief, we cannot attempt an exact definition of the term, "duty of water," except that it defines the amount of land which a given quantity of water should reasonably irrigate, and the higher the duty, the less amount of water needed for the unit of area. The term is frequently used to specify the amount of water which is used, rather than the amount which is needed. From the statutes of the State of Wyoming, it is apparent that the law making body of that State intended to place a limit upon the amount which might be diverted from the stream, and for that purpose the maximum quantity which might be diverted was fixed, this being designed to supply the needs of lands under the most adverse conditions within the State. This statute provides that no allotment for irrigation shall exceed one cubic foot per second for each 70 acres of land irrigated. Revised Statutes of Wyoming, § 872. This statute of course specifies a maximum of flow rather than a definite quantity, but taking into consideration the irrigation season, the maximum quantity permitted under this statute may be determined. Considering the Wheatland tract, M. R. Johnston, formerly superintendent, stated that the irrigation season was from 90 to 100 days (91). The demand was not constant, but fluctuates during the season, as the water is required for different crops, there being at times short periods when no water is

needed at all by the individual farmer, the average farmer drawing water from 80 to 85 per cent of the time during the irrigation season (201, 203), the greatest demand being during the latter part of June (208), the quantity required diminishing until the 15th of August, after which time two "runs" are made (209). It therefore is obvious that the Wheatland tract does not require the maximum amount of water permitted by the law of Wyoming for the full period of the irrigation season. However, let us consider this question of the amount of water applied to these lands upon the assumption that there is a legitimate demand for one cubic foot of water for each 70 acres of land within the tract without diminution during a 90 day period. This would amount to approximately 180 acre feet of water for each 70 acres of land. The Wyoming witness, Mr. Elliott, first testified to 33,000 acres in round numbers under irrigation in the Wheatland and Bordeaux tracts. On this basis the total amount of water for this 33,000 acres of land, which might be legitimately distributed if conditions imperatively demanded it, would be, in round numbers, 85,000 acre feet, and yet, in the face of the contention that there was a shortage of water testified to by a few individual farmers produced as witnesses for the plaintiff (but see *contra* 205), the evidence discloses that there was distributed to the Wheatland tract 100,000 acre fee that year, or 15,000 acre feet more than the law of Wyoming permitted under the most adverse conditions—conditions demanding the highest amount of water—conditions which it cannot and will not be contended prevail in the Wheatland area. As a matter of fact, if the demand for water exists for only 80 to 85 per cent of the time covered by the irrigation season, and even then the demand is for quantities varying according to the needs of the crops, it is

readily seen that the Wheatland area in the year 1912 must have received an amount very much larger than 15,000 acre feet above the amount which could legitimately have been applied. However, for the sake of the argument, conceding them the mamimum amount and contending for only 15,000 acre feet in excess of what they might have used, we find that they carried over in the reservoir at the close of the irrigation season of 1912, 40,000 acre feet of water, these two items making a total of 55,000 acre feet, substantially the same amount that it is sought to divert through the Greeley-Poudre tunnel.

As a matter of fact, there are only 28,623.75 acres irrigated in the Wheatland tracts, instead of 33,000, which we have assumed (195). Our illustration, therefore, is more than generous to the plaintiff. And Mr. Elliott testified: "I have ordered several farmers there to quit wasting water" (205).

In considering the flow of the streams, Mr. Meeker, the Wyoming hydrographer, attempted to show a distribution of the water from the Big and Little Laramies (see Exhibits T-7, T-8, at pages 1260, 1261). Considering first the Little Laramie, according to the table Exhibit T-8, there was distributed to "ditches between No. 2 dam and Two Rivers 17,245 acre feet" in the year 1912. No. 2 dam on the Little Laramie is the diversion point for water from that stream to Lake Hattie. Two Rivers is the junction of the Big and Little Laramie rivers. According to the survey made by the defendants, there are 31,341 acres irrigated between these two points. According to Wyoming, the area is larger. Now if Meeker be correct in his statements concerning stream flow, and also that only 17,245 acre feet were used in the year 1912 for the irrigation of this area of land, of which the least amount testified to was 31,341 acres,

he shows distribution amounting to only .55 acre feet per acre for the irrigation, by flooding, of an area devoted almost entirely to native hay meadows. This is so palpably an error that it scarcely needs discussion. The evaporation alone would probably not be accounted for by the .55 acre feet. It must be remembered that these meadows were irrigated, as described by the witness Grant and others, not by the use of distributing laterals, but largely by the construction of dams in such a manner as to cause "copious flooding."

Passing for a moment to the consideration of the Big Laramie, in Exhibit T-7, Meeker states that there was distributed to the Pioneer Canal in 1912, 17,703 acre feet. He also testified that there was under this canal 11,556 acres. Our survey determined 10,605. Therefore, if his stream flow measurements be correct and his distribution also correct, we find that there was applied to the lands under the Pioneer canal, which are also largely native hay meadows where the method of irrigation is substantially the same as on the Little Laramie, 1.6 acre feet per acre.

This discrepancy is remarkable. Obviously he is in error somewhere, and the contention of plaintiff throughout this whole case has been that water was applied to these hay meadows to an unnecessary amount. But Mr. Meeker found only so much water flowing in the stream. According to his measurements, the big channel reservoir lower down, Wheatland Reservoir No. 2, intercepted all the flow at that point. It had been more than filled in the year 1912, and Meeker must of necessity, when he attempted to show the distribution of this water, keep the amount distributed down to the amount which his stream measurements disclose, or otherwise all his measure-

ments would be worthless. Therefore, not only does he contend that Wheatland Reservoir No. 2 has a capacity of only 83,400 acre feet, as against the amount of 126,000 disclosed by the survey thereof, but he reduces the amount which he states is distributed to these lands under irrigation on the Little Laramie River to a quantity which is ridiculously low. It is only, therefore, natural that there should be a lack of consistency when his figures are analyzed. If the duty of water on the Little Laramie is only about .55 of an acre foot per acre, why, under exactly similar conditions, should it be 1.6 on the Big Laramie, and why should the Wheatland people, as Elliott testifies, receive from 2.6 to 2.7 acre feet per acre? Let us cite Meeker's conclusions concerning the duty of water, even in the face of his previous figures. He testifies: "From my records and experience, the duty of water diverted from the Laramie River between the Pioneer dam and Two Rivers stations is approximately one acre foot per acre. This includes copious flooding of the meadow lands and irrigation of the pasture land adjacent to the river, If all the lands irrigated between these stations were included, the duty of water would be higher" (4317). A higher duty means less water. Concerning the lands on the Little Laramie, he also placed the duty of water at one acre foot per acre. This particular testimony was by error, omitted from the abstract. We therefore take the liberty of quoting from the original transcript (4320):

> "Q. I neglected to ask you if you could state approximately the duty of water realized between Lake Hattie No. 2 dam on the Little Laramie and Two Rivers? A. That is also approximately one acre foot per acre per annum.

Q. Is the general character of the irrigated crops grown there similar to that in the Big Laramie valley? A. Yes, sir.

Q. Including meadow lands and irrigated pasture? A. Yes, sir, and on account of the copious application and large return waters, there is also a large re-use of water between the two points, which accounts for the high duty.

Q. What can you say of the relative rapidity of the return flow in that portion of the stream? A. That is also very rapid."

Here again we find that his conclusions are at material variance with the statements contained in his table. But accepting his conclusion that the duty of water on the Laramie Plains is one acre foot per acre, and also accepting his conclusions which are adopted by the plaintiff in its supplemental brief on page 115, that the average annual flow of the Laramie River is not to exceed 200,000 acre feet, and the average annual flow of the Little Laramie 100,000 acre feet, and also accepting, for the sake of argument alone, the further statement that these two sources constitute the entire supply of water available for the irrigation of the Wyoming land claimed to be irrigated, we find that there is a total of 310,000 acre feet of water, with a duty of water of one acre foot per acre, or a sufficient amount on this basis to irrigate 310,000 acres of land. And yet Wyoming contends for a total of 152,097 acres irrigated, including all of the irrigated lands on the Laramie River supplied with water not only from the Big and Little Laramies, but also from the tributary streams, and including also the total amount under irrigation in the Wheatland tract.

When the evidence is analyzed, where is there anything upon which Wyoming can stand, assuming that her own testimony concerning the supply is correct, and also that her claims concerning the amount of land irrigated are correct?

Under this state of facts the defendants are most certainly entitled to a dismissal, because Wyoming, the plaintiff in this case, has failed to show any damage whatsoever or any threatened damage, because of the diversions now made and those proposed to be made by the State of Colorado and its citizens.

Referring briefly to the conclusions of Mr. Field concerning the flow of the streams, to the effect that the normal flow of the Big Laramie at the state line is in excess of 250,000 acre feet and that the total amount of flow in the river available for the irrigation of all lands down to and including the Wheatland tracts was 431,200 acre feet, and applying Meeker's duty of water, there is enough for 431,200 acres of land, from which, if we deduct the 56,000 acre feet per annum proposed to be diverted by the Greeley-Poudre tunnel, or even deducting the total amount in contemplation through this system, 71,000 acre feet, there remains a sufficient amount of water for the irrigation of 360,200 acres of land. If we apply Professor Carpenter's conclusions as to stream flow, then this amount is increased even more and after the deduction of the amount proposed to be taken by Colorado, there would remain, for Wyoming, water for the irrigation of more than 400,000 acres.

Let us revert again to Meeker's conclusions. His testimony concerning the duty of water was as to the Laramie Plains only. Now if it be contended that the duty of water is lower on the Wheatland tract, let us deduct for the irrigation of that tract the

amount which ich they might possibly contend is legiti-
mate, it being ing the maximum amount permitted by
the laws of W f Wyoming, that is, 85,000 acre feet. We
then have, ac according to Meeker's figures, water
enough in the the Big and Little Laramie rivers alone
for the irrigat igation of 225,000 acres of land under a
duty of water ater of one acre foot per acre.

In acceptin epting the plaintiff's testimony of stream
flow, etc., we d we do so solely for the sake of argument,
contending tha that our evidence in this regard is of
higher value th ue than that of plaintiff, but we submit
that even und under plaintiff's own testimony, it has
failed to sustai sustain the burden of proof. On the con-
trary, it has sh as shown that no damage whatsoever can
result to it by r t by reason of the diversions of which com-
plaint is made. ade.

In view of ew of the condition disclosed by this wit-
ness, is it at all at all surprising that the State Engineer of
Wyoming has is has issued permits for the construction of
the systems desi ns designed to divert a vast amount of addi-
tional water fro ter from the Laramie River and its tribu-
taries in Wyomi Wyoming? (See table, p. 228, Vol. II, defts.
orig. brief.) Ap f.) Apparently he was justified in so doing,
although counse counsel for the plaintiff, in their supple-
mental brief, de rief, devote a chapter commencing on page
221, to an attem n attempt to explain these permits or pos-
sibly to excuse th xcuse the action of the State Engineer. (But
see *contra*, pp. 1 *a*, pp. 191 to 231, incl., Vol. II, defts. orig.
brief.)

Plaintiff lays
Colorado's whole ntiff lays great stress upon a contention that
compel prior Wy 's whole defense depends upon her right to
reservoirs. We rior Wyoming appropriators to construct
right to complain rs. We do contend that Wyoming has no
water within the complain of the beneficial application of
ithin the State of Colorado so long as she

has an abundant supply for her own use either from the direct flow of the stream or from that and water stored in reservoirs. If necessary, although it is not at all clear that such is the case, Wyoming, we contend, should, so far as is practical, conserve her flood and winter waters and cease her enormous needless waste before making complaint of a beneficial application in Colorado.

V. CONTRAST IN AREAS.

It is claimed by plaintiff, however, that the value of the product from irrigation in California, for illustration, justifies expenditures for the conservation and distribution of water, which would clearly not be justified by the value of the hay raised upon the ranches upon the Laramie Plains.

This introduces the further contention of the defendants, that even though there should be a question as to the adequacy of water supply, that the doubt must be resolved in favor of the State of Colorado, if for no other reason than that the returns obtained from the application of water in the Poudre valley amounts in value to from five to ten times what it will be if this water were applied upon the Laramie Plains. To this end, we went to exhaustive lengths to show the character of the development now reached upon lands under irrigation in the Laramie Plains and in the Poudre valley and the results based upon experience in each area to be expected from the application of the water from the Laramie River to the lands of the Greeley-Poudre district, in contrast to the returns to be expected from lands under irrigation upon the Laramie Plains. May we most urgently request a consideration of this discussion under the head of "Comparison of Areas," commencing on page 99, volume 1 of our original

brief. We produced this evidence and numerous exhibits were introduced, in order to give to the Court a clear idea of the contrast between these two areas. (See *Bailey*, 2575-2612; Heidke, 1727, 1780-2; Edwards, 2190-2204, 2232-2236; Timothy, 2341-72; *House*, 2388-2453; Gardner, 2916-30; *Carpenter*, 2931-91; Field, 3046-76; Parker, 3095-3112; Ewing, 3113-27; Mattox, 3172-77; *McCreery*, 3178-98; *Rothchild*, 3198-3219; Drake, 3220-37; McClelland, 3238-51; Baxter, 3252-66; Watrous, 3268-74; Gillette, 3278-98; Hottel, 3298-3304; *Petrikin*, 3305-33; 3580-87; Link, 3375-86; and Officer, 3511-26.)

To review this evidence would be merely to make a restatement of our former brief in this regard. Suffice it to say that every phase of agricultural development in the areas under consideration was considered in the testimony. Comparisons of census reports for many decades were tabulated or diagramed in order to show the rapid development in the Poudre valley and the relative absence of development on the Laramie Plains (House, 2388-2453). Meteorological reports were resorted to, statistics of all kinds relating to agricultural products were introduced; photographs of development on the Laramie Plains showing the character of improvements (Deft's. Ex. 115 and 116—albums), were introduced in contrast with similar photographs taken in the Poudre valley (Gardner, 2916-30, Deft's. Ex. 119, 120 and 121), and the testimony of many experts given, of whom probably the most notable is Dr. L. H. Bailey of Ithaca, New York, whose testimony will be found in the transcript at pages 2575 to 2615, inclusive. Dr. Bailey's testimony was procured because of his eminent standing as an agriculturist and his lack of interest in the outcome of this case. He testified that the two areas were to be contrasted,

rather than co[illegible]red (2584), and in substance that the Poudre va[illegible] is an area of remarkable agricultural developm[illegible] capable of supporting many times the populatio[illegible]ich can be supported by the Laramie Plains, [illegible] is primarily a livestock producing area and [illegible]h, because of the severity of the climate prese[illegible] very interesting experiment in agriculture; b[illegible]at its possibilities are limited to the growth of [illegible] hardier crops and that it will develop further[illegible] as a grazing and to some extent as a fe[illegible] region with such accompanying forage as can[illegible]rown with profit. Concluding, he says as follo[illegible]

> "To[illegible]y sum up the principal reasons why[illegible]Poudre valley area is, in my judgmen[illegible]uch superior to the Laramie Plains a[illegible] an agricultural region, I think I [illegible]do more than practically repeat the[illegible]ent I have already made in my testi[illegible] I feel that the development that is [illegible]neral Greeley District is one that is i[illegible]to produce more value per acre an[illegible]r diversity in cropping, to maintai[illegible]ger rural population and more r[illegible]tural. Tustries founded on agriculthese [illegible]ral fundamental reasons for cated, [illegible]s, as I have already indiparticu[illegible]hiefly are soil and climate, is difficu[illegible]latter, for the reason that it sible to[illegible]rcome climate, but it is posconditio[illegible]e some difficulties in soil the cli[illegible]nther words, I should regard ing fa[illegible]a more important controlequal, i[illegible] soil, other th[illegible]gs being in it a[illegible]tis such that crops can grow

The testimony of this witness is very significant in view of the constant contention made by the defendants that the Laramie Plains area, although earlier in settlement than the Poudre valley, was still undeveloped except as a stock-raising country, and that the irrigation upon that area was devoted almost entirely to the production of native hay; whereas, on the other hand, the Poudre valley is an area producing crops of very high value, such as sugar beets, potatoes, fruit, vegetables of all sorts, alfalfa and small grains.

We have previously referred to two tables showing the classification of irrigated lands covered by the surveys made by the defendants of the Laramie Plains areas, exhibit 117 pertaining to the lands on the Little Laramie and 118 on the Big Laramie in Wyoming. The classification of these areas, together with the number of acres devoted to the various purposes according to these two exhibits, may be summarized as follows:

Meadow (native hay)	39,732.9 acres
Pasture (irrigated)	12,737.8 acres
Alfalfa	1,659.0 acres
Oats	2,150.6 acres
Other grains	268.9 acres
Potatoes	37.4 acres
Garden	19.6 acres
Flax	19.0 acres
Plowed ground	3,095.1 acres

The testimony of witness E. B. House, professor of civil and irrigation engineering at the State Agricultural College of Colorado, is also very interesting, inasmuch as it is directed to a review of the census reports for the decades from 1870 to 1910, inclusive, and also to a consideration of the meteorological re-

ports showing the temperatures at Greeley, Colorado, and Laramie City, Wyoming, for two decades, 1893 to 1902, inclusive, and 1903 to 1912, inclusive. Comparison of the areas as to population, production, etc., based upon census reports, is shown by charts, Exhibits 86 to 104, inclusive. The meteorological reports are summarized on the diagram Exhibit 105, from which it appears that the average number of days in the season above frost, based upon the records of twenty years, is 125.5 days at Greeley and 57.6 at Laramie. The testimony of Professor House appears at pages 2388 to 2453, inclusive.

It is almost impossible to attempt to review all of the evidence introduced to show the high state of development in the Poudre valley, particularly the potato industry (3095-3112, 3178-98, 3198-3219); the production of sugar from sugar beets and the feeding of livestock (Petrikin, 3305-33, 3580-87; Timothy, 2341-72; Drake, 3220-37, and McCreery, 3189-94); production from market gardens and orchards (3185-88; 3172-77; 3238-51; 3252-66; 3238-51); the material improvements, such as railroads, public buildings and institutions, towns and cities, and all of the other things which prove a highly posperous district.

Aside from the verbal testimony introduced for this purpose, photographs were taken, to a portion of which we wish especially to draw attention: Exhibits 119 and 120 are albums containing photographs of the improvements under the Larimer County Canal and under the Larimer and Weld Canal in the Poudre valley. The development under these canals is typical of the area. Moreover, the Larimer and Weld Canal dates from the year 1879, the same year in which the Pioneer canal on the Laramie Plains was constructed. The Larimer County Canal is two years

later. Contrast these with the development shown by the photographs in Exhibit 116, which is an album containing pictures of the farm and ranch improvements on the Laramie Plains in Wyoming, and note also the contrast shown by some large panoramic photographs of the Wheatland and Laramie Plains areas upon one hand and of the Poudre valley on the other, shown in Exhibit 122.

As will be seen from a glance at the map, Exhibit 1 attached to the answer of The Greeley-Poudre Irrigation District, the lands within that district lie immediately adjacent to those now under development in the Poudre valley, and it is to be expected that with irrigation, the same development will result when the lands of this district are reclaimed. The evidence proved that, without any exaggeration, the returns from the use of water in the Poudre valley were actually from five to ten times the returns from lands under irrigation on the Laramie Plains (1782, 2967). The reason for this difference is obvious (2938, 2965). The average elevation of the Poudre valley is between 4,500 and 5,000 feet above sea level. The average elevation of the Laramie Plains is about 7,100 feet. Doctor Bailey testified that for the sake of comparison elevation can be projected into latitude. That if this be done, the Laramie Plains area might be compared to a point in the general latitude of Edmonton, Alberta, except that the Laramie Plains lacks the greater length of day which prevails in the northern latitude (2598; see also 2965). Eliminating a discussion of properties of soil in the two areas (2596-7, 2937-8), it is obvious that the lack of development in the Laramie Plains along lines of agriculture is due to adverse climatic conditions which cannot be overcome, and that its development along these lines is limited, so much so

that their development commencing at a date earlier than the settlement of the Poudre valley (2598-2601, 2937-44), shows today an area devoted almost entirely to the production of live stock and agriculture connected therewith, that is, the production of native hay. It is remarkable that of the 31,341 acres classified in Exhibit 117, 22,081 acres are devoted to meadow land producing native hay, 5,801 acres irrigated pasture and only 219 acres to alfalfa, 1,319 acres to oats, and a mere nominal amount to other crops; and of the lands classified in Exhibit 118 a total of 29,279.3, 17,651.9 acres are meadow or native hay lands, 6,936.8 acres irrigated pasture, and only 1,440 acres were devoted to alfalfa, 831.8 acres to oats and a mere nominal amount to other crops.

The Wheatland area, lying at an average elevation of about 4,700 feet, should become more of a normal agricultural district. The development already made there is an indication of what may be expected and we make no contention that this area is other than normal for irrigated lands of similar altitude and latitude.

VI. THE PRIORITIES OF APPROPRIATION.

In view of the language in the second paragraph of the order restoring this case to the docket, it becomes necessary to consider the relative priorities on the Laramie River in Wyoming and in Colorado.

Volume II, pp. 132 to 256, inclusive, of the original brief filed by defendants, contains an exhaustive discussion of the facts and evidence concerning the relative priorities of the Greeley-Poudre enterprise here in question and the subsequnt large and junior enterprises for which permits have been granted in Wyoming, a part of which have been completed to a greater or less degree, notably The Laramie Water

Company's system (Lake Hattie, etc.); the James Lake system; enlargement of the Wheatland system; the enlargement to King ditch; Sodergreen Highline and others of minor importance, and we respectfully refer to that portion of our original brief to avoid repetition of the discussion there appearing.

The decree of the District Court of Colorado adjudicating the priority of the Greeley-Poudre enterprise, including its several units, was offered in evidence as defendant's Exhibit No. 179 (3933). The table appearing in this decree also contains reference to certain other small ditches along the Laramie valley which were adjudicated in that decree. This, however, was a decree obtained upon a supplemental adjudication. The decrees of the District Court of Colorado for the former adjudications fixing the priorities of canals and reservoirs earlier in date than those appearing in Exhibit 179 were not offered in evidence by either party.

(1) The Colorado Diversions.

We have previously shown that a survey of the lands within the Laramie River valley in Colorado under irrigation amounts to a total of only 4,250 acres (3459). These lands consist of narrow strips of native hay meadow along the river or its tributaries irrigated by means of a number of small ditches, the diversions taking the water a short distance from the stream. The land irrigated, according to the Wyoming engineer, Whiting, who made a survey of the course of a few of these ditches (p. 1265 of record—not in abstract), generally extended from 500 to 600 feet from the stream, some of the ditches reaching a distance of approximately 1,200 feet away from the stream (1266, 1275). See also the plat of this irrigated area made by the engineer Wortham on behalf

of the defendants, Exhibit 130, and the testimony of Wortham (3454-3462). No complaint is made against the diversion by these ditches, neither is complaint made of the diversions by means of the Skyline canal, nor the Divide or Wilson Supply canal. We shall therefore first consider briefly the priorities of these appropriations.

Fourteen out of the many ditches used for the irrigation of these 4,250 acres of land in the Laramie River valley in Colorado and the dates of construction thereof are given at abstract pages 3334 to 3336 and may be summarized as follows:

Name of Ditch.	Date of Construction.
Long Park No. 1	1902
Link Ditch No. 1	1894
Link Ditch No. 2	1896
Hills Ditch	about 1880
Yelton Ditch	1880 or 1882
Upper Smith-Brown Ditch	1879
Lower Smith-Brown Ditch	1880 or 1881
Comet Ditch	1895
Homestead Ditch	about 1884
Mansfield Ditch No. 1	about 1882
Mansfield Ditch No. 2	about 1878 or 1880
Bliler & Boswell Ditch	prior to 1880
Warren Ditch	about 1880
Stuck Creek Ditch	1881

These are a sample of the meadow ditches in the narrow Colorado valley. The land irrigated by means of these ditches is devoted to the production of native hay. The water is applied plentifully and because of the proximity of the lands to the stream and the heavy slope, there is a constant return flow from the lands irrigated back into the stream. The irrigation season commences from the first to the

15th of May and continues until about the middle of July (3336, 3342). Exactly the same conditions prevail on the upper reaches of the Little Laramie valley in Wyoming, that being the area on the stream above Filmore, the station at which measurements were taken (1110, 3314). As we have previously stated, neither of the parties to this cause attempted to make any charge for the amount of water diverted from either stream for the irrigation of these mountain meadows. The more recent of these appropriations in Colorado as adjudicated by the District Court of the State of Colorado in and for the County of Larimer are set forth in the decree, defts. Ex. 179 (3393). We do not contend that this decree is any more binding upon the plaintiff in this case than are the decrees of their Court on us, but we wish the Court to understand the status of these and other ditches and that the appropriations made by means of them have been judicially determined by the courts of the State of Colorado.

We next desire to consider the Skyline canal and the Divide or Wilson Supply ditch, these being the two ditches through which for a number of years diversions had been made from the Laramie River for use in the Poudre valley, and which the defendants admit will divert about 20,000 acre feet per annum on the average. This we have previously explained. These two ditches are not specifically complained of in this proceeding. The construction of the Skyline canal was commenced in the year 1891 and completed in 1893 (2206). It has a carrying capacity at its lower end of 130 cubic feet per second (2209). This appropriation has also been adjudicated in Colorado.

The date of construction of the Divide or Wilson Supply canal does not seem to have been definitely fixed in the record. However, according to the table,

Exhibit 124, this ditch is credited with water in the Poudre in the year 1902 and subsequent years. It is obvious, therefore, that the work of construction was completed prior to that year.

The decree of the District Court in and for Larimer County, in which these priorities were adjudicated, was not introduced in evidence. However, a later decree including the diversions made by the Greeley-Poudre system (Exhibit 179), shows that this decree, so offered in evidence, commenced with priority No. 65; that priorities numbered 1 to 64 have been covered by the previous decrees on the Laramie River, the appropriations being made in part by the ditches hereinbefore mentioned. It must not be understood, however, that this means there were 65 ditches. A number of the ditches had several decrees, arising by reason of enlargements after original construction. Each enlargement is a new and separate appropriation and takes its junior priority.

The evidence upon which the foregoing discussion is based defines the limits of the beneficial use to which the Laramie River had been put in Colorado prior to the inception of the Greeley-Poudre system, and may be summarized as follows: Through a number of ditches diverting water from the Laramie River there was irrigated in Colorado 4,250 acres of land, all of which lie immediately adjacent to the steam or the tributaries from which the appropriations were made, and was devoted to the production of native hay. From these lands there was a very rapid return to the stream. The amount thus used has not been taken into consideration in any stream measurement. And, secondly, there was actually diverted from the Laramie River watershed by means of the Skyline canal, constructed in 1891, an amount

which will average 16,000 acre feet per annum, and through the Divide or Wilson Supply Canal, constructed prior to 1902, an amount which will average 4,000 acre feet per annum.

(2) The Wyoming Diversions.

As we have previously stated, no evidence was introduced from which a clear line of demarcation can be drawn between the development prior to August 25, 1902, and after that date; nor during a period prior to May 29, 1911, or after that date. These two dates are the dates of the commencement of the Colorado construction complained of and the date of the inception of this suit, respectively. We did, as we have stated, attempt to determine the total amount of land under irrigation in Wyoming, but we are unable at this time to make a definite statement as to the amount of land which was reclaimed by irrigation from the older ditches, or the amount reclaimed by irrigation by the newer projects, except as the same is reviewed in the supplemental brief of the plaintiff wherein, under the heading "The Contested Priorities," the newer projects in Wyoming are discussed.

Omitting a few small ditches, the newer projects in Wyoming now constructed or substantially constructed, include the Bordeaux and Sybille units of the Wheatland tracts; the Lake Hattie system; the Lake James system; the Hutton Lakes system; and the Sodergreen Highline. In addition to these there are many others of immense size for which premits have been issued, but on which no material work of construction had been done at the time the evidence was taken. (See table, Vol. II, p. 228, defts. orig. brief.) We will discuss these projects in the order in which they are mentioned.

(a) *Wheatland Project.*

The original Wheatland tract, consisting of 60,000 acres, is reclaimed to the extent of 29,000 acres. This project dates from the year 1884. It appears from the testimony that at a time when only a very small percentage of the lands of the tract were under irrigation, storage facilities were provided by the Wyoming Development Company, the projectors of this system, who began the construction of Reservoir No. 1 and Reservoir No. 2. Reservoir No. 1 having a capacity of 7,000 acre feet, and Reservoir No. 2 a capacity of 126,000 acre feet. In addition to this storage, they have the direct flow of the Laramie River, through their inter-mountain tunnel, and of the Sybille and Blue Grass creeks, for the irrigation of this tract. Reservoir No. 2 was completed about 1900. It is significant that according to the witness, M. R. Johnston, there was only about 10,000 acres of land under irrigation in the Wheatland tract in 1900, and yet they had a storage capacity in these reservoirs, in addition to the direct flow of the river, to the amount of 133,000 acre feet. It is not surprising, therefore, that an attempt was made to find additional land upon which to put the surplus water available. Accordingly the Sybille and Bordeaux tracts were projected. They are what is geneariy known as "Carey Act" lands. The Bordeaux tract consists of 10,000 acres and the Sybille tract 30,000 acres (168-169). The ditches for the irrigation of these new tracts were an extension of the main system designed for the irrigation of the original Wheatland tract and a new canal from Blue Grass Creek (40), although the surveys for the ditches leading to the Bordeaux tract were commenced in February of 1904, construction work began in June, 1907, and for the system leading to the Sybille tract, the

surveys commenced in August, 1907 and construction work began in July, 1910 (108). When the evidence was taken, there was under irirgation in the Bordeaux tract, according to the plaintiff, only 1,004 acres (168), but the defendants' survey disclosed only 451 acres (Exhibit 2). The ditch leading to the Sybille tract was not completed when testimony was taken in 1913, and no land was irrigated in that tract (169). It is quite obvious that these two new projects resulted from the fact that the owners of the original Wheatland system found themselves in the possession of more water available in their reservoirs than was needed on the original tract. The Sybille and Bordeaux projects were an after-thought arising because of this condition. They were not in contemplation by the Wyoming Development Company at the time of the construction of the big Wheatland Reservoir No. 2, and do not relate back to the date of that reservoir, and much less to any date prior to that time. The witness, M. R. Johnston, testified that the Bordeaux tract was conceived for development somewhere about 1908 or 1909 and the Sybille or Cooney Hill tract some two years later (41), and that these two tracts were not in contemplation when he took charge of the system as superintendent in 1888 nor when the Reservoir No. 2 was constructed in 1900 (42).

(b) *Lake Hattie System.*

The next project, the Lake Hattie system which the plaintiff in its supplemental brief describes as consisting of the Lake Hattie inlet ditch takes water from the Big Laramie and Little Laramie rivers and consists in part of the Stewart ditch (being the inlet taking water from the Little Laramie), the Lake Hattie reservoir and the outlet canal with its

two branches, the North and South Canals. During the taking of the testimony, reference was made from time to time to various disconnected and random surveys made for various lines of a ditch to take water from the Laramie River, one or two of which were in the general vicinity of the line of the Lake Hattie inlet and the outlet canal from Lake Hattie. No construction had followed any of these surveys and they were abandoned. One of these suggested ditches was referred to as a possible Pioneer Highline canal, and in the original brief of plaintiff herein, an attempt was made to fix the date of the priority of the Lake Hattie system back to the date of some one or other of these old surveys known as the Loback and Bellamy surveys, made in the year 1886. (See page 76 plaintiff's original brief.) This contention, however, was not tenable, the evidence disclosing that there was absolutely no relationship between the old random surveys and the very recent surveys upon which the Lake Hattie system was constructed. (See Vol. II, pp. 234-53, defendant's original brief.) However, in order that there might be no possible misunderstanding concerning this, the defendants took great pains to review the evidence relating to these old surveys and the Lake Hattie system. Among other things it was shown that the Lake Hattie system was based upon the surveys commencing April 16, 1908 (646, 774) and not earlier, and that construction was based entirely upon permits issued by the State Engineer of the State of Wyoming between April 21, 1908, and July 11, 1912. (See defendants' Exhibits 159 to 167, inclusive; also the evidence of Ralph I. Meeker to the effect that these were the permits upon which the system was constructed, 1070, 1071). While it is true that the Lake Hattie system (but not any Pio-

neer Highline canal) was practically completed at the time evidence was introduced, nevertheless, there can be no serious contention for a date earlier than April 21, 1908, and we believe the claim to have been waived by the plaintiff, inasmuch as in their supplemental brief they state in substance that some such diversion as this from the Big Laramie River was in contemplation as early as 1884, "so that if the taking of thought, the making of intermittent surveys, the search for capital and capitalists and other activities incident to promotions may be considered such diligent prosecution of the work of construction as would entitle the promoters to the benefit of the doctrine of relation, the Lake Hattie enterprise might be considered to date from 1884."

"In the view of the plaintiff, however, these historic particulars are only valuable to show the connection between the works of the Lake Hattie system, as finally realized, and the original Pioneer canal enterprise projected and constructed in 1879 and the following years, * * * For the present we are considering this new work only as originating in the beginning of construction in July, 1909, in competition for priority with the Tunnel Project on which construction was actually begun near the end of that year."

There would seem to be no doubt whatsoever, and we believe that it will not be seriously contended, that the earliest date to which the Lake Hattie system is entitled is the date of its initial survey, April 16, 1908, evidenced by the permit issued thereupon by the State Engineer on April 21, 1908 and not the date when actual construction began in 1909. May we earnestly ask a consideration of the discussion concerning the permits relating to this system and to other systems in our original brief (Vol. II, pp. 198, 255).

We are unable to state the amount of land which it was contemplated to reclaim by this system. If the evidence discloses this amount, we are unaware of it. On page 39 of the supplemental brief of plaintiff, it is said that about 700 acres of new land were irrigated from this system in 1913. We have previously discussed the evidence showing the enormous quantities of water which have been stored in this reservoir prior to 1913. We are informed that the first water was taken from the reservoir early in July, 1911. Plaintiff's Exhibit K purports to give the amount stored during 1912 and 1913. If there were only 700 acres of new land irrigated from this system, we are interested in knowing what became of the water which was withdrawn from the reservoir. These defendants contended throughout the trial of this case that this water was merely wasted and that vast quantities of it were permitted to run through one of the distributing canals into a large depression known as Big Basin and into other waste lakes, from all of which there was no outlet. This contention was confirmed in part by the testimony of the water commissioner, Grant, who testified concerning this reservoir:

> "I did not know that they were running water out of Lake Hattie and wasting it into Big Basin until about the first of September. The only time I knew of their running water down into Alkali Lake or Alkali Basin was when they tried out the canal once or twice. It only ran for a day or so at that time. I heard that at a later time when Mr. Goldsborough had some prospective land buyers out there, he ran water for seveal days and wasted it into Big Basin. I did not go to look it up. I think there was consider-

able water left in Lake Hattie when I resigned, about September 15." (1286)

Defendants' contention in this regard was denied by the plaintiff, except that it was admitted that in testing the canal, some water was run through it and into one of the waste basins. It is interesting to surmise what became of the balance. May we again state that the total capacity of the reservoir is 110,500 acre feet, of which 62,500 acre feet are available (786-787).

(c) Lake James System.

Lake James, as has been previously explained, has an available capacity of 41,100 acre feet. It is filled from the Little Laramie, Seven Mile and Four Mile creeks. This system was initiated by survey begun March 22, 1908 (638). Several permits were issued for the construction of this system, the earliest being March 27, 1908 (3962). This reservoir had stored water for several years prior to 1913, although the evidence fails to disclose that any land had been reclaimed under it. On page 40 of the supplemental brief of the plaintiff, where this system is discussed, it is said: "Some 1,500 acres had been irrigated under this system, of which 515 acres were in tillage in 1913." Again it is of interest to ask what became of the vast amount of water which had been stored in this reservoir? It was admitted that unused water in lakes on the Laramie Plains evaporated at the rate of five feet in depth per year.

(d) The Hutton Lakes System.

We have previously explained in this brief that the water of Sand Creek has been heretofore diverted from its channel and permitted to flow into Hut-

ton Lakes, a natural basin from which there was no outlet. As we understand it, Hutton Lakes consist of two lakes, Hutton Lake and Creighton Lake. The names are sometimes used interchangeably. It seems that it was recently proposed to utilize these lakes as reservoirs by a company known as The Northwestern Land & Iron Company, the plan being to enlarge and extend the old King ditch, diverting water from the Laramie River, to build a flume or syphon across the bed of Sand Creek, and thus to utilize these lakes. The date of the surveys is not definitely shown. The plaintiff throughout the case appeared to evince very slight interest in this project, and no evidence is given as to the amount of land which it was proposed to irrigate by means of this new system. However, applications were filed in the office of the state engineer on June 3, 1909, on which permits were issued Oct. 17, 1909 (3961). The ditch, however, had never been completed, in that the flume or syphon across Sand Creek remained to be constructed and additional work upon the reservoir was yet to be done (322). In discussing this project (p. 39 of the supplemental brief) the plaintiff does not contend that any of the land whatsoever has been reclaimed by means of the system.

(e) The Sodergreen Highline Ditch.

Before discussing this ditch we desire to reiterate a former statement. This ditch diverts water from the Laramie River above the Pioneer dam, where measurements of stream flow were made by Mr. Meeker, the Wyoming hydrographer, who made no allowance for the amount diverted by this canal or other ditches in the same locality, when his measurements of the stream flow were discussed. The survey was commenced in November, 1907, and con-

struction was completed during the year 1910 (418-445). The permit for construction was issued April 14, 1908 (3960). The owner of the ditch, Oscar Sodergreen, testified that from four to five thousand acres of land had been irrigated by means of it (418). Some doubt, however, is cast upon these figures by further testimony of this witness at page 446, wherein he describes the irrigation under this ditch and says: "I don't know how much has been irrigated; all that I could. These lands lie in a regular natural slope, and it irrigates by just turning the water out of the ditch at intervals. It was raw prairie land. The greatest part is hay land now."

(f) General Discussion Junior Wyoming Projects.

These six projects, that is, the Bordeaux tract, Sybille tract, Lake Hattie system, Lake James system, Hutton Lake system and the Sodergreen Highline, seem to have been singled out from a great number of projects covered by surveys and filings made subsequent to the year 1902, probably because they were either completed or a material amount of construction work had been done upon them, and they take a position as more or less definitely fixed, because of that construction work. However, it must be borne in mind that they are by no means all of the projects proposed to be constructed within the State of Wyoming subsequent to the year 1902. *In Volume II, Part II of our original brief,* the question of priorities and the evidence relating to all these projects and also to the Greeley-Poudre system was very carefully and exhaustively reviewed. We most earnestly ask the consideration of the court to that discussion. It would seem unnecessary to again review the whole subject as fully as we did in our original

brief, but we desire to say that the evidence concerning the filings in the office of the State Engineer of Wyoming, upon which permits had been issued for projects, in addition to these which we have described, will be found in the transcript at pages 3909 to 3933, inclusive, and in Exhibits 159 to 178, inclusive.

The filings in the office of the State Engineer and the permits issued thereon have been classified and tabulated in connection with the discussion of this subject in Volume II of our original brief, particular reference being made to pages 214, 215, 217, 218, 219, 220 and 228. Suffice it to say here that the evidence discloses that many large projects for the diversion of water from the Laramie River in Wyoming, in addition to those previously discussed, have been surveyed, findings of ample water have been made by the State Engineer of Wyoming, and permits have been issued for the construction thereof long since the year 1902. These had not been constructed when the evidence in this cause was taken, but there is no suggestion that they have been definitely abandoned, and so far as these defendants are aware, these projects are still in contemplation of the persons promoting them and stand as large junior and approved claims from the river.

The situation relative to these six projects above specified may be summarized as follows: The Sybille and Bordeaux tracts were not in contemplation of the owners of the Wheatland system when the Wheatland Reservoir No. 2 was constructed, nor for many years thereafter. These two projects were afterthoughts, wherein it is proposed to utilize the surplus water already provided primarily for the irrigation of the original Wheatland tract. There can be no claim that these projects are entitled to a

date earlier than the date upon which their permits were filed. The doctrine of relation cannot be applied to give them a date concurrent with the construction of Wheatland Reservoir No. 2 or any other part of that system. Even if we ignore the Wyoming law and date them as of initial survey, the appropriation of water for the irrrigation of the Bordeaux tract cannot take a date earlier than February, 1904, nor can the appropriation of the Sybille tract date earlier than August, 1907. In passing may we remark that it is contended that various delays in the construction of the works designed for the irrigation of the Greeley-Poudre district lands destroy the continuity which it is contended must exist between the inception and the completion of the project, and that because of the lapse of time since the initiation of this system shown by the surveys made August 25, 1902, it cannot be contended that due diligence has been exercised by the owners of the Greeley-Poudre system. The difficulties in the way of this construction and the cause for these delays, we will discuss later, but it is interesting here to know that while the initial surveys for the system designed to irrigate the Bordeaux tract were made in February of 1904, nevertheless in the year 1913, when the evidence was taken, a mere nominal amount of land out of the 10,000 acres included within this tract had been irrigated and, the only work required in making the canal was the construction of a large lateral ditch leading from the main Wheatland system. No reservoirs were necessary. This ditch was constructed in a territory adjacent to lands now under irrigation, easily accessible, and yet the beneficial application of water, which is the ultimate test of appropriation under all laws relating to irrigation, had not been made. The ditch leading from the main Wheatland

system to the Sybille tract was surveyed in August, 1907, the conditions were almost exactly the same as those surrounding the Bordeaux tract, and yet in 1913, we find that this ditch to the Sybille tract had not been completed, water had never been run through it and not one acre of land in the Sybille tract had been irrigated except some small portions of privately owned lands located within the confines of that tract which had been irrigated from other sources. The charge of the lack of diligence upon the part of the defendant in the construction of the Greeley-Poudre system hardly comes in good faith in view of this situation, particularly when the difficulty of construction and the immensity of the project for the irrigation of the Greeley-Poudre lands and the enormous expenditure of money in construction are considered.

Passing now to the Lake James project we find that it cannot be contended, and as a matter of fact it is not contended, that it is entitled to a priority date earlier than March 22, 1908. This system was apparently completed and water had been stored during at least three seasons, when the testimony was taken, and yet we find that the plaintiff admits that only 1,500 acres irrigated under this system in the year 1913.

The Lake Hattie system was based upon surveys commenced April 16, 1908. It had been completed and water had been stored for several years and yet under this system the plaintiffs themselves contend for only 700 acres of land reclaimed.

The Lake Hutton system surveys were filed June 3, 1909, and yet this system is not completed and no water run through the inlet from the Laramie River and not an acre of land reclaimed under this

project although all this time the waters of Sand Creek, naturally tributary to the Laramie River and available for the use of many ditches below the mouth of Sand Creek which is some distance above the city of Laramie, are diverted into these lakes and allowed to evaporate. How can this condition be possible if the contention of the plaintiff that the ditches on the Laramie Plains had been short of water for years, be true? The defendants have contended throughout this case that there was a superabundance of water and that Wyoming has wasted a large portion of her supply. Here is indisputable evidence of that fact. Very evidently the findings of the State Engineer of Wyoming, of ample water supply, were correct.

The Sodergreen Highline, which was constructed upon surveys commenced in November of 1907, is completed and has been used for the irrigation of land testified to between four and five thousand acres in extent. The capacity of this ditch is not known although it is obviously of considerable size.

These projects are long prior to the Greeley-Poudre system. If priority of diversion regardless of state lines were to be applied to a case such as this, then obviously each one of these recently initiated systems, as well as all others contemplated by the permits to which we have referred, must be denied water until the demands of the Greeley-Poudr system on the Laramie River have been fully satisfied. However, we do not believe that that principle is the law of this case. The fact, however, that the Wheatland Reservoir No. 2 has storage sufficient for the irrigation of 40,000 acres of land in addition to the amount of land which it was originally designed to irrigate; the fact that Lake James has stored water to the amount of 41,100 acre feet and

practically no lands are yet reclaimed under it and that Lake Hattie has stored water to a total capacity of 110,500 acre feet, 42,000 acre feet of which cannot be withdrawn from the reservoir as it is now constructed, and that only 700 acres of land have been reclaimed under it; the further fact that these two reservoirs with a total active capacity of 109,600 acre feet have water sufficient for the irrigation of 109,600 acres of land according to the statements and conclusions made by the Wyoming hydrographer, Ralph I. Meeker concerning the duty of water on the Laramie Plains; the still further fact that water from Sand Creek has been wasted year after year in Hutton Lakes without any attempt to apply it to beneficial use; and lastly, the fact that each year enormous quantities of water are deliberately and needlessly wasted; all conclusively prove the contention of the defendants that there is more than an abundance of water for the irrigation of the lands now irrigated in Wyoming after deduction has been made for the diversion through the tunnel by the Greeley-Poudre system, and further that a surplus remains for the reclamation of thousands of acres in Wyoming.

(3) The Greeley-Poudre Diversion.

The appropriation of the Greeley-Poudre system from the Colorado branch of the Laramie River by means of the tunnel and collection ditches dates from August 25, 1902 This is the decreed date of the priority in the State of Colorado. (Exhibit 179) As we have stated, this Colorado decree is no more binding upon the State of Wyoming than Wyoming decrees are upon Colorado, but we refer to it in order to show that it legally establishes the date under the laws of the State of Colorado and is binding upon

all Colorado appropriations from this stream. The plaintiff contends that there is a lack of continuity both in the plan or design and also in work as originally proposed and as undertaken by The Greeley-Poudre Irrigation District, and that the tunnel as a means of diverting water from the Laramie River was not in contemplation of the original promoters, neither was it originally designed to irrigate the specific lands now included within the limits of the present Greeley-Poudre district.

This contention is not established by the evidence and the District Court of Colorado found otherwise. In fact, the evidence discloses a complete chronological connection between the original ideas of Wallis A. Link, who discovered the possibility of making this diversion and which he later planned, and the system now in a great measure completed. The only changes made were in no wise fundamental and arose merely because of the improved methods of construction suggesting themselves as the work progressed. The plan was in all respects the same from the first—to build three collection canals and the tunnel. However, it must be borne in mind that the tunnel is not the fundamental feature in the consideration of this appropriation. The tunnel was merely a factor, the means to an end. The whole purpose and object of the contemplated diversion from the very inception was to procure water available in the Laramie River for the irrigation of lands in the Poudre Valley.

A great deal has been said in the supplemental brief of the survey of a canal which the plaintiff terms "The Detour Canal." This title is entirely of their own invention. No such name was ever applied by the defendants or their witnesses. The surveys for this canal were commenced in the fall

of 1908 and continued into the year 1909. The line of survey may be generally described as commencing in the valley of the Laramie River at a point near Glendevey, about nine miles below the tunnel, running thence in a northerly direction along the side of the mountain forming the eastern wall of the Laramie River Valley in Colorado, to or beyond the Wyoming-Colorado line; thence easterly into a stream which is tributary to the North Fork of the Poudre River. Inasmuch as the range of mountains to the east of the Laramie River is very much lower in the general location of the Colorado-Wyoming line than further south, it was thought by some that it might be possible to construct a ditch running around this higher portion of the range and thereby divert the water from the Laramie River without the enormous expense of constructing the tunnel. The tunnel surveys and filings based thereon, as we will presently show, had been made some four years earlier and construction was proceeding. But the plaintiff argues the tunnel was not a definite part of the project at the time this ditch survey was made. In this they are entirely in error. We shall presently trace the history of the development of the Greeley-Poudre system commencing with August 25, 1902 but, for the time, considering only the contentions of plaintiff concerning this so-called Detour Canal, let us state that during the progress of the surveys and construction work upon the Greeley-Poudre system, but before the actual drilling of the tunnel was commenced, a reconnaissance survey was made in order to determine an alleged possibility of avoiding the enormous expense of tunnel construction. This was in the years 1905 and 1906 (1759), and in connection with the idea of a ditch such as we have described, it was thought possible to construct a reservoir in

the channel of the Laramie River near Glendevey or about nine miles below the present tunnel (1760-1767). Had this plan been feasible, the mountain ditches and the collection ditches already designed and partly constructed, as well as the tunnel, could be eliminated and the water carried around through the mountains between the Laramie River and the North Fork of the Cache la Poudre River. The result of the survey disclosed that this canal was impracticable (1768), and of course, with the failure of the scheme for the canal, there failed also the plan for the reservoir which would avail nothing for the irrigation of lands in the Poudre Valley. The previous plans for the collection ditches and the tunnel were thereby confirmed as being the only available method by which the water could be diverted from the Laramie River. However, we find from the testimony of D. A. Camfield, who became interested in The Laramie Poudre Reservoirs and Irrigation Company in the fall of 1908, that there was a body of land lying north of and higher than the lands within the area of the present Greeley-Poudre district, which were desirable for reclamation (2170), but which could not be irrigated by means of the diversion canal from the Poudre River. Accordingly in 1908 another survey was made of this line for a proposed ditch out of the Laramie Valley. This survey of 1908 being much more in detail than the reconnaissance of 1905 and 1906, but the result of this last survey was the same as before. Charles R. Hedke, the construction engineer of The Laramie Poudre Reservoirs and Irrigation Company, testifies that this detailed survey and investigation confirmed the former conclusions that had been reached in 1905 and 1906. The survey disclosed that "it required a ditch about 100 miles in length, with obstacles of every possible nature, steep

hillsides, unsuitable material, broken and disintegrated rock, and conditions were such that under ordinary ditch construction, water turned in at the head of the canal would undoubtedly be lost before it reached the lower end unless the canal were lined. Many tunnels were necessary; also syphons and flumes, and the character of the country required special construction for almost the entire length of the canal. That means of diverting water was entirely abandoned after that time. It would have cost about $30,000 per mile and 100 miles of that canal would make the cost beyond considration" (1762).

It must be borne in mind that the tunnel surveys had been made prior to this time (in 1904) and construction upon the collection ditches was progressing and this was simply an effort, in the first place, to determine an alleged alternative route for the diversion without the great expense of constructing the tunnel and, in the second place, to obtain if possible, water for lands capable of irrigation lying higher than the diversion ditch from the Poudre River (1838). The witness, Hedke, after reviewing the various surveys that were made in order to secure the most advantageous means and locations for the diversions from the Laramie to the Poudre River, says: "My conclusion was and is that the Greeley-Poudre tunnel is the only means of diversion between the Laramie River and the Poudre. It represents the final economical development for the purpose of diverting water from the Laramie drainage to the Poudre drainage" (1766).

We have mentioned the survey of a reservoir at Glendevey in connection with the survey of this proposed ditch around the divide. This reservoir site was known as the Laramie Reservoir. Of it engineer Hedke testifies: "Surveys of the Laramie Reservior

were completed, but it was separate and apart from the system commonly called the Greeley-Poudre system. It was surveyed and mapped as a subsequent and junior enterprise. It was surveyed sometime in November, 1906. * * * Later, those in charge of construction of a system in Wyoming—The Interstate Reservoir Company—interfered with the development and construction of this reservoir. This was after our survey. * * * They made application to the national government for rights of way which interfered with our work. We considered it was a proposition that would not be necessary in contemplation with our system and abandoned it for the time and no further steps were taken to perfect that portion of the work. * * * It finally worked out that some rights of way were obtained by the Wyoming people from the government" (1767). In this connection it is of interest to note that this same Wyoming company, The Interstate Reservoir Company, made a number of filings and was granted several permits for other ditches and reservoirs within the State of Wyoming, none of which were ever completed, except that possibly a portion of them were later woven into the Lake Hattie system (see Exhibits 170 and 171). The indefinite plans of the various parties in interest leading up to the Lake Hattie system as fiinally constructed also include in some indefinite way, a reservoir site for which filings were made, located at or near the Colorado-Wyoming line. This is known as the Robertson-McConnell Reservoir, named after two men by that name, who, at some time or other in the history of the Lake Hattie system were interested in some of the filings relating to it. A permit for the construction of this Robertson-McConnell Reservoir at the state line, was granted by the State Engineer of Wyoming on Octo-

ber 15, 1909 (Exhibit 177). This survey disclosed plans for a reservoir with a capacity of 335,831 acre feet. It is impossible for us to clearly define the claims of various promoters who were at one time or another interested in the Lake James and Lake Hattie systems, but it is obvious that even after construction these two systems were still in the speculative stage. By that we mean that they had a vast amount of water available and were evidently seeking land upon which to make the application. The claims of The Interstate Reservoir Company for a reservoir in Colorado at Glendevey and the claims for the Robertson-McConnell Reservoir at the state line for which a permit was granted, merely go to show that in the minds of these people there was sufficient assurance of a vast amount of water available for storage even after the diversion by the Greeley-Poudre district and that these people were contemplating the construction of these reservoirs, knowing of the work then being done upon the Greeley-Poudre system.

We believe that any argument, based upon the fact that a survey was made for the canal which plaintiff's counsel terms the Detour Canal, to the effect that at the date of that survey, the tunnel was not definitely planned or contemplated, will avail nothing. We have already explained, the tunnel was only a means to an end, and then after it had been planned a survey had been made showing the enormous cost of such construction, all alternative routes were sought in order to avoid this expense if possible. This alternative route proved to be absolutely impracticable and the tunnel plan thereforeto adopted in 1902-1904, was confirmed as the only feasible course to pursue. As we will show later, there can be no question—as a matter of fact it is ad-

mitted—that the survey upon the tunnel itself had been made in the year 1904, before the so-called Detour Canal survey was made, and obviously, in view of the fact that the tunnel was constructed as planned in 1902-1904, it cannot be contended that there was any abandonment of the plan for the construction of the tunnel.

VII. HISTORY OF GREELEY-POUDRE SYSTEM.

The possibility of construction of the Greeley-Poudre tunnel enterprise was first revealed to Wallis A. Link in 1897 while he was hunting on the divide between the Laramie and Poudre rivers. This discovery is the source of some irony by plaintiff in its original brief, for the evident reasons set forth in the defendants' original brief replying thereto, and, as there observed, while this discovery by Mr. Link in 1897 ultimately led to the actual commencement upon the tunnel enterprise of the Greeley-Poudre system on August 25, 1902, by Link and his associates, no claim of priority of appropriation for the enterprise has been asserted upon pretext of the date of discovery of the site in 1897, and it is also true, that no evidence was offered of previous discovery, observations or surveys by persons in no manner identified with the enterprise finally initiated. The discovery and all of the subsequent reconnaissance work by Link and his associate between 1897 and 1902 are but historical facts preliminary to the actual beginning of construction. (Vol. II, pp. 167-71, Defts. Orig. Brief.)

Following the discovery of the tunnel site, Mr. Link made further investigations of the feasibility of a general tunnel enterprise and thereafter interested A. I. Akin in the general plans, at which time Link drew a rough plat or map of the country showing

the possibility of the tunnel and its three collection or supply ditches. Subsequently reconnaissances were made by Link and Akin and the general plan for the enterprise was adopted and arrangements were made for the beginning of surveys.

Before any surveys were commenced Link and Akin adopted a general well-defined plan of action and outlined the tunnel system substantially as it is partially constructed today (1931-4). The tunnel was the first and most important unit of the system, provided sufficient water could be carried to its west portal to warrant the enormous expenditure of money required in its construction. Hence it was that these gentlemen outlined three lines of canal to be constructed for the purpose of intercepting the waters on either side of the adjacent territory and carrying the same up-stream to the point where the west portal of the tunnel would be. A number of small natural lakes in the vicinity of the upper of the three collection ditches were to be utilized as reservoirs for storage and regulation of flow of the water through the canals. Considerable time was spent upon the ground and particularly along the line of the upper canal, the construction of which presented the first problem for solution (1937).

The initial suveys were commenced upon a system already carefully planned and the first engineering was naturally done upon that part of the collection ditch system which still presented the most serious problems of engineering and construction. If this Upper Rawah ditch should prove to be feasible the remainder of the system, which was more exposed to view, seemed practicable (see Link, pp. 1929-2036; Akin, pp. 2038-75).

August 25, 1902 (1929-35; 2039-42), initial surveys upon the tunnel enterprise of the Greeley-

Poudre system were commenced by engineer Frank Beach under the direction and with the assistance of his employers, Link and Akin, and the engineering work continued until the close of the working season of that year (1933, 1938-9, 2039). This is the date of the priority of the Greeley-Poudre system established by the district court of Larimer County, Colorado (Ex. 179).

The mountain wilderness in which the tunnel project and its collection ditches and reservoirs is located and the early history of the enterprise are reviewed at length in our original brief, Vol. II, pp. 133-163. Briefly, the tunnel, collection ditches and reservoirs are located high in the mountains, remote from settlements and in a region where all labor and supplies have to be transported over mountain roads by wagons and teams for a distance of 80 miles or more from the nearest railroad stations at Laramie and Tie Siding, Wyoming and Fort Collins, Colorado (1404, 1619, 1755). Climatic and physical conditions are such that work is limited to from 90 to 120 days in each year. During the rest of the year the snowfall is so heavy that no open work can be done (2077). A considerable portion of the country is heavily timbered and all of the construction, following clearing the way, involves the excavation of rock and other similar materials. In fact the region is in all respects to be contrasted rather than compared with plains areas.

As stated, the original surveys commenced August 25, 1902, and were continued until the party were driven out by snow (1933, 1930, 2039). Realizing that if the collection ditches and reservoirs were impracticable insufficient water would be available to warrant the enormous cost of tunnel construction, Link and Akin directed their first efforts to sur-

veys of these collection units, and, as we shall hereafter observe, finally covered the 1902 and successive surveys in complete record filings for the tunned and all the other units in 1904 and began the first actual excavation in June, 1904, upon a short canal to be used for carrying the water obtained from the Upper Rawah collection canal to the tunnel.

With the opening of the short working season of 1903 Link and Akin proceeded with the construction of wagon roads into the remote mountainous region where the furthermost collection canal (Upper Rawah Ditch) must necessarily be constructed. These wagon roads must first be constructed to permit transportation of men, supplies, machinery, etc. (1942-45; 2042-43.) The whole of the working season of 1903 was occupied with this road construction so necessary to further engineering or construction work.

March 17, 1904, Engineer R. Q. Tenney and party commenced the first survey of the tunnel unit of the system, previous surveys having been extended to the upper collection ditch, the practicability of which was the first essential element in determining the feasibility of the tunnel project (1822, 1847-50, 1936-7, 2045-46, Ex. 75).

Immediately following the R. W. Tenney survey, Zac T. Duvall, an irrigation engineer of wide experience, continued the surveys, assisted by R. Q. Tenney. He and his party commenced work May 22, 1904 and were continuously engaged during the entire working season of 1904. The results of their efforts were later incorporated into a certain filing map, a copy of which was herein introduced as defendant's Exhibit No. 75. As observed by Mr. Duvall, this map merely sets forth those units actually

surveyed by Mr. Duvall and did not attempt to include any previous or other surveys.

It is interesting to note that the Greeley-Poudre tunnel subsequently completed for The Greeley-Poudre Irrigation District is upon the same location selected by R. Q. Tenney in March 17, 1904 and Zac T. Duvall in May of that year, before any actual excavation, other than the building of roads, had taken place upon any unit or part of the tunnel system and its three collection canals (See Defts. Orig. Brief, Vol. II, pp. 138-63, including all page references), and further, that the three collection canals were finally constructed upon the lines fixed by Mr. Duvall in 1904 with some minor changes in methods of carrying the water to the tunnel; and that the first of these to be constructed was the upper line situate in the most remote region and involving the most difficult engineering problem. There were some minor departures from the original lines of the lower west side collection canal, principally that of substituting tunnels and further ditch lines for inverted syphons, but such changes had no effect upon the general plan of the system.

Before continuing further we should again note that the first actual excavation took place in 1904 and that this work was not performed upon any of the three collection canals, but, on the contrary, at a point low down in the Laramie River Valley and at a much lower elevation than the Upper Rawah Ditch or the Skyline Ditch of The Water Supply & Storage Co. A short canal some 500 or 600 feet long was constructed to connect the East and West forks of the Laramie River so that the water flowing down the West Fork of the stream from the Upper Rawah Canal, could be conveyed directly to the portal of the tunnel. Water was turned into this canal July 10,

1904, prior to any excavation upon the Upper Rawah or any other canal of the sytsem (1885).

The construction of this short canal is a complete answer to any contention of plaintiff's counsel that the Upper Rawah ditch was merely an extension of the Skyline Ditch of The Water Supply & Storage Co. and had no connection with the tunnel project, or that the original plan contemplated the permanent use of the Skyline canal for carriage of water from the Upper Rawah ditch. If such had been the plan it is evident that this short canal, constructed at a location of 1,000 feet lower in elevation than the Skyline ditch and at the immediate west portal of the tunnel location, would not have been the first to be built upon the system. Very evidently any such expenditure of time or money would have been useless and of no purpose had any other than the tunnel plan been the ultimate object from the outset, and this fact becomes more apparent by consideration of all the testimony concerning the Upper Rawah Ditch which is fully discussed on pp. 171-186, Vol. II, Defts. Orig. Brief.

The deep snow at the higher elevations prevented Duvall from commencing final surveys upon the Upper Rawah Canal until July 4, 1904. After that date both survey and actual excavation proceeded upon that unit of the tunnel system.

The work done in 1903, 1904 and 1905 is described in detail by the witness, Duvall, in his testimony (1874, 1906), and in the testimony of Wallis Link (1907, 1998), A. I. Akin (2038, 2075), and others, and photographs of the 1902, 1903, 1904 and other work are in evidence. This evidence is all reviewed in our original brief, Vol. II, pp. 138-163. It would seem unnecessary for us to again go into details in this brief.

Of the work done in the years 1905 and 1906, we have the testimony of the witnesses, Link and Akin and othered above mentioned, and in addition thereto the testimony of the engineer, Charles R. Hedke, who became connected with the project, more particularly with the tunnel surveys, as consulting engineer in March, 1904. In 1905, he entered actively upon the work connected with this system and his testimony is of particular interest as all surveys and construction were under his direction from 1905 until February of 1911, after which time he did no field work on the Greeley-Poudre project, but perfromed services from time to time as consulting engineer. His testimony covered a wide range of discussion involving the surveys, plans and work done upon this system. (Hedke, 1723 to 1873, incl.)

During the seasons of 1905 and 1906 the work proceeded. Surveys were continued and made more in detail for the purpose of determining definite locations, cross sections, etc., of other units of the enterprise. In addition to the work on the Laramie River, surveys and other work were proceeding in the Poudre Valley. While the work in the Laramie River involved the problem of securing the water, that in the Poudre Valley involved the question of application, and consideration was given to several possible plans (1748.) As these plans devolved, Link and Akin and their later associates, determined upon reclamation of the lands now embraced within the territorial limits of The Greeley-Poudre Irrigation District. The reclamation of a portion of these lands had previously been undertaken by means of the "Poudre Valley Canal" diverting water from the Poudre River. The upper portion of this canal had been constructed in 1901 but it failed to reach the lands and was thereafter used as a feeder for

certain reservoirs. The continuation and extension of this canal was undertaken. It is now the main canal of The Greeley-Poudre Irrigation District (1735-9). After 1905 a portion of the work upon the system was prosecuted upon the Poudre Valley units. During 1904, Wellington Hibbard also became interested in the tunnel enterprise and upon him fell the greater part of the burden of financing this gigantic reclamation project (1963). Under his management arrangements were made whereby the water to be diverted from the Laramie River could be carried through the Poudre Valley Canal to the lands now included within the irrigation district (2053).

Witness Akin testified that up to October 1906, $31,738.90 (2053), had been expended by himself and his associates on this enterprise, and in addition, they had expended $4,998 in the purchase of necessary property on the Laramie River.

During the years 1902 to 1906 the title to the system was vested first in Wallis A. Link and A. I. Akin. In the early spring of 1904, Myon Akin and Wellington Hibbard became interested (2045). In September, 1906, the title passed to a company composed in part of these men, known as The Laramie Reservoirs and Irrigation Company (2055). March 19, 1907, the defendant, The Laramie-Poudre Reservoirs and Irrigation Company was organized and succeeded to all the rights, title and interest of The Laramie Reservoirs and Irrigation Company.

Following the organization of The Laramie-Poudre Reservoirs and Irrigation Company the work upon the entire system, both on the Laramie River and in the Poudre Valley, progressed much more rapidly. Engineering plans were worked out in further detail, construction gangs continued excava-

tion in the mountains, at first in large part upon the Upper Rawah Ditch (2054-2060); upon the large canal upon the plains of the Poudre Valley, and upon all parts of the system, and wagon trains were freighting from the railroads at Fort Collins and Laramie City and upon the plains.

During the season of 1907, from $40,000 to $50,000 were expended on the Upper Rawah Canal and Laramie River portion of the system (1795, 2053). On the line of the extension of the Poudre Valley Canal (now the Greeley-Poudre Canal) construction work was carried on throughout the year upon a section of from 30 to 35 miles in length (1768 to 1770, 2069-64).

In 1908 the work still continued although it was probably not pushed so vigorously as in the year 1907, because of the fact that the financial situation in the fall of 1907 interfered with the plans of the company for securing money for construction.

During the year 1907 and to March 1908, $129,572 were expended on actual construction and about $250,000 for all purposes (2064.) (See Defts. Orig. Brief, Vol. II, pp. 138-163).

During 1908, D. A. Camfield, a man who had had extensive experience in irrigation enterprises, entered the company (2138-57.) He testified that after making an investigation of the project and considering the possibilities from every standpoint, he bought 23 per cent of the stock in The Laramie-Poudre Reservoirs and Irrigation Company then engaged in construction of the system.

At the time Mr. Camfield purchased into the concern, approximately $800,000 had been expended for all purposes upon the system, so far as it had been completed (2159). Through the efforts of Mr.

Camfield, the lands which it had been theretofore designed to irrigate by means of this system, were formed into The Greeley-Poudre Irrigation District (2160), one of the defendants herein, and on Sept. 8, 1909, a contract was entered into between the irrigation district and The Laramie-Poudre Reservoirs and Irrigation Company whereby that company was to complete its project (under construction since Aug. 25, 1902) and turn the same over to the irrigation district for a payment of $5,000,000 of the bonds of the district, the payments for future work to be made upon monthly estimates as the work progressed (2161). Arrangements were made whereby these bonds were sold to a banking house in Chicago.

Construction upon the tunnel unit of the system was organized (2162). A controlling interest was purchased in the Poudre Valley ditch. Prior to this time merely a carriage right had been held in this canal (2162). A hydro-electric power plant on the Poudre side of the tunnel was established at a cost of $97,000 in order to furnish light and power for the construction of the tunnel (2163). All supplies and machinery used in its construction had to be transported by wagon from Fort Collins and Laramie (1648, 1649). A transmission line about three miles in length was run over the divide between the Poudre and Laramie Rivers and the work of drilling the tunnel was commenced at both ends. Large camps resembling electric lighted villages were established at both places, and the work prosecuted continuously day and night until the great tunnel was completed. The two bores met in July, 1911 (1652).

Plaintiffs in their supplemental brief comment upon the contention that it was impossible to do work upon the collection ditches upon the Laramie River

in the winter time, stating that this is contradicted by our own testimony showing that work was done on the tunnel throughout the winter months. It will be obvious without explanation, that the protected tunnel work could be carried on during the winter months under conditions which would absolutely prevent the construction of ditches out in the open.

The power plant and the tunnel, together with the concrete linings placed in portions of it, cost about $600,000 (1652). The tunnel is 11,366 feet in length and passes clear through the range of mountains. It is 7½ feet high and 9¼ feet wide (1647).

In the meantime the work of mountain canal construction, more particularly the construction of the East Side and West Side collection ditches, was continued during the working season, until October, 1910. These canals, as we have previously described, run along the side of the mountains on each side of the Laramie River Valley, practically conducting the water of tributary streams up the channel of the Laramie River to the reservoir. The construction is not only extremely difficult, on account of the inaccessible location, and very slow of accomplishment but is also very expensive owing to the fact that a large percentage of the work must be done in rock (1658, 1663).

It must not be overlooked, however, that the work done upon the system in the Poudre Valley is just as essentially a part of this whole project, as is the work on the Laramie River. The diversion of water from the Laramie River into the Poudre River, would not of itself irrigate the lands of this district. In the first place there was not a sufficient quantity, and in the second place, the diversion ditches from

the Poudre River and storage reservoirs in that area have to be constructed.

The water from the Laramie River is by no means a sufficient amount for the irrigation of the 125,000 acres of land included within the district, an additional supply had to be obtained from the Poudre watershed. This problem had been made the subject of special study by Prof. Carpenter and covered by a report made in 1909, confirming the conclusions which had previously been reached as to the water supply, upon which plans had been made and a vast amount of construction done (3933-3957). Professor Carpenter reported at that time, that there was an average amount of 120,000 acre feet of water in the Poudre river represented by the peaks of the flood flow, in excess of prior claims from that stream alone but without taking any account of the then existing and prior claims upon this excess water by canals upon the principal stream (South Platte), below the mouth of the tributary (Cache la Poudre). He explained, however, as has been commented upon by plaintiff in its supplemental brief, that there were unusually high floods which it was impracticable to intercept and impound, because of the uncertainty of these flows, and the further fact that no ditch capable of diverting them would be justified, even though no claims existed upon the South Platte, inasmuch as these flows were of short duration and any diversion system would have to be built of enormous size in order to intercept a very high flow of usually short duration. He therefore states that of the 120,000 feet excess in the Poudre River, possibly 60,000 to 90,000 acre feet might be made available to the lands of the irrigation district, having no regard to South Platte claims. In some seasons these prior South Platte claims may consume all the excess flow of the Cache la Poudre.

The plan for the irrigation of this district included a large reservoir to be constructed in the channel of the Poudre River in the mountains. It is obvious that such a reservoir, if large enough, like the Wheatland Reservoir No. 2, is capable of intercepting peak flows and equalizing the distribution (3936).

There are some streams of intermittent or flood flow entering the Poudre River from the north on the plains area. These are merely torrential streams, with the exception of possibly one, Crow Creek, which rises in Wyoming, and flows into Colorado. This stream is the one from which the City of Cheyenne takes its water for domestic purposes. As a rule it does not discharge water into the South Platte River, the small quantity which it carries normally being intercepted largely in the State of Wyoming, although Professor Carpenter explains in his discussion of inter-watershed appropriations, the appropriators in Wyoming are junior to the appropriations in Colorado on this stream. (This is the same stream involved in the recent case of Grover Irr. Co. vs. Lovella Ditch Co., 9 Wyo. 110, wherein Colorado citizens were denied easement for using waters in Colorado which rise and flow in Wyoming. This decision was made since Prof. Carpenter's report.)

It was planned, however, to intercept, as far as possible, the floods occurring occasionally in these streams.

Professor Carpenter's estimate as to the available water for the Greeley-Poudre District may be summed up as follows: From the Laramie River, 70,100 acre feet; from the Poudre River 60,000 to 90,000 acre feet (without consideration of South

Platte Claims); from Doudy Lakes, that being a system of lakes lying in the mountains on the Poudre side which from a part of the reservoir system of the district, 2,990 acre feet; from Douglas reservoir, which is a reservoir already existing in which the Greeley-Poudre district has an interest, 5,833 acre feet; and from flood waters of Lone Tree and Crow Creeks from 3,000 to 10,000 acre feet, making a total of 142,000 to 179,000 acre feet (3936). The water of Lone Tree and Crow Creek are now denied Colorado users by Wyoming). It must be remembered that the Laramie River water estimated as an amount of 70,100 acre feet is based upon estimates of the quantity at the tunnel, from which point it is subject to unavoidable loss by evaporation as it flows through the canyon of the Poudre River and by unavoidable seepage and evaporation through the diversion ditch to the lands of The Greeley-Poudre Irrigation District. However, the natural loss through the canyon of the Poudre would probably be no greater than a similar loss in the Laramie River from the tunnel to the Laramie Plains. This total does not represent the net amount available for application upon the lands of the district, but rather, to the amount estimated to be available at the points of diversion. The seepage losses from canals would be probably no more than similar losses from the Wheatland canals in Wyoming.

All of the available water from both the Poudre drainage and the Laramie River is necessary for the irrigation from year to year of the lands within the Greeley-Poudre district (1708).

Moreover, inasmuch as the Poudre River is but a tributary of the South Platte, and there are ditches diverting water from the South Platte river below

the mouth of the Poudre within the State of Colorado of earlier date than some of the Poudre Valley ditches and many of its reservoirs, and much earlier than the Greeley-Poudre system, there is at times a demand for water on the part of these lower South Platte ditches which necessitates the closing of headgates on the Poudre, in order to supply the demand of the lower canals (3411). This may result in the appropriators of water from the Poudre closing their headgates at a time when, if the Poudre River were considered alone, there would be available water for their needs.

Very briefly the system of works in the Poudre Valley necessary for the irrigation of these lands in The Greeley-Poudre Irrigation District consisted of the construction of a canal many miles in length from the end of the Poudre Valley canal, which we have previously described, to and along the upper boundary of the lands of the district, together with several branches necessary for the proper distribution of this water, and the construction of several reservoirs. These reservoirs secure the greatest economy by regulating and equalizing the flow of the canals so as to deliver the water only when needed by the farmers and also assure annual production by storing the water of high years for use in years of low flow in the streams. Of these, the Doudy Lakes, just mentioned, were already in existence, so also was Douglas reservoir, owned only in part by the district. In addition to these, the plan called for the construction of the reservoirs known as McGrew Lake, March Reservoir, Camfield Reservoir and several other smaller reservoirs situated in the general vicinity of the lands of the district, together with outlet canals whereby the water from these reservoirs could

be distributed, and also the construction of one large channel reservoir in the canyon of the Poudre River in the mountains. On the map, Exhibit 1, attached to the answer of the corporations named defendants herein, the works of this system, as planned, are clearly shown. A glance at this map, which shows both the Poudre River and the Laramie River drainage areas, will enable the Court to understand more clearly the discussion made in these briefs. On this map the reservoirs and ditches of the Greeley-Poudre system are colored red. It will appear that there are three channel reservoirs planned in the Poudre canyon. These were alternative sites then contemplated, of which only one, the middle or Elkhorn Reservoir will probably be constructed, as it is the more practicable.

The engineering and construction of the plains division, so called, of this system had been vigorously pursued since 1905 by The Laramie-Poudre Reservoirs and Irrigation Company, and its predecessors, at the same time work was progressing on the Laramie River and, under the contract with the district, all this work was to be pushed to early completion. It is contended in the supplemental brief of the plaintiff, that during the years 1905 and 1906, no construction work was in progress on the Laramie River end of the system, although it appears that detailed engineering was being done during those years. However, the work of the system as a whole was being conducted with regular continuity, commencing with the surveys of August 25, 1902, and the work developed naturally and increased as the financing of the project progressed. Concerning the work done in the Poudre Valley and the system as there planned, see particularly the evidence of the witness,

Wortham, engineer for the district, at pages 1699 to 1716, and that portion of the testimony of Charles R. Hedke, the construction engineer for The Laramie-Poudre Reservoirs and Irrigation Company at pages 1743 to 1855. This testimony of the witness, Hedke, shows the work done between the years 1905 and 1911 on the system as a whole. It is of interest to review his testimony of the amount of work which he found already done and the surveys already made by his predecessors on the Laramie River, when he took charge of the work early in the year 1905 (1745), confirming the testimony of the engineer, Duvall, who had made the earlier surveys, and witnesses Link and Akin.

It seems to be contended by the plaintiff that the work done on what is termed the Plains Division, has no bearing upon or relation to the diversions from the Laramie River. But this contention is erroneous. The system whereby the Laramie River water could be diverted from the Poudre River and applied to the lands of the district was absolutely essential and cannot be disassociated with the work on the Laramie. It is true that the system contemplated the appropriation of some of the water from the Poudre. Probably one-half or less of the supply must be obtained from that stream, but nevertheless, inasmuch as the ditch which diverts Poudre River water also diverts water which is added to the Poudre River by means of the tunnel and collection ditches, and inasmuch as the reservoirs designed to store the flood waters will in a measure store water both from the Poudre River and that added from the Laramie River, it follows that the plains division of the work is inseparable from the mountain division and the system must be treated as a whole.

Without tracing further the detailed history of the Greeley-Poudre System, we will state that the work progressed with greater vigor subsequent to 1908 than previously both upon the Laramie and Poudre Rivers and the Plains Divisions of the work. Crews of men and equipment were everywhere at work from the collection ditches in the mountains to the lower end of the great canal (2162), and this work was progressing in full force to an early completion when its final progrees was prevented by Wyoming and her citizens, culminating in the bringing and prosecution of this suit (2164-6).

The great tunnel is complete (1778), and the entire project in a considerable measure constructed (2124), but sufficient construction yet remains to prevent use of the entire system.

In our original brief, Vol. II, pp. 134-167, we have given a more detailed history of the project and there reviewed the evidence. We respectfully urge consideration of the facts there set forth.

We have endeavored to trace, step by step, in this and especially in our original brief, the history of the project, commencing with the time upon which Wallis A. Link conceived the idea of this diversion in 1897 and the first survey on August 25, 1902, down to the close of the suit.

The record shows the following:

Progress Upon Greeley-Poudre System.

(Commenced August 25, 1902.)

1902—Engineering during entire working season after August 25th.

1903—Road construction upon system during entire working season with activity all winter.

1904—Tunnel line definitely surveyed on locations selected in 1902 where tunnel is now completed.

1904-7—Active construction upon the enterprise, engineering continued. Up to October, 1906; $36,734.40 expended on the system (2053); up to March 1, 1907, $46,079.32 expended.

1908—By March, 1908, $296,079.32 had been expended in actual construction alone (See Vol. II, p. 162, Orig. Brief).

1908—$800,000 expended upon project for all purposes from initiation (2159).

1911—(Feb. 1) $1,825,000 (cash) expended on system to date (1779).

1913—More than $3,000,000 in bonds sold and proceeds expended on system (2130) and more than $900,000 had been expended on Laramie River portion alone.

(All the foregoing appears in detail, pp. 133-67, Vol. II, Defts. Orig. Brief.)

It would seem that at least "reasonable diligence" has obtained. We fail to find a similar degree of diligence displayed on the Wyoming projects, old or new, all the facts considered.

It will be remembered that the August 25, 1902 surveys were upon the line of the upper collection ditch which was also designed to tap some natural lakes known as the Link Lakes; that this ditch at first was called The Lake Link Ditch, and later the Upper Rawah Ditch; and that it was so constructed that a portion of the water which it intercepted might either pass down the West Fork of the Laramie to the tunnel or be from that stream diverted by the

Skyline ditch, and taken into Chambers Lake, and thence into the Poudre River.

In the original brief by Wyoming, counsel sought to show that because a part of the waters from this canal (of 224 cu. ft. per second capacity) might be diverted by the Skyline canal (of 130 cu. ft. per second capacity), it might be considered that the former canal was originally a separate institution from the tunnel enterprise. This they claimed was borne out by the filing which recorded the extent of the 1902 survey (stopped by snow). We made answer in full to this erroneous assumption in Vol. II, at pp. 171-186 of our original brief where we quoted the record in detail.

In this supplemental brief, counsel for Wyoming still seek to lead the Court to a misunderstanding of the facts to the extent of making a sketch map which appears on p. 45 of the brief, wherein they omit the course of the waters down the West Fork of the Laramie to the tunnel and substitute dotted lines between the lower canal (of 130 cu. ft. capacity) already diverting water from the West Fork, and the Upper Canal (224 cu. ft. capacity), thereby to leave the erroneous impression that the waters of the upper and larger canal, discharging for tunnel carriage lower down, are for carriage through the lower and smaller canal, already carrying its full capacity. Counsel further invent the name of "Skyline Extension" for this Upper Rawah Ditch of the Greeley-Poudre tunnel system. The record in this case, in large part quoted in Vol. II, pp. 171-186 of our original brief, and the decree of the District Court of Larimer County, Colorado (Deft. Ex. 179), reveal the facts. As we previously observed to try to carry the water of the larger canal through the

smaller would be like trying to fit a square peg into a round hole.

It is argued that, inasmuch as this ditch was the first one to be considered and the water, at least in part, could be temporarily taken through the Skyline ditch into Chambers Lake, there was not in the minds of the projectors any idea of a tunnel at the time of its original survey. But this contention is clearly disproved when the testimony of Link and Akin is considered. They both say it was merely a question of initial work of the system; that inasmuch as they did not have money to finance all of the work necessary to be done, there was in their minds a theory that some small part of the water from this Upper Rawah ditch, if temporarily taken through the Skyline Ditch and thence into the Poudre River, would furnish them, through temporary sale of this water, means with which the additional work on the tunnel could be carried on (1930, 1931). There was and is no carriage space available in the Skyline ditch during the season of high flow, May and June, so that it is obvious that no part of the water from the Upper Rawah Canal could be taken through to the Poudre River by that route at the very time when this Upper Rawah Ditch is capable of intercepting the greatest flow (2002). Moreover, the upper canal (Upper Rawah) as actually constructed in 1904 and thereafter, had a capacity of nearly 50% greater than the total capacity of the lower or Skyline ditch. These facts in themselves show that this method could not have been the basic idea in the minds of Link and Akin when they commenced work on the Upper Rawah ditch. Moreover, as we have shown, the surveys for the tunnel in natural sequence according to the plans as outlined, were made in the

year 1904, also the surveys for the East and West side collection ditches. Now where is there any ground for contention that the tunnel plan originated only after the formation of the Greeley-Poudre District in 1909? The tunnel as finally constructed was built upon the line located by Link 1897, adopted by Link and Akin in 1902 and definitely selected in the Tenney and Duvall surveys made in 1904.

We then find that in the years 1904 and 1905, additional persons, Mr. Myron Akin, and Mr. Wellington Hibbard became interested in the project and invested in it, and that a corporation including these original parties was formed, known as The Laramie Reservoirs and Irrigation Company. In the meantime the system developed as rapidly as conditions would permit. Later this corporation was succeeded by another one, The Laramie-Poudre Reservoirs and Irrigation Company, and in the spring of 1905 we find that Mr. Hedke, the engineer employed by this last named company, continued with the work of construction including not only the work on the Laramie River, but the engineering work necessary to develop the system on the plains. During 1906 and 1907 the work continued. In the year 1908, a powerful influence in the person of Mr. D. A. Camfield, who had previously constructed a number of other large enterprises for irrigation districts and the works for their irrigation, came into this project, at which time approximately $800,000 had been expended on this system. But Mr. Camfield, having financed his former projects through the organization of irrigation districts and issue and sale of bonds which are a charge upon the lands, entered The Laramie-Poudre Reservoirs and Irrigation Company and purchased stock therein upon the understanding that an

irrigation district would be formed to include the lands already long since selected for irrigation. Pursuant to this plan The Greeley-Poudre Irrigation District was formed early in the year 1909. This district is a public corporation organized under the laws of the State of Colorado. The lands included are subjected to a bonded indebtedness for the purpose of purchasing or constructing systems for the irrigation of the lands. Under this law the qualified electors of the district elect directors who manage the affairs of the district. The Greley-Poudre District when organized, made a bond issue of $5,100,000 (2161) and entered into a contract with The Laramie-Poudre Reservoirs and Irrigation Company, under which the district purchased the properties and the company was to continue to completion the work of construction then and theretofore in progress since 1902 and to turn the system over, completed, to the district. In the meantime payments in bonds were to be made by the district to the company on monthly estimates as the work progressed. The company in turn obtained the money to prosecute its work by the sale of these bonds to a banking house known as Farson Sons & Company, which had contracted to purchase these bonds as the same were delivered from the district to the company.

This plan gave to the project sufficient finances to enable the work upon the whole system to be prosecuted with greater progress and this was continued as has been described by these various witnesses, until the year 1911, when because of threats made by the plaintiff through various persons in Wyoming, or officers of that state, the market for these bonds was destroyed and the banking house of Farson

Sons & Company compelled to decline to purchase more of them. This suit followed these threats. This case was commenced May 29, 1911, and from that time on it has been impossible to obtain a market for these bonds and work on the construction of this system has progressed but little. However, the district has expended such money as it has been able to receive through taxation, in doing what it could do and in keeping the system intact until the outcome of this case, when a favorable decision will permit the district to obtain finances for the completion of the work necessary to be done in the irrigation of these lands, which, from experience, will produce a development like that already existing on the lands now under irrigation in the Poudre valley.

The financial embarrassment which occasioned the complete cessation of most of the work on this system is due directly to numerous letters sent out, and interviews given to the public press by persons in the State of Wyoming, seeking to discredit the financial responsibility of The Greeley-Poudre Irrigation District, and also its ability to obtain water, particularly from the Laramie River for irrigation, followed by the initiation of this suit (see evidence, pp. 2164; 3682 to 3689; 3668 to 3670). When this condition was reached and when, because no more bonds could be sold, The Greeley-Poudre Irrigation District and The Laramie-Poudre Reservoirs and Irrigation Company were compelled to temporarily discontinue the work of construction, the district had, and for that matter still has $2,340,000 of its bonds in its treasury. Three hundred thousand dollars worth of bonds were held in escrow for purposes not of interest here, and two million four hundred and sixty thousand dollars bonds have been expended upon this system (2165). These bonds are an outstanding lien

against the lands of the farmers of the irrigation district and are in the hands of innocent purchasers throughout the Central and Eastern States.

Moreover, in anticipation of the development of this tract of land, many persons had settled upon lands within this district, making improvements thereon and a number of small towns sprang up within the territorial limits of the district more particularly Pierce, Hungerford, Camfield and others. Banks and mercantile houses had been established and two lines of railroad had been built by the Union Pacific Railroad Company into the territorial limits of the district (3663-3665). These are merely a few of the items which might be mentioned showing the investments which have already been made in anticipation of the reclamation of this tract, all of which must come to naught, and this vast amount of money expended directly or indirectly on this project and in anticipation of its successful culmination will be lost and the holders of bonds to the amount of over two millions of dollars will lose their investment.

Nowhere, from the beginning to the end of the record in this case, is there a word so much as suggesting the abandonment of this project, or of any material portion thereof. The most that can be said is that as details were worked out, minor changes were made which is some instances eliminated small items of construction formerly under consideration. For Illustration: the construction of the dam for the tunnel eliminated the canal between the East and West forks of the Laramie River and also the pipe line leading across the valley from the West Side collection ditch, but not one of these items so eliminated, can be considered to be an aban-

donment. They are nothing more or less than a change in mere details.

The work of construction was proceeding rapidly when brought to a halt through no fault whatsoever of the defendants, but due to the alarm which had been occasioned by the threats publicly made by the citizens of the plaintiff state. We are not so foolish as to say that the plaintiff had no right to institute a suit if it felt that its rights were in jeopardy, but we do say that it comes with very bad grace for the plaintiff to contend that from the time when the work ceased in the year 1911, no substantial construction work had been done upon this system, and that therefore the original date of priority had been lost when the uncontradicted testimony shows that the cessation of work and the inability to resume it are due entirely to the acts of the plaintiff or citizens of that state.

Let us refer briefly to the history of some of the Wyoming projects, to learn what diligence has been shown in bringing about the beneficial application of water there. The Wheatland system for the irrigation of the Wheatland tract, consisting of 60,000 acres, had its inception in the year 1884, according to the plaintiff, and yet, in the year 1913 only fifty per cent of the land in that tract had been brought under irrigation; and yet this plaintiff under the doctrine of relation is contending for an appropriation as of date 1884, for the irrigation of 60,000 acres of land.

We have previously noticed the fact that although surveys for diversion ditches for the irrigation of the Bordeaux tract had started in February, 1904, nevertheless, in the year 1913, when the evidence was taken, only 1,004 acres, according to the plaintiff's witnesses, was under irrigation in that

tract. The surveys for the system designed for the irrigation of the Sybille tract of 30,000 acres, were commenced in August of 1907. This ditch is only 16 miles in length, and yet in the year 1913, it was not completed, and no lands whatsoever had been irrigated in the Sybille tract. Again the Lake Hattie and Lake James projects, initiated in the year 1908, and substantially completed when the testimony was taken, has been used for the reclamation of only a nominal amount of land. The Hutton Lake project, commenced in the year 1909, was not yet completed. Each one of these Wyoming projects is relatively simple of construction, readily accessible and of small cost compared with the Greeley-Poudre system. Under the laws of all states where the doctrine of appropriation obtains, beneficial use is the one chief requisite of an appropriation. It is recognized, however, that beneficial use cannot be made until the water is diverted from the stream. Such diversion works as are necessary must first be constructed. Therefore, under the doctrine of relation, when water has been beneficially applied and an appropriation thereby established, the date of that appropriation relates back to the inception of the work necessary to be done in order to make that beneficial application, provided due diligence has been exercised in the construction of such works. What is due diligence under every decision upon this point depends entirely upon the circumstances. It is a question of fact. The Greeley-Poudre system could not be built in a day, nor in a year. It is a stupendous undertaking, designed for the irrigation of an enormous tract of land—one hundred twenty-five thousand acres—with the place of application far remote from the

source of supply, involving engineering efforts which are almost startling in their daring. But we have shown a continuity of effort without interruption from the inception of this project, commencing with the date of the first survey, August 25, 1902, continued until forced to discontinue through the efforts of the very people who now claim lack of diligence on our part. But if there be such a lack of diligence as to destroy the right of the Greeley-Poudre system to its original date of appropriation, August 25, 1902, as contended for by the plaintiffs in their supplemental brief, what will be said of the Wheatland tract where an appropriation was made as of the year 1884, with subsequent enlargements, upon which a decree has been based adjudicating them water for the irrigation of 60,000 acres of land, when during a period of 29 years they had made beneficial application of this water upon only fifty per cent of the area for which this water was decreed. It is true, the Wheatland people made the diversion, but where is the beneficial application upon which that diversion must stand if it be entitled to its priority date? The same thought is likewise applicable to the other Wyoming projects we have just mentioned. Manifestly Wyoming is not in any position to complain of a lack of diligence in the construction of the Greeley-Poudre system.

VIII. CONCLUSION.

In concluding this brief may we suggest that we have endeavored herein to reply to the plaintiff's supplemental brief, rather than to present all of our defenses. In our original brief the salient features of the whole case were discussed and the evidence

reviewed. We sincerely trust that the order for re-argument does not mean that this original brief is out of the consideration of the Court. For many features of the case we must refer the Court to that discussion, and this present effort is not intended to supplant our first brief, but rather to supplement it. Since the original briefs were filed the Court has heard the oral arguments, made in December, 1916, and some of the facts, particularly the geography of the situation, are already before the Court. We trust that our review of the evidence herein and in our original brief will enable the Court to understand the questions of fact necessary for the consideration of this case.

Our general conclusions may be summarized as follows:

That the date of the commencement of the work complained of is August 25, 1902; that prior to that date, the only appropriations of water from the Laramie River in Colorado, were those made through many small ditches for irrigation of 4,250 acres of mountain meadow lands, adjacent to the streams, where the water, because of the character of the lands irrigated, returned with slight loss immediately to the stream, which diversions are so non-consumptive that no charge was made against the flow of the river on their account by the experts, as likewise obtained with regard to those diversions above Filmore in the area called the Centennial Valley on the Little Laramie River in Wyoming; that in addition to the use of water on these mountain meadow lands in Colorado, prior diversions had been made from the river by the Skyline and Divide ditches in Colorado in the aggregate average amount of 20,000 acre

feet per year, and that these three items, the mountain meadow irrigation, the Skyline ditch and the Divide or Wilson supply ditch, define the total benefits the State of Colorado had derived from the use of water from the Laramie River for irrigation prior to August 25, 1902;

That the total flow of the Laramie River at the Colorado-Wyoming line amounts to an average of from 250,000 to 320,000 acre feet per annum, this including the amount of 20,000 acre feet diverted by the Skyline and Divide ditches;

That the diversion through the Greeley-Poudre tunnel system here sought to be enjoined, will amount to an average of 56,000 acre feet per annum, according to the system as planned and in part constructed, with the probability of this being enlarged by the extension of the West Side Collection Ditch to divert an additional amount of 15,000 acre feet from McIntyre Creek, making a total of 71,000 acre feet per annum. If this cause should result in a decision favorable to defendants, Colorado will then be permitted to use the 20,000 acre feet now being diverted and a probable additional 71,000 acre feet through the Greeley-Poudre tunnel system, or a total of 91,000 acre feet per annum out of the minimum average flow of 250,000 acre feet per annum of the waters of that branch of the Laramie River rising and flowing within the State of Colorado. In other words, Colorado will be permitted to divert from the Laramie River but 91/250 of the water of that stream and its tributaries rising and flowing within her borders.

Passing now to Wyoming. The plaintiff in its supplemental brief contends that the total amount of

land under irrigation from the Laramie River in Wyoming is 152,097 acres, practically all of which was irrigated under projects begun prior to 1902. The defendants contend, and this is based upon a survey of practically all of these Wyoming lands, that the total amount under irrigation from the Laramie River in Wyoming is only 108,073.75 acres. We agree with Wyoming that the greater part of this was irrigated under systems initiated prior to August 25, 1902. As a matter of fact, the only lands which the plaintiff contends have been reclaimed since that date, excepting some small tracts under some unimportant ditches are as follows: Bordeaux tract, 1,004 acres; Lake James, 1,500 acres; Lake Hattie, 700 acres; Sodergreen, High Line Canal 4,000 to 5,000 acres; total, 7,204 to 8,204 acres, an inconsequential quantity, considering the whole. We are therefore justified in making the assumption that the greater part of the land under irrigation from the stream in Wyoming, is served by ditches initiated prior to August 25, 1902.

The Court has also asked that the extent of the use at the time that this suit was commenced be shown. There is no material difference in the amount of the use at that time compared with the amount of use on the earlier date, August 25, 1902.

We further contend that, including the Colorado water which we will place at the minimum average amount of 250,000 acre feet per annum, there are 431,200 acre feet of water in the Laramie River and its tributaries (including, of course, the amounts diverted above) available down to and including the Wheatland tracts, or if the flow from the North Laramie and the Chugwater be added, 470,000 acre

feet or more. If the higher estimate of flow at the state line be taken, that is 320,000 acre feet per annum, then the amount of the flow at the lower point of the river would be correspondingly increased. Taking for illustration the lower amount available for all lands down to and including the Wheatland tracts, 431,200 acre feet, Colorado seeks to divert by all her methods only 91,000 acre feet thereof, leaving 340,200 acre feet of water per annum available for the irrigation of Wyoming lands down to and including the Wheatland tracts, and more than that amount if Chugwater and North Laramie be added. It would appear that Wyoming will have an abundance of water for all of her legitimate needs, with a surplus available for future development, even after deducting the Colorado diversions. That in a year of normal flow, at least 15,000 acre feet of water above the legal amount which might have been diverted for irrigation under conditions demanding the greatest amount of water needed in that state, was diverted and applied to the lands in the Wheatland tracts, and yet, they had 40,000 acre feet remaining in the Wheatland No. 2 Reservoir at the close of the irrigation season. That water to unknown quantities has been wasted on the Laramie Plains by needless running of the same in canals during the winter months, by being impounded in reservoirs or waste basins from which there was no outlet and many other methods of unnecessary waste, thereby revealing water far in excess of all needs or demands (see Vol. I, pp. 299-307). That in the year 1912 four reservoirs alone, that is, Lake James, Wheatland Reservoir No. 1, Wheatland Reservoir No. 2, and Lake Hattie received 156,600 acre feet of water in storage, above the loss

by seepage and evaporation, which was not used or withdrawn, this representing surplus water which remained after use, loss and waste.

We have shown that the duty of water on the Laramie Plains, according to Wyoming's expert upon the subject, is one acre foot per acre, and on this basis, Wyoming has enough water in the Laramie River, considering the total to be 470,000 acre feet per year, to irrigate 379,000 acres of land after Colorado has diverted the amount which she seeks to divert, that is, 91,000 acre feet.

Wyoming contends that her supply is limited to an average of 200,000 acre feet on the Big Laramie and 110,000 acre feet on the Little Laramie, or a total of 310,000 acre feet. The measurements by which this conclusion was reached did not include the 20,000 acre feet diverted through the Skyline and Divide canals in Colorado. In other words, the estimate of 200,000 acre feet made by the Wyoming expert as the average amount at the state line, was the net amount of water at that point. Assuming for the sake of argument alone, that this is the total supply which Wyoming has, and there be deducted from it the 71,000 acre feet to be diverted by the Greeley-Poudre system, there would remain for usein Wyoming, 239,000 acre feet, or sufficient under the duty of water established by this same witness, for the irrigation of a corresponding number of acres of land. The plaintiff contends that she has 152,097 acres under irrigation. The surveys revealed but 108,073.75 acres. But even if their claim of acreage were correct, determined as it was by approximation, it appears from the plaintiff's own evidence that there is more water than is needed for the irrigation

of the lands now under irrigation and a surplus for future development.

The Court has also asked that the extent of appropriations made, or authorized in either or both states since the commencement of the suit, be given. In answer, we say that no appropriations have been made from the Colorado branch of the Laramie subsequent to the commencement of this suit, nor in fact, subsequent to the Greeley-Poudre enterprise (Aug. 25, 1902). The extent of the appropriations authorized in Wyoming since the commencement of the suit, is rather incomplete and the evidence was not taken with a view to this line of declaration. This suit was filed May 29, 1911. The evidence discloses that a number of filings have been made with the State Engineer of Wyoming for large projects since that date, upon which permits have been issued. So far as we are advised, none of these were constructed, nor even in the course of construction when the evidence was taken. These were shown in part by defendants' exhibits as follows: Permit No. 2719 Enl., filed July 11, 1912, for Pioneer High Line Canal enlargement of Lake Hattie supply canals taking water from the Big and Little Laramie Rivers and providing for use of water from the new Lake Hattie enterprise by a system of exchange with the river; Exhibit No. 160; and Permit No. 2720 Enl., filed July 11, 1912, for the Lake Hattie supply No. 2 enlargement, taking water from the Little Laramie River, Exhibit No. 167. However, there are doubtless others. Plaintiff offered no testimony concerning recent enterprises granted permits. So to have done would have been to admit that still unappropriated water remained in

the stream and thereby to deny their own contention of injury. The defendants limited their proof of recent permits and admission of abundant water supply by Wyoming, to those permits covering the new large enterprises which Wyoming witnesses, on cross-examination, admitted had been initiated long junior to the Colorado tunnel enterprise (3909-3933, 3958-62).

But there have been numerous projects initiated in Wyoming subsequent to the initiation of the work complained of, among them, those which we have previously discussed, that is, the Sybille and Bordeaux tracts, the Lake James system, the Lake Hattie system, the Lake Hutton system, the Sodergreen High Line and a great many others which need not be mentioned. All of these are based upon surveys commenced long subsequent to August 25, 1902, and have received permits from the State Engineer of the State of Wyoming authorizing construction (see defendants' Exhibits 159 to 178, inclusive, and pages 3893 to 3933, inclusive).

In Volume II, of our original brief, pages 198 to 231, inclusive, we discussed these recent and junior Wyoming appropriations in detail. On pages 214, 215, 218, 219, 220, 227 and 228 the permits are set forth in detail.

By the statutes of Wyoming the State Engineer is forbidden to issue permits authorizing diversions from streams where no unappropriated waters remain (3917-18, Revised Statutes of Wyoming, 1910, Secs. 727, 728 and 729), and Elwood Mead, the first State Engineer of Wyoming, and to whom is due the credit of the permit system obtaining in that State, in the first biennial report of the State Engineer, 1891-2, states: "An approved permit is a guarantee

from the State * * * that the engineer believes that there is an adequate water supply'' (3918).

The foregoing permits authorizing the construction of these large junior Wyoming enterprises, having been issued by the State Engineer, are a declaration upon the part of the State that sufficient unappropriated waters remain in the stream to supply the new systems for which permits were granted, after supplying all senior appropriations.

It would seem that Wyoming is in no position to contend that the insignificant diversion to be made by the Greeley-Poudre tunnel system would materially affect senior appropriations in Wyoming in view of her declarations, by issuing permits, that ample water remains in the stream to satisfy the enormous new Wyoming projects many years junior to the tunnel project in Colorado.

Further discussion of the facts of the case already covered in our former brief and particularly in Vol. I, pp. 16-21 and Vol. II, pp. 131-255, would involve but continued repetition. Vol. I of this brief is devoted entirely to the law of the case as directed by the first paragraph of the order for re-argument. We shall not here add to the conclusions there stated.

We therefore conclude:

That more than 250,000 acre feet of water annually rise and flow in the Colorado branch of the Laramie River and that of this amount, the State of Colorado will be unable to divert more than 91,000 acre feet or to make use of more than 91/250 of the waters naturally rising and flowing within her borders; that an average of 470,000 acre feet of water annually rise and flow in the Laramie River in both

Colorado and Wyoming, and that Colorado will be unable to use more than 91/470 of the flow of the stream.

That 108,073.75 acres of land are irrigated from the Laramie River and tributaries in Wyoming, and that after Colorado shall have diverted 91,000 acre feet of water from that branch of the stream which rises and flows within her borders, there will ever remain in the stream sufficient water to supply the acreage now under irrigation in Wyoming and ample for all present and future diversions within her borders;

That the tunnel enterprise in Colorado was initiated August 25, 1902, and that long subsequent to said date many large, new and junior enterprises were first initiated and granted permits by the State of Wyoming, thereby admitting that ample water still remained in the Laramie River and its tributaries to supply said new and junior enterprises after satisfying all senior appropriations; and that the Coloado enterprise is senior and superior to said subsequent enterprises in Wyoming and senior and superior as against any additional or enlarged claims upon the stream for reclamation of additional acreage by means of Wyoming appropriations prior to August 25, 1902;

That while in Vol. I of this brief, pp. 215 to 319, inclusive, we observed that the general principles of prior appropriation are *intrastate* in their application and do not apply irrespective of state lines, nevertheless, if the doctrine were sought to be here applied, plaintiff has failed to offer sufficient proof for adjudication of water rights from this interstate stream or upon which this Court could determine the relative priorities of the several diversions in the two States and settle the same by decree;

That the diversions by Colorado and her citizens and the exercise by Colorado of her sovereign rights in the necessary use of her natural resources and a part of the waters of that portion of the stream which rises and flows within her borders will not injure the State of Wyoming or her citizens or interfere with Wyoming in the exercise of her sovereign rights;

That the State of Wyoming has wholly failed to prove the allegations of her bill or that diversion by the Colorado enterprise complained of will in any manner injure Wyoming or her citizens, and that the action should be dismissed.

Respectfully submitted,

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STATE OF WYOMING *v.* STATE OF COLORADO ET AL.

IN EQUITY.

No. 3, Original. Argued December 6, 7, 8, 1916; restored to docket for reargument March 6, 1917; reargued January 9, 10, 11, 1918; restored to docket for reargument June 6, 1921; reargued January 9, 10, 1922.—Decided June 5, 1922.

1. The waters of an innavigable stream rising in one State and flowing into a State adjoining may not be disposed of by the upper State as she may choose, regardless of the harm that may ensue to the lower State and her citizens. P. 466.
2. The relative rights of two adjoining States to the use of an innavigable interstate stream, must be determined in accordance with right and equity and in harmony with the constitutional principle of state equality. Pp. 465, 470.
3. This does not imply an equal division of the water between the two States. P. 465. *Kansas* v. *Colorado*, 206 U. S. 46.
4. The doctrine of appropriation, by which priority of appropriation gives superiority of right, affords the only equitable basis for determining this controversy, in which Wyoming seeks to prevent diversion of water from the headwaters of the Laramie River in Colorado for use in irrigating Colorado lands, to the detriment of prior irrigation appropriations made from the same stream in Wyoming. P. 467.

So *held*, in view of the early adoption and continual practice of the doctrine in both jurisdictions alike, sanctioned by the United States as owner of the public lands, its perpetuation in the constitutions of both States at the times of their creation as a doctrine already existing and essential to their natural conditions, its relation to the settlement and irrigational and agricultural enterprises in both, and the recognition in both of the right to appropriate water from interstate streams.

5. In applying the doctrine of appropriation in this case, private appropriations should be recognized in the order of their priority, as they would be if the stream lay wholly in either State. Pp. 468, 470.

6. Such recognition of private rights *held* not inappropriate in a suit between the two States, in view of the relation of the appropriations to taxable values, and to the welfare, prosperity and happiness of people in each State. P. 468.

7. In as much as the doctrine of appropriation, as it exists within these two States, was adopted, and practised from the beginning, with the sanction of the United States as owner of the public lands, and in as much as the United States does not now seek to impose any policy of its own choosing on either State, the question whether, in virtue of such ownership, it might do so, is not here considered. P. 465.

8. The fact that the proposed diversion is to another watershed from which Wyoming can receive no benefit is not in itself a valid objection, since like diversions are made and recognized as lawful in both States. P. 466.

9. The doctrine of appropriation lays upon each State a duty to exercise her right reasonably and in a manner calculated to conserve the common supply. P. 484.

10. The evidence establishes:

(*a*) The average yearly flow of the Laramie River, in Wyoming, is not a proper measure of the supply practically available there from year to year. P. 471.

(*b*) Computation should be based on the unalterable need for a supply that is fairly constant and dependable, or susceptible of being made so by storage and conservation within practicable limits; substantial stability of supply being essential to successful reclamation and irrigation. P. 480.

(*c*) The reasonable measure of the supply available in Wyoming for practical use is not the lowest natural yearly flow, but something considerably greater, obtainable by storage. P. 484.

(*d*) So measured, the entire supply, from the Laramie and from certain tributaries in Wyoming, available for Wyoming appropriations here involved and for the proposed Colorado appropriation, is 288,000 acre-feet per annum. P. 488.

(*e*) The Wyoming appropriations senior to the proposed Colorado appropriation require 272,500 acre-feet, and the overplus available for that appropriation is therefore restricted to 15,500 acre-feet, per annum. P. 496.

11. Permits, issued by the State Engineer of Wyoming, to appropriate water in specified quantity from the stream, are mere licenses, and not adjudications that a surplus subject to appropriation exists. P. 488.

419. Argument for Wyoming.

12. The proposed Colorado appropriation is to be dated from the time when the project became a fixed plan with a definite purpose, and when work upon it was begun; not related back to an earlier date, when the project was inceptive and uncertain; and, by the same rule, several of the Wyoming appropriations are treated as relating to dates later than those claimed for them. Pp. 490–495.

THIS was an original suit, brought in this court by the State of Wyoming against the State of Colorado and two Colorado corporations, for the purpose of preventing a diversion of part of the water of the Laramie River, a stream flowing from Colorado into Wyoming. The facts are fully stated in the opinion, *post,* 455. The bill was filed on May 29, 1911. A motion to dismiss, equivalent to a demurrer, was argued and, on October 21, 1912, was overruled without prejudice. The case was argued, and twice reargued, on final hearing, the United States participating in the last two arguments, by leave of the court.

In the following summaries of the arguments made upon the last occasion, discussion of the facts is for the most part omitted.

Mr. N. E. Corthell and *Mr. John W. Lacey,* with whom *Mr. Douglas A. Preston,* Attorney General of the State of Wyoming, *Mr. John D. Clark* and *Mr. Herbert V. Lacey* were on the briefs, for complainant.

In Colorado and Wyoming, and in every other State where irrigation is practiced, it is held to be the only equitable rule that the rights of a prior appropriator shall be considered exclusive, and that he shall at all times take from the stream such amount of water as he needs up to the full amount of his appropriation, without any requirement that he divide with other appropriators in times of scarcity. He is not obliged to build reservoirs, nor store the water, but may take it from the stream as it was running when he first appropriated; he is not required to

make any expenditures whatever, in order that others may have water. Indeed, to require that he shall incur the expense necessary in storing water would often be to destroy his priority, since the expense would be more than the value of his prior right. 1 Wiel, Water Rights, 3d ed., § 279; 2 Kinney, Irrigation, 2d ed., § 801, p. 1398; *Conant* v. *Deep Creek Co.*, 23 Utah, 627; *Hill* v. *Smith*, 27 Cal. 476, 482; *Smith* v. *Denniff*, 24 Mont. 20; *Phoenix Water Co.* v. *Fletcher*, 23 Cal. 482; *Wyatt* v. *Larimer & Weld Co.*, 18 Colo. 298; *Comstock* v. *Ramsey*, 55 Colo. 244; *Barnes* v. *Sabron*, 10 Nev. 217; *Willey* v. *Decker*, 11 Wyo. 496; Rev. Stats. § 2339; *United States* v. *Rio Grande Co.*, 174 U. S. 704.

The rights of the prior appropriator are especially active in time of water deficiency. *Avery* v. *Johnson*, 59 Wash. 332; *Huning* v. *Porter*, 6 Ariz. 171; 1 Wiel, Water Rights, § 301.

In accordance with these principles, Wyoming, during the irrigation season of each year, is entitled to the flow of the stream as it may at the time naturally flow, up to the amount necessary to supply the Wyoming appropriations that are prior in time to the inception of the Colorado attempt at diversion. All of the evidence, without contradiction, shows that, in practically every year during the irrigation season, the entire stream flow is not only taken by the Wyoming prior appropriators but is necessary for the purposes of irrigating their lands; and in many of the years—dry years as they are called,—the water in the stream is insufficient for the concededly prior Wyoming appropriations. If the water were being diverted by Colorado into reservoirs within the watershed, then the objection to such diversion would be less serious. If it were diverted within the watershed, it would not be difficult, under the Wyoming system, or indeed under any system, to require the owners of the reservoir in the watershed into which the water is diverted to turn it back into

the stream for the use of the prior appropriators. But in the case at bar, Colorado's diversion will take the water to a place where it will be impossible to return it to the stream, and therefore in every year when the water in the stream may turn out to be less than the amount of the prior Wyoming appropriations plus the Colorado diversion, irreparable wrong will be done to the Wyoming appropriators, and in most of the years the wrong will go to the extent of entirely depriving many of the Wyoming appropriators of water. But in not more than one year in seven could any substantial fraction of seventy thousand acre-feet of water be taken during the irrigating season without depriving the Wyoming prior appropriators of necessary water.

We submit, therefore, that, if the state line between Colorado and Wyoming leaves the rights of appropriators as if all were in the same State, it is clear that the Wyoming appropriators have the right to the water during practically every year; that the years when they will not need it all cannot be ascertained in advance, and that the diversion as intended by Colorado, because of its character and the place to which it will take the water, will in most years cause such injury and damage as entitle the Wyoming appropriators to injunctive relief.

The question of the effect of state lines upon the rights of appropriators in different States has been before the courts of the arid region in a number of cases. The universal holding is, that priority of appropriation gives priority of right on interstate streams, the same as on streams wholly within one State. *Hoge* v. *Eaton*, 135 Fed. 411, 414 (reversed on another point, 141 Fed. 64); *Taylor* v. *Hulett*, 15 Idaho, 265; *Conant* v. *Deep Creek Co.*, 23 Utah, 627; *Willey* v. *Decker*, 11 Wyo. 496, 533; *Farm Investment Co.* v. *Carpenter*, 9 Wyo. 110; *Howell* v. *Johnson*, 89 Fed. 556; *Anderson* v. *Bassman*, 140 Fed. 14; *Morris* v. *Bean*, 123 Fed. 618; 146 Fed. 423; 159 Fed. 651,

655; *Miller* v. *Rickey*, 127 Fed. 573; 152 Fed. 11, 17; s. c. 218 U. S. 258; *Bean* v. *Morris*, 221 U. S. 485; 3 Kinney, Irrigation, § 1225.

Both Colorado and Wyoming are at the crest of the continent. They have both adopted to its broadest extent the doctrine of prior appropriation. And, whether it can stand alongside the doctrine of riparian rights in the same jurisdiction, (as it actually does in a majority of the irrigation States), or is so antagonistic as to exclude the latter, we believe that, for the purposes of the decision of this case, the doctrine of prior appropriation must furnish the rule. The people of both States, by their constitutions, have declared that doctrine to be the just and reasonable doctrine throughout the area involved in this litigation, and, by their legislatures, have reiterated the same doctrine, and provided numerous rules and regulations for carrying it out in both States. The courts in both States have given their adherence, even to the extent of saying that the rule was in force in each State long prior to any constitutions or statutes on the subject. Therefore, so far as the parties here are concerned, that rule and doctrine must be held reasonable and just, and neither State could complain of its use in settling the controversy here.

The facts in the case at bar would permit, and even justify, a decision of this cause on the general principles of prior appropriation, without deciding anything as to the rights of different States whose differing climates have caused the adoption of rules and principles differing in the one State from those in the other.

We realize that the doctrine of prior appropriation is not recognized in all the States, and that, if general principles are to be here decided, such as shall apply to all interstate streams, and boundaries shall be here fixed to the rights of differing States in interstate streams applicable to all circumstances, in reaching such universal prin-

ciples and conclusions there are many and serious problems entirely outside of mere appropriation problems.

Waters falling in Colorado flow out of that State, some to the Gulf of California, and some to the Gulf of Mexico; and it would be entirely possible within that State to construct diverting systems which would turn waters, naturally tributary to the flow into the Gulf of Mexico, into the streams emptying into the Gulf of California. The States through which the waters would run, in case of such diversion, would be different from those through which they would run naturally. The same situation exists in Wyoming, even to a greater degree. It would be entirely possible in Wyoming to construct diversion works such as would turn large bodies of the water from one great river system into another. Each State receiving water from Wyoming has great need for the water. In the case of at least two of the systems, the water from Wyoming flows into and through States which refuse to recognize rights by prior appropriation as superior to riparian rights. In some cases the needed flow from Wyoming is into States which fully recognize the doctrine of prior appropriation. We recognize that Wyoming, if allowed to divert the waters from one stream and one system to another, could inflict vast injury upon sister States. It may not be amiss, therefore, for this court to consider in the decision of this case, the general question of the effect of its decision on the problems which would naturally grow out of the attempt upon the part of Wyoming or Colorado to use within their own boundaries methods of diverting water such as will become injurious to sister States.

The streams rising in Colorado and Wyoming but illustrate the very general character of the questions involved, if rules are sought applicable universally to rights on interstate streams. The stream in the case at bar rises in Colorado, and flows into and through Wyoming, and thence into Nebraska, and on down into other States where

the riparian-rights doctrine pure and simple is adopted. The rights of Wyoming might easily be ground between the upper and nether millstone, if Colorado should be permitted to take a large share of the water on some general principle of prior appropriation, while at the same time Nebraska and lower States could require Wyoming to permit the waters to flow on down into the lower States, practically undiminished in quantity.

The situation for Wyoming will be still worse—far worse—if Colorado shall be permitted to ignore the Wyoming rights acquired by prior appropriation, and, also at the same time all riparian rights, by taking waters for use not only within the watershed, but also without, while leaving Nebraska and lower States the power to compel Wyoming to yield to Nebraska riparian rights.

[Counsel then referred to decisions of the court in *Georgia* v. *Tennessee Copper Co.*, 206 U. S. 230; *Kansas* v. *Colorado*, 206 U. S. 46; *Rickey Land Co.* v. *Miller & Lux*, 218 U. S. 258; *Bean* v. *Morris*, 221 U. S. 485; also to 3 Kinney, Irrigation, §§ 1225, 1227, 1230; to the opinion of Attorney General Harmon, 21 Ops. Atty. Gen. 274, and a letter of Mr. Evarts, 1 Moore, Int. Law Dig., 653, concerning the rights of this country and of Mexico to the waters of the Rio Grande, and to the case of *United States* v. *Rio Grande Co.*, 174 U. S. 690, and the Treaty with Mexico of May 21, 1906, 34 Stat. 2953.]

It is apparent that nothing in any of these quotations or discussions draws in any clear way the lines bounding the rights of a State, as distinguished from those of its citizens, in the waters of an interstate stream. Nor is there anything in any clear way marking out the principles upon which equitable division of waters shall be made in such streams. These matters are left to be determined by rules that may be worked out, or by analogies from rules governing such matters where the adjoining proprietors, instead of being States, are individuals. Some of the

suggestions of this court seem to hint that such rules "may be more or less analogous to common-law rights between upper and lower proprietors." (218 U. S. 258.)

A just criticism has often been made on precedents established in interstate relations, to the effect that many such precedents are almost solely the result of *vis major*. It is to be hoped that the tendencies in dealings between States are in the direction of principles of right and justice; in other words, equitable principles. When such principles are sought and applied in international relations, they are found to approximate more and more closely the equitable principles governing relations between individuals.

The parties to this controversy are not permitted to make war upon, nor even to make treaties with, one another. Their controversy is, therefore, brought to this court to be here determined. If the case is to be ruled by principles of law already discovered, so far as we can see they are ruled by principles governing between private persons. The precedents as to international rights on international streams are scarcely sufficient upon which to base any rule, and, such as they are, they are contradictory; even this Government contending, now that riparian rights govern when diversions of water were made within the boundaries of a foreign government, and again contending that the foreign government has no right to complain when diversions were made within the boundaries of this country, and still later, while in words protesting that it was not doing so, in deeds recognizing the rights of those injured by diversions within our territories.

The Roman law, as appears from the Pandects of Justinian, adopted the principles of riparian rights, and apparently allowed something in the way of irrigation and of equitable division of waters for that purpose. The same is true of the Code Napoleon, Art. 644, and of the

Mexican law at the time of the acquisition of our Mexican territory, including Colorado and large parts of Wyoming. 1 Wiel, Water Rights, pp. 68, 685, 1026. But in all these jurisdictions, while water was to an extent used for irrigation, riparian rights were held superior to rights for irrigation.

It is needless to cite authority to show that in Great Britain, and in most of the States of the Union, while there has been some limited right to use water for irrigation, still the rights of the riparian proprietor are superior. In all the jurisdictions above mentioned, the riparian proprietor had the right to insist that the use of water should not unreasonably reduce the flow of the stream, should be confined within the watershed, and the surplus be returned to the stream.

There are eighteen of our own States and Territories which may be denominated generally the irrigation States, inasmuch as in each there is more or less of arid land requiring irrigation, and the laws recognize, more or less, irrigation rights. In ten of these, while the use of waters of streams for irrigation is permitted, the riparian proprietor is recognized as having the superior right, and the waters are not permitted to be diverted by the irrigators beyond the watershed; but the surplus must be returned to the original stream. 1 Wiel, Water Rights, p. 849; 1 Kinney, Irrigation, p. 782; 2 Farnham, Waters, p. 1572; 3 *id.*, p. 1903; *Wiggins* v. *Water Co.*, 113 Cal. 182; *Bathgate* v. *Irvine*, 125 Cal. 135; *Southern California Co.* v. *Wilshire*, 144 Cal. 68; *Anaheim Water Co.* v. *Fuller*, 150 Cal. 327; *Clark* v. *Allaman*, 71 Kans. 206; *Watkins Land Co.* v. *Clements*, 98 Tex. Civ. App. 578; *Matagorda Co.* v. *Markham Co.*, 154 S. W. 1176.

In the other seven irrigating States, viz., Arizona, Colorado, Idaho, New Mexico, Nevada, Utah, and Wyoming, fuller rights of appropriation are recognized, and apparently the right is recognized to take water outside the

watershed, even over the objections of those within it. But in none of these States is any diversion from the watershed permitted on any principle of equitable division, even remotely expressed or implied. On the contrary, each of these States insists upon the doctrine that the rights of a prior appropriator are exclusive, even to the full extent of his prior appropriation. No division of the waters which would take anything from the prior appropriator to his injury is recognized as in any sense equitable.

This court, in *Kansas* v. *Colorado,* reached a conclusion that, on the facts in that case, equitable division of the waters was a reasonable principle, as between adjoining States on an interstate stream. As we understand that case, this principle of equitable division was not evolved as a new principle, but was a mere application of the doctrine of equitable division as between private riparian owners. No rules for equitable division were there laid down, nor were any such rules even discussed, excepting by a reference to rules of division between riparian owners.

The equitable division was all within the watershed. No question arose there of permitting such division as would carry waters without the watershed. One would search in vain for any doctrine of equitable division of waters which would permit one proprietor to carry the waters without the watershed, with no obligation to return them to the stream, in any State or country administering the rule of riparian rights. In the seven States, possibly the most arid, as we have seen, no doctrine of equitable division of the waters is allowed.

It is interesting, moreover, to note that there are at least tendencies in some of these States, constituting the seven last above mentioned, to recognize rights of owners along the stream and to restrict the diversion beyond the watershed. Nevada Laws, 1907, c. 18, § 4, p. 31; New Mexico

Laws, 1907, c. 49, § 72, p. 95; *Hutchison* v. *Watson Ditch Co.*, 16 Idaho, 484; *Anderson* v. *Bassman*, 140 Fed. 14.

This court has in many cases considered the rights of States as against one another. *Missouri* v. *Illinois*, 180 U. S. 208; *Georgia* v. *Tennessee Copper Co.*, 206 U. S. 230; *Kansas* v. *Colorado*, 185 U. S. 125; 206 U. S. 46, and cases cited by these. It is clearly established by this court that a State does not have a right to do acts within her own borders which shall affirmatively cause injury in another State. The question of the sovereign right of Colorado to take the waters as she will, is one so fully settled by this court that, even if the principle claimed by Colorado were much better founded, in reason, we should not feel it necessary to discuss it further.

Mr. Victor E. Keyes, Attorney General of the State of Colorado, *Mr. Delph E. Carpenter* and *Mr. Platt Rogers*, with whom *Mr. Leslie E. Hubbard*, *Mr. Fred Farrar*, *Mr. Julius C. Gunter* and *Mr. Ralph E. C. Kerwin* were on the briefs, for defendants.[1]

The rights of the States here involved necessarily include the rights and claims of their respective citizens. *Kansas* v. *Colorado*, 206 U. S. 46, 85. It is as though the controversy were between independent Nations. *Missouri* v. *Illinois*, 180 U. S. 208; 200 U. S. 496; *Kansas* v. *Colorado*, 185 U. S. 125; 206 U. S. 46; *Rickey Land Co.* v. *Miller & Lux*, 218 U. S. 258; *Georgia* v. *Tennessee Copper Co.*, 206 U. S. 230, 237, 238. Nations have absolute dominion of everything within their boundaries, including the waters, and the property rights of the individual are

[1] The case was argued on behalf of the defendants, at the hearing in 1916, by *Messrs. Farrar* (then Attorney General of Colorado), *Carpenter* and *Gunter;* and at the hearing in 1918, by *Messrs. Hubbard* (then Attorney General of Colorado), *Farrar*, *Carpenter* and *Rogers*.

such only as the State may grant him. Vattel, Law of Nations (Chitty ed., 1872) pp. 53, 120, 123, 125, 148, 149, 163, 164; *The Exchange*, 7 Cr. 116, 136; *Rhode Island* v. *Massachusetts*, 12 Pet. 657, 733, 734.

Each State of the Union, new or original, has the same unlimited jurisdiction over persons and things within its territorial limits as any Nation, where that jurisdiction has not been surrendered to the United States by the Constitution. *New York* v. *Miln*, 11 Pet. 102, 139; *Chisholm* v. *Georgia*, 2 Dall. 419, 435; *Texas* v. *White*, 7 Wall. 700, 725; Taylor, Int. Law, § 124; Whart. Dig. Int. Law, § 1; *Pennoyer* v. *Neff*, 95 U. S. 722; *Kansas* v. *Colorado*, 206 U. S. 46, 93.

Each of the new States is possessed of the same powers and jurisdiction over the streams within its borders as were retained by the original States, and the sovereign powers exercised by Congress over the Territories passed to the new States upon their admission, including jurisdiction of streams within their borders, with the right to determine the use that may be made of their waters by individuals, except as Congress may control navigation. The uses recognized as limited property rights in the citizen have been determined by each State according to its own necessities, and fixed by its local laws and decisions; and the United States and its courts have adopted the state laws, regulations and court decisions, as the rules controlling within their respective jurisdictions. Congress, whenever it has legislated upon the subject with respect to public lands, has specifically recognized these local laws, customs and court decisions as controlling the regulation of streams within the States.

From the earliest decisions of this court to the present time, all uses of water for navigation, fisheries, power, domestic, irrigation, and other beneficial purposes, have been treated as within the sovereign jurisdiction and con-

trol of the several States, save alone for the federal control of navigation.[1]

Acts of Congress and decisions of the courts and the Land Department, declare the jurisdiction of the public land States over the waters within their domain, in so far as the United States is concerned.[2]

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[1] *Willson* v. *Blackbird Creek Marsh Co.*, 2 Pet. 245; *Martin* v. *Waddell*, 16 Pet. 367, 409, 410; *Pollard* v. *Hagan*, 3 How. 212, 220, 221; *Holyoke Co.* v. *Lyman*, 15 Wall. 500; *Barney* v. *Keokuk*, 94 U. S. 324; *McCready* v. *Virginia*, 94 U. S. 391; *Pound* v. *Turck*, 95 U. S. 459; *Escanaba Co.* v. *Chicago*, 107 U. S. 678; *Cardwell* v. *American Bridge Co.*, 113 U. S. 205; *St. Louis* v. *Myers*, 138 U. S. 566; *Hamilton* v. *Vicksburg, S. & P. R. R.*, 119 U. S. 280; *Willamette Bridge Co.* v. *Hatch*, 125 U. S. 1; *Geer* v. *Connecticut*, 161 U. S. 519; *Ward* v. *Race Horse*, 163 U. S. 504; *Manchester* v. *Massachusetts*, 139 U. S. 240; *Hardin* v. *Jordan*, 140 U. S. 371, 380; *Kaukauna Water Power Co.* v. *Green Bay Canal Co.*, 142 U. S. 254; *Shively* v. *Bowlby*, 152 U. S. 1, and cases cited; *Grand Rapids & Indiana R. R. Co.* v. *Butler*, 159 U. S. 87; *Lake Shore & Michigan Southern Ry. Co.* v. *Ohio*, 165 U. S. 365; *St. Anthony Falls Co.* v. *Water Commissioners*, 168 U. S. 349; *United States Freehold Land & Emigration Co.* v. *Diego Gallegos*, (U. S. C. C., Colo., 1898); *United States* v. *Rio Grande Co.*, 174 U. S. 690, 702–6; *Gutierrez* v. *Albuquerque Land Co.*, 188 U. S. 545, 552, 553; *Clark* v. *Nash*, 198 U. S. 361; *Manigault* v. *Springs*, 199 U. S. 473; *Whitaker* v. *McLeide*, 197 U. S. 510; *Bacon* v. *Walker*, 204 U. S. 311; *Kansas* v. *Colorado*, 206 U. S. 46; *Georgia* v. *Tennessee Copper Co.*, 206 U. S. 230; *Hudson Water Co.* v. *McCarter*, 209 U. S. 349; s. c. 70 N. J. Eq. 525, 695; 3 Kinney, Irrigation, 2d ed., p. 2224; *Waldridge* v. *Robinson*, 22 Idaho, 240; *Boquillas Cattle Co.* v. *Curtis*, 213 U. S. 339; *McGilvra* v. *Ross*, 215 U. S. 70; *Synder* v. *Gold Dredging Co.*, 181 Fed. 62; *Marshall Dental Co.* v. *Iowa*, 226 U. S. 460, *Scott* v. *Lattig*, 227 U. S. 229; *United States* v. *Cress*, 243 U. S. 316.

[2] Acts of July 26, 1866, 14 Stat. 253; July 9, 1870, 16 Stat. 218; March 3, 1877, 19 Stat. 377; March 3, 1891, 26 Stat. 1095; August 18, 1894, 28 Stat. 422; March 2, 1897, 29 Stat. 603; February 26, 1897, 29 Stat. 599; June 17, 1902, 32 Stat. 388; February 21, 1911, 36 Stat. 925; *Atchison* v. *Peterson*, 20 Wall. 507; *Basey* v. *Gallagher*, 20 Wall. 670; *Broder* v. *Water Co.*, 101 U. S. 274; *Jennison* v. *Kirk*, 98 U. S. 453, 456; *United States* v. *Rio Grande Co.*, 174 U. S. 690;

The Colorado enabling act and the proclamation of the President, admit the State to the Union "on an equal footing with the original States in all respects whatsoever." 18 Stat. 474; 19 Stat. 665. The constitution, made in pursuance of the enabling act, and approved by the proclamation, declares that the water of every natural stream, not already appropriated, is the property of the public and dedicated to use of the people of the State, subject to appropriation as provided. It thus appears that, on her very admission, and as a part of the solemn transaction, Colorado asserted her full sovereign dominion over the waters of her streams, and that this assertion was then and there approved by the United States. These provisions of her constitution have been many times upheld by her courts;[1] and her claim to full jurisdiction over the waters within her borders has been repeatedly asserted by her legislature. (Citing many acts.) Wyoming has assumed the same attitude.[2] She, likewise, refuses to permit the diversion of waters in Wyoming for use in other jurisdictions.

The two States, therefore, are at one, in asserting full and exclusive sovereign control; in permitting usufructuary rights to their citizens according to the appropriation doctrine; and in denying these privileges to other States and their citizens.

Gutierres v. *Albuquerque Land Co.*, 188 U. S. 545; *Kansas* v. *Colorado*, 206 U. S. 46; *Boquillas Cattle Co.* v. *Curtis*, 213 U. S. 339; *Twin Falls Canal Co.* v. *Foote*, 192 Fed. 583; *Stanfield* v. *Umatilla River Water Users Assn.*, 192 Fed. 596; *Withdrawal of Public Lands for Irrigation Purposes*, 32 L. D. 254.

[1] See *Wheeler* v. *Northern Colorado Irrig. Co.*, 10 Colo. 582; *Ft. Morgan Co.* v. *South Platte Co.*, 18 Colo. 1; *Stockman* v. *Leddy*, 55 Colo. 24.

[2] Wyo. Const., Art. VIII, §§ 1–5; Wyo. Comp. Stats. 1910, § 724, p. 247; *Farm Investment Co.* v. *Carpenter*, 9 Wyo. 110; (distinguishing *Willey* v. *Decker*, 11 Wyo. 496); *Grover Irrig. Co.* v. *Lovella Ditch Co.*, 21 Wyo. 204.

It might be said that the United States, in admitting these States with their constitutions as they are, gave recognition to their claims amounting to a grant. *Farm Investment Co.* v. *Carpenter*, 9 Wyo. 110. But their jurisdictions and rights are not so dependent, but rest directly on the Federal Constitution. *Stockman* v. *Leddy*, 55 Colo. 24; *Kansas* v. *Colorado*, 206 U. S. 46; *United States* v. *Hanson*, 167 Fed. 881.

The doctrines of riparian rights and of appropriation are local rules for determining the private rights of citizens in particular States—usufructuary rights in the property of the State, which, in the final analysis, must yield to the will of the State and her eminent domain.[1]

They have no extra-territorial force, either for or against the State. Story, Conflict of Laws, c. 2, pp. 19–34; *Pennoyer* v. *Neff*, 95 U. S. 714, 720. The State has an interest, independent of and behind the title of its citizens. *Georgia* v. *Tennessee Copper Co.*, 206 U. S. 230; *Kansas* v. *Colorado*, 206 U. S. 46, 99; *Hudson Water Co.* v. *McCarter*, 209 U. S. 349, 354–357.

That private rights in waters of interstate streams cannot determine the rights of States *inter sese*, is recognized in *Rickey Land Co.* v. *Miller & Lux*, 218 U. S. 258, 260, 261; and *Bean* v. *Morris*, 221 U. S. 485. The assumption of concurrence or acquiescence made in those cases, whereby rights might be acquired in one State for enjoyment or use in another, cannot be applied in the case of Colorado. And the question of constitutional protection, passed in *Bean* v. *Morris*, *supra*, 488, cannot arise here, since, with the exception of one small appropriation, no

[1](*a*) Riparian rights. 3 Kent Com., § 439; 2 Black. Com., pp. 14, 18; *McCarter* v. *Hudson Water Co.*, 70 N. J. Eq. 525; 70 N. J. Eq. 695; s. c. 209 U. S. 349, 355; *St. Anthony Falls Co.* v. *Water Commissioners*, 168 U. S. 349; *Whitaker* v. *McBride*, 197 U. S. 510, 511.

(*b*) Rights by appropriation. *United States* v. *Rio Grande Co.*, 174 U. S. 690, 702; *Kansas* v. *Colorado*, 206 U. S. 46, 94.

use whatever had been made of the waters of the Laramie River prior to the admission of Colorado, in 1876; and substantially all of the Wyoming development has occurred since that date, and a large part subsequent to the Colorado project here complained of.

Even were we to assume that Colorado had not, since 1876, expressly denied recognition of all extra-territorial claims, the fact remains that there is no concurrence of laws upon which to base a presumption of interstate servitudes. Both States assert full ownership and control over the waters within their borders and abolish the system of riparian rights. Beyond this the systems diverge.

The doctrines of riparian rights and of appropriation both are fundamentally inapplicable to the regulation of rights between States, which stand upon an equality "in all respects whatever," to the same degree as independent Nations. Each State depends for its existence primarily upon its natural resources, of which water, in the arid regions, is frequently the most valuable. Self defense compels the State to withhold its resources for the benefit of future as well as present generations and for the welfare and perpetuity of the State. With independent Nations, these natural resources, if need require, must be defended by the sword. But with States of the Union this court must determine the controversy. *Kansas* v. *Colorado*, 185 U. S. 125; 206 U. S. 46; *Missouri* v. *Illinois*, 180 U. S. 208; 200 U. S. 496.

If the rule of riparian rights were to control the settlement of this controversy, Colorado would be forever deprived of all but the most insignificant use of her own waters in the Laramie, and her fertile but arid lands would remain forever unproductive, by reason of the fact that only the lands of the narrow mountain valleys in Colorado are riparian; and these waters, imperative to her present and future development and welfare, would

pass forever into Wyoming, there to be used, enjoyed or wasted, or pass to the sea. On the other hand, by the doctrine of appropriation, if physical conditions had permitted, all waters of this stream, those rising in Wyoming included, might have been diverted within the latter State, and carried into and applied to land in Colorado; and, if all this were prior to Wyoming developments, Colorado could forever after prevent Wyoming from the use, not only of the Colorado waters, but of those rising in Wyoming as well.

Canals and diversion works are usually first constructed where no natural obstacles interfere. Infant Nations or States can little afford to undertake projects which, in their later history, their accumulated energies often accomplish with apparent ease. Prior appropriation is very frequently the accident of physical location; and, were the rule to apply between States, their destiny would be determined, not by their present or future necessities for use of their natural resources, but rather by accident. While, to be sure, the rule does apply to individuals within the State, in their case the preference of the first taker is within the governmental powers of the State; and, in disposing of its resources to the most ultimate good, inasmuch as the water, if parceled among the many, would benefit no one, the State may determine to whom the exclusive use may be given, in order ultimately to bring to the State and its people the greatest benefit with the least waste; and, furthermore, the State, whenever it may so desire, by the power of eminent domain, may take away all vested usufructuary rights and establish some new plan adapted to future conditions, only perhaps in the future to again condemn and establish still a different order of things.

But we can not agree that among Nations or States, with equal powers and sovereign rights, one may claim through its citizens, by mere first use, a preferred and

exclusive right perpetually to use for its benefit waters rising within and flowing from the domain of its neighbor, thereby to deny forever to the Nation or State of origin a part or all of the benefit of its own stream, be its necessities ever so great. Waters that rise and flow from one State into another are forever lost to the former unless there used, and any rule which forbids this use denies to that State the benefit of its inherent sovereign right to enjoy its own and maintain itself within its domain. It would be, in effect, to invade and take the domain of one State and to give it to another, without consent or compensation. It would be the assertion by a foreign State of jurisdiction over a portion of the domain of another State.

The usufructuary rights of the individual citizen of Wyoming are defined by the constitution, laws and decisions of the courts of that State. But the local law of Wyoming can have no extra-territorial effect, and especially when prejudicial to the rights of other States. Story, Conflict of Laws, § 32, p. 29; *Farnum* v. *Blackstone Canal Co.*, 1 Sumner, 46, 62; *The Exchange*, 7 Cr. 116, 136; Cooley, Const. Lim., 7th ed., p. 176; *Hilton* v. *Guyot*, 159 U. S. 113. One State cannot expropriate property within the territory of another State. I Whart. Int. Law Digest, pp. 38, 39; *Crosby* v. *Hanover*, 36 N. H. 404, 423; *Holyoke Water Co.* v. *Connecticut River Co.*, 52 Conn. 570, 575, 576; *McCarter* v. *Hudson Water Co.*, 70 N. J. Eq. 695, 717.

The fundamental rule that one Nation cannot exercise its sovereign power and jurisdiction over the waters or domain of another Nation without its consent and cannot expropriate the waters of an upper Nation for the use of the lower Nation by claim of prior appropriation, even on an international river, has been recognized and followed by the United States in its relations with Mexico. 21 Ops. Atty. Gen. 280–283. When the United States, as a

matter of international policy but not of international law, settled the differences over the Rio Grande with Mexico, it took the precaution so to word the treaty that the adjustment could never be taken as a recognition of any lawful claims by Mexico. Treaty of May 1, 1906, Art. V, 34 Stat. 2953.

As we understand the term "equal," when used with reference to the States, it refers to that equality in the family of States which obtains with Nations in the family of Nations. Each State has an equal right, not only to govern itself, but as well to maintain itself and improve its domain, increase in population and promote for the present and for all time the general welfare of itself and its citizens. But if, (purely by way of illustration) we were to use a narrower construction, and say that equal States have the right to enjoy an equal part of an interstate stream, even then the doctrine of appropriation is inapplicable, for it takes from one State an exclusive (not equal) portion of the waters of the stream, and gives it to the other without remuneration.

Priority is a rule of the past and not of the future. States must look to the future more than to the past. *Hudson Water Co.* v. *McCarter*, 209 U. S. 349, 355. The State may find its future needs so imperative that it must extinguish, by eminent domain, even the usufructuary property rights it has permitted its citizens, and take the waters for a greater need. How, then, could the limited right of a State, determined upon rules of priority of appropriation, as regards another State, be reconciled with its future imperative necessities?

How solve the problem, if one State has adopted the law of appropriation and the other the modified doctrine of riparian rights? What would be the result, if the principle of appropriation were applied as between two appropriation States and, thereafter, one should change and adopt the common-law doctrine of riparian rights? De-

termination of the rights of the various appropriators in the two States upon the basis of priority would be thrown into complete confusion. Neither State can legislate for or impose its own policy upon the other; Congress cannot enforce either rule upon any State.

The unnecessary loss, occasioned by depriving the State of origin of control of its waters, and by causing the water to pass down losing streams in order to supply some prior appropriator in another State, would appear to be wasteful, and inept, and so inequitable and unjust.

Could any advocate of the doctrine of appropriation regardless of state lines advance any hypothesis upon which a stream and its tributaries, like the Colorado River, flowing within or bordering six States and a foreign country, could be administered, and the water apportioned to the various appropriators in the seventeen hundred or more miles of its length, upon the basis of priority of appropriation?

If priority of right regardless of state lines is the principle which governs this controversy, how are the rights of the respective individuals in Wyoming and Colorado to be determined, having due regard to the conflicting laws of each State; and, after determination, how are they to be enforced? Possibly this court might appoint an officer or direct a United States marshal to organize a body of men to police the stream and divide the water according to the priorities which this court might undertake to adjudicate; but the very suggestion shows the absurdity of the contention. No such procedure was ever in contemplation either by Congress or by the respective States where water is used for irrigation. The entire adjudication and administration of priorities is founded, and has been constructed, on the theory of state control, and is utterly in conflict with any other theory. Manifestly, the doctrine of priority of appropriation does not adapt itself to interstate questions. Diversion and uses of water under the rule of priority require the most rigid police regulation.

The state courts, understanding as they do the local conditions and necessities, are in the best position to adjust conflicts between individual appropriators. But, if priorities must obtain irrespective of state lines, local courts will be shorn of their jurisdiction and some other court or tribunal will of necessity assume the task. The difficulties are greatly enlarged when appropriations by reservoirs and the complicated system of exchanging water are taken into the account. Taking the Platte River and its branches, for illustration, it may be estimated that administration under the rule of priority, irrespective of state lines, would require readjudication and police regulation of upwards of 4,000 diversions already established and decreed by state authorities in Colorado, Wyoming and Nebraska, and, in the years to come, probably a like number of new and now more or less incomplete enterprises. In view of the fact that the right of each appropriator is limited to his actual necessities each day, and that his diversions must constantly be regulated and restricted accordingly; and in view of the complications arising from exchanges and other administrative features existing upon each of the tributaries, as well as upon the stream itself; it is self-evident that the difficulties confronting interstate administration of the Platte River would become so involved that, to give each appropriator his just dues, and no more, and at the particular time his necessities demanded, would be next to impossible. If such should be declared to be the rule, the rights of all must be protected and enforced, the least must receive the same consideration as the greatest, and that, too, at the particular time when the crop demands water in order that loss may be avoided.

Yet state officials and tribunals are confined in power to their own borders, and bound by local laws, rules and regulations. They can not adjust conflicting claims or determine rights of foreign users. Different systems in

different States invite irreconcilable conflict and insoluble administrative problems.

If this court should decide that the private usufructuary rights of the individual appropriators preclude the States from asserting greater rights to the river, and that priority shall obtain irrespective of state lines, then such rights must be adjudicated by the court in this and similar cases. This would necessitate a determination not of the rights of the States, but of each individual claimant; and the rights of each, great or small, would have to be separately considered and passed upon. The mere suggestion of the problem portrays the insurmountable obstacles to be encountered.

Then, too, conditions are constantly changing. New and conflicting rules and laws may become imperative in Colorado, Nebraska and Wyoming. Who then shall enact these laws? The subject is no longer within the control of the States, because their jurisdiction has been denied them. Congress cannot legislate, for it has no power so to do. 206 U. S. 90–92. The canals divert waters from streams washing lands long since passed into private hands, and not public lands of the United States. This court cannot legislate. Who then shall remedy the evil or supply the new rule?

It would seem, from the opinion in *Kansas* v. *Colorado*, 206 U. S. 46, that any doctrine of equitable apportionment of the waters of rivers between States must be founded upon a broad basis of equitable consideration of all the facts of each case as they appear, with full regard to the equal rights of States of equal dignity, powers and jurisdiction, and not upon the narrower basis of local laws governing mere usufructuary rights of private citizens. But even though we here construe that decision within the narrower limits and assume an equal apportionment of the waters of the stream, we here find that the Laramie River rises not in one but in both States. The waters of

the Wyoming part of the stream, as well as those of the Colorado branch, are available to Wyoming and her citizens. On the other hand, natural conditions are such that Colorado is limited to use of but a part (91/250) of the waters of that branch which rises and flows within her borders. Whatever the injury might be to Wyoming (though none has been proved), this would not appear to be an inequitable use of her own resources by Colorado.

A greater degree of caution is manifest in such controversies as this, than would obtain in suits between citizens within the same or different jurisdictions. The complaining State should be required to establish the injury and its right to relief upon the clearest and most indisputable testimony, before this court would be warranted in preventing the other State from exercising its sovereign control over its natural resources. *Missouri* v. *Illinois*, 180 U. S. 208, 248.

Wyoming has wholly failed to prove the allegations of her bill, and even more, has by her own conduct denied her charges against Colorado by permitting appropriations for and authorizing construction of many new and enormous enterprises in Wyoming, long junior to the Colorado enterprise of which she complains and drawing water from the same stream; and, irrespective of other conclusive proof, has thereby admitted that there was and is ample water in the stream to supply all appropriations junior, as well as senior, to the Colorado enterprise, and that no injury could result to senior appropriations in Wyoming by reason of the Colorado diversion; and that by her official acts, she has contributed to the very depletion whereof she complains. Further, the proof shows that, not only is there ample water in the stream for use of all Wyoming enterprises, but, as well, that Wyoming needlessly wastes more water than will be withdrawn from the stream by Colorado. And, furthermore, the proof reveals, without contradiction, that Wyoming is not only

diverting from the drainage of the Cache la Poudre over into that of the Laramie, but generally recognizes and permits such diversions, by official sanction and decrees of her courts, within her own territory, and by means thereof she has been able tc effect her most valuable reclamation and development. No proof was offered in support of her claims as a riparian owner and, on the other hand, by her constitution, laws and decisions of her courts, she has abolished and denied any such; and, lastly, she has offered no sufficient proof whereby this court could adjudicate and determine the relative rights of appropriation within either Wyoming or Colorado, if such a rule as she alleges were here applied.

Mr. Assistant Attorney General Riter, with whom *Mr. Solicitor General Beck* and *Mr. John F. Truesdell,* Special Assistant to the Attorney General, were on the brief, for the United States.[1]

The attitude of the executive branch of the Government is, briefly, that the United States has not surrendered to the States or parted in any way with its original right to use the surplus waters (those not appropriated by others under its own laws) of innavigable streams in the Western States; that the United States is, and always has been, since the cession of the territories now comprised in those States, the owner of all the unappropriated and surplus waters; that the appropriated waters there have been granted by the United States under its own laws, using local customs and state laws as subordinate instrumentalities only; that the rights of the States, both as the actual owners of lands granted to them and as the ultimate owners of the property of their citizens, so far as

[1] *Mr. Solicitor General Davis* argued the case on behalf of the United States, at the hearing in 1918. *Mr. Assistant Attorney General Kearful, Mr. Truesdell,* and *Mr. Ethelbert Ward,* Special Assistant to the Attorney General, were with him on the brief.

they may be said to be such owners, are confined to such water rights as have been granted by the United States to them or their citizens under the laws of Congress; and that controversies such as this should be decided upon the basis of such federal grants, and without regard to state boundaries.

As for the effect of these questions upon the public interests and governmental policies of the United States, we think it sufficient here to call attention to the vast areas of land still belonging to the United States; to the fact that much of it is in the arid region where land without water to irrigate it, is of little value; to the federal reclamation policy, which depends upon federal use of both land and water and often upon federal use of interstate streams; to the federal Indian policy, where the Government's ability to protect its Indian wards depends largely upon its ownership and control of the waters on reservations and other Indian lands; and, finally, to the fact that, if the water on these public lands be held to belong to the States, the Federal Government will be at the mercy of the States and be helpless as to these policies in a very real sense, because, while under our system the States are represented in and have a powerful influence upon the Federal Government, the United States is not in any way represented in the States, and, both theoretically and as a practical matter can not control or even influence their action.

The United States retains its original plenary ownership of the right of use of innavigable waters in the Western States, except in so far as it has parted with it through acts of Congress; and this property, like the property in the public lands generally, is wholly immune from state interference or control. The state power affects only those rights which have been granted by Congress.

We respectfully suggest the necessity of keeping separately in mind the two questions of, first, whether the

United States or the States own the right of use of the innavigable waters in the Western States, and, second, the effect of a decision of that question upon the rights of these two opposing States in the waters of an interstate stream. It is our contention that federal ownership controls, and offers a logical and workable solution of this question of rights between the States; but, even if we should be wrong in this, we deem it clear that the United States owns the right of use of the waters in and on its public lands within the States, just as it owns the lands themselves, and that such ownership should not be thrown in doubt by any decision as to the broader question of the rights between States.

Upon the acquisition of the territory now comprised within the Western States, the United States became vested with all property rights in that territory except vested private rights and such Indian rights as the United States might choose to recognize. Therefore, whatever property rights exist in water in that territory, whether the water be navigable or innavigable, belonged to the United States until the creation of the States; and, furthermore, such rights are still federal property, notwithstanding the creation of the States unless, first, they are of such a character as to go to the States upon their mere creation as such and because of the character of state sovereignty, or unless, second, they have been granted to the States or to private persons under acts of Congress.

Property rights in navigable waters and their shores and beds become vested in the States on their creation, as a part of their sovereignty, but the rule is different as to nonnavigable waters and their places of occurrence. The States take no property rights in them. Such waters are not *publici juris*, and title to their use is the same as title to land.

Because of its fugitive nature, the only property rights which exist in water in its natural state are rights of use,

the corpus being only susceptible of ownershi; while in possession. This corpus while in possession i: personal property, but the right of use of the water in) natural state is a real property right of the highest c:. ıity and value. *Tyler* v. *Wilkinson*, 4 Mason, 397; *F* ıbrey v. *Owen*, 6 Ex. 352; 20 L. J. Ex. 212; *Hargrave* v. .ok, 108 Cal. 72; *Smith* v. *Rochester*, 92 N. Y. 463, 480 *Gardner* v. *Newburgh*, 2 Johns. Ch. 162, 166; *Insuran* ? *Co.* v. *Childs*, 25 Colo. 360, 363; *Davis* v. *Randall*, 14 Colo. 488, 492. 3 Kent. Com. p. 439; Wiel, Wate Rights, 3d ed., p. 755; § 711, p. 777 *et seq.*, and nume ıus cases cited; § 283, p. 298; § 285, p. 301; Long, Irri ıtion, 2d ed., § 34, p. 70; 2 Kinney, Irrigation, 2d ed., § 76! p. 1328; Washburn, Easements, 4th ed., pp. 316, 317; 2 V ashburn, Real Property, 6th ed., § 1284.

Because of the necessity of protecting the p· lic interests therein (mainly navigation and fishery) property rights in navigable waters in England belon· d *prima facie* to the Crown; and in this country they be. ng *prima facie* to the municipal sovereignties, the St· es. The Federal Government, though having full cont l (under the commerce clause) for purposes of foreign nd interstate navigation, has no right of property in s· h waters, or their shores or beds, except as it derives i· rom the States, either by grant or under operation of tate law. *Shively* v. *Bowlby*, 152 U. S. 1, 15, 46, 48; *Hardin* v. *Jordan*, 140 U. S. 371, 381; *United States* v. *Chandler-Dunbar Co.*, 229 U. S. 53, 63; *United States* v. *Rio Grande Co.*, 174 U. S. 690.

The crux of the question we are examining is whether innavigable waters are *publici juris*, like navigable waters. Ownership by the States depends upon showing that they are. Such waters are not *publici juris* and ownership of usufructuary rights therein rests upon the same basis and is of the same character as ownership of land. In the first place, it is to be noted that it is now decided beyond any

further possibility of question that the beds and shores of innavigable streams and lakes, even though they are meandered, are owned as ordinary upland is owned, and are not owned by the States. Title to such lands in the public land States comes from the United States and not from the States. *Hardin* v. *Shedd,* 190 U. S. 508. The fact that this court holds that the grantee of the upland from the United States takes to the thread of the stream or not in accordance with the state law, using such law as a rule of convenience merely, in no way weakens this statement. The title comes from the United States, and it is perfectly competent for Congress to change this rule of convenience applied to the grants of the United States if it sees fit. [Cf. *Oklahoma* v. *Texas,* 258 U. S. 574; *Brewer-Elliott Oil Co.* v. *United States,* 260 U. S. 77. Reporter.]

As to the property rights in these innavigable waters themselves, it is to be observed, first, that diffused surface waters and all underground waters were originally looked upon by the law as part and parcel of the soil, and as belonging to its owner. The tendency now is to recognize these waters as distinct from the soil, and as being susceptible of ownership, when out of possession, only as to usufructuary rights therein. Furthermore, the tendency is to treat such rights, not only as interlocking with the rights in the streams and lakes which the underground waters support, but also (even, we think, in the pure appropriation States) as belonging to the several owners of the lands which have access to them. Wiel, Water Rights, §§ 1090, 1124.

Turning to the innavigable surface streams and lakes, it will be found that, in England, it was recognized, at least as early as Lord Hale's time, that the proprietary right in the use and flow of such waters was not in the Crown. Unlike navigable waters, they did not at common law belong *prima facie,* or of common right, to the

sovereign, but did so belong to private persons just as land did. The rule was, and is, the same in our original States; and so, following the same principle upon which this court decided that navigable waters and their shores and beds go to the new States, as well as to the original ones, since it is the States which under our system are the possessors of municipal sovereignty (*Pollard* v. *Hagan*, 3 How. 212, 229, and *Shively* v. *Bowlby*, 152 U. S. 1), we see that neither the new States, nor the original thirteen, have any property rights in innavigable waters by virtue of their sovereignty, or have any different kind of power whatever over them than they have over land. *Smith* v. *Rochester*, 92 N. Y. 463, 473; *Gardner* v. *Newburgh*, 2 Johns Ch. 162, 166; Lord Hale's de Jure Maris, with Judge Cowan's note to *Ex parte Jennings*, 6 Cow. 536, 539-546; *Watuppa Reservoir Co.* v. *Fall River*, 147 Mass. 548, 554, 555, 558, 561; *Home of Aged Women* v. *Commonwealth*, 202 Mass. 422, 433-434; *Opinions of Justices*, 118 Me. 503, 506, 507; *Wadsworth* v. *Smith*, 11 Me. 278, 280, 281; *Chapman* v. *Kimball*, 9 Conn. 38, 40, 41; *Barclay R. R. Co.* v. *Ingham*, 36 Pa. St. 194, 200, *et seq;* Angell, Water Courses, 6th ed., pars. 2, 535; Gould, Waters, 3d ed., par. 46; *Cobb* v. *Davenport*, 32 N. J. L. 369; *Simmons* v. *Paterson*, 60 N. J. Eq. 385, 389; *Attorney General* v. *Delaware &c. R. R. Co.*, 27 N. J. Eq. 631, 638; *Doremus* v. *Paterson*, 65 N. J. Eq. 711, 712. Contra, in part: *McCarter* v. *Hudson Water Co.*, 70 N. J. Eq. 695, affirmed by this court on other and broader grounds. 209 U. S. 349.

General expressions by some of the early writers, and also the existence of prescriptive rights, for a time left some doubt as to whether water, as such, was not *publici juris*, and also as to whether the riparian owner's right to divert the waters on which his land bordered was not dependent in some way upon actual appropriation. Whatever doubt existed in that respect was put at rest in England by a series of cases of which *Mason* v. *Hill*, 5

Barn. & Adol. 1, 23, 24, decided by Lord Denman in 1833, was perhaps the most important. In this country the question had already been disposed of by Mr. Justice Story in *Tyler* v. *Wilkinson,* 4 Mason, 397. Since those cases, it has been settled that, under the common law, both in England and in the United States, the usufructuary rights to innavigable waters belong to the owners of the land bordering on them; that the rights of such owners in the water are in no way dependent upon its use; that such waters are in no proper sense *publici juris,* as, for instance, navigable waters are; that the water right is part and parcel of the title to land itself; and that title to such usufructuary right has the same origin as the title to the land. *Embrey* v. *Owen,* 6 Ex. 352, 368; 20 L. J. Ex. 212; *Ferguson* v. *Shirreff,* 6 Dunlop, 1355, 1374 (Scot's Rev. Reps.)

Undoubtedly the States have the power to control individuals in their use of water. Whatever the power is, it is limited by the provisions of the Fourteenth Amendment protecting vested rights. The power is the same as that which the State has over vested rights in lands. Water rights, under both the appropriation and the riparian doctrines, are vested rights in real property, which can be lost only by grant, condemnation, prescription, or abandonment. The ways in which this power of the State is exercised, of course, will differ in accordance with the kind of property the use of which is to be affected or controlled. Thus, we have regulations limiting the use of land for the public good that would not be at all applicable to water, and, vice versa, we have regulations concerning water that could not apply to land. Wiel, Water Rights, pp. 196, 197; *Robertson* v. *People,* 40 Colo. 119, 124; *Broad Run Co.* v. *Duel Co.,* 47 Colo. 573, 579; *Combs* v. *Farmers Co.,* 38 Colo. 420, 428.

The argument based on the necessities of the arid region wrongly assumes that the riparian system is not suited to

western conditions and that, therefore, the States can dispose of the federal property in water. We think it sufficient here to point out that the main principle of the riparian system is equality of right between the riparian owners; that they among them own the entire right of use of the stream; that any proper use under the circumstances, including, of course, irrigation, is permitted; that rights exactly like appropriation rights can be and frequently are created by grant or condemnation of rights of the riparian owners; that the appropriation system, so called, is not so much a system of owning and using rights as it is a means of acquiring them; that it is an open question whether the correlative rights of the riparian system are not better suited to an irrigation community than the sometimes more definite and less related appropriation rights; and finally, that both classes of rights are now being created out of, and logically rest, under our theory, upon the original federal ownership of riparian rights, and that the argument for state ownership is merely one that it would be better to allow the States to dispose of this class of federal property, and is as applicable to lands as to water.

The fundamental principle of water law, that the corpus of water can only be the subject of ownership while in possession, and that, therefore, water itself in its natural state is owned by no one, has no effect upon the question of whether the title to the usufructuary right therein belongs to the State as a part of its sovereignty.

Water rights now vested in others derive their existence, like titles to land, from the acts of Congress. All interest in water not so granted necessarily remains in the United States. The acts grant nothing to the States, and ratification of state constitutions asserting state ownership of water does not divest the United States of its property rights therein. The earliest acts of Congress affecting innavigable waters show full consciousness of power to deal with

such waters on the public lands. Rev. Stats. § 2476. Acts of May 18, 1796, 1 Stat. 468; March 3, 1803, § 17, 2 Stat. 235; February 20, 1811, § 3, 2 Stat. 642; and March 3, 1811, § 12, 2 Stat. 666; *Railroad Co.* v. *Schurmeir*, 7 Wall. 272, 289; *Scott* v. *Lattig*, 227 U. S. 229, 242; *Hardin* v. *Shedd*, 190 U. S. 508, 519. Since the passage of the Act of July 26, 1866, 14 Stat. 251, the disposition of such waters on the public lands has been controlled by that act and by the local laws and customs used as its subordinate instrumentalities. The occasion of this legislation was the extensive occupation and exploitation of the public lands in the West following the discovery of gold in California. The need was to legalize appropriations of mineral land, rights of way, and water rights already made under local customs and laws, and to provide for the future acquisition of rights of the same character in the same manner. *Jennison* v. *Kirk*, 98 U. S. 453; *Atchison* v. *Peterson*, 20 Wall. 507; *Basey* v. *Gallagher*, 20 Wall. 670; *Broder* v. *Water Co.*, 101 U. S. 274; Wiel, Water Rights, § 66, *et seq.*; § 92, *et seq.*; 1 Kinney, Irrigation, §§ 596, 611, 636, *et seq.* To meet this situation the Act of 1866 and the supplementary Act of 1870, 16 Stat. 217, were passed. Congress had already provided adequate means for the acquisition of the government title to agricultural lands by passing the Homestead Act in 1862.

The relation of the Acts of 1866 and 1870 to water rights and waterways was precisely the same as their relation to the mineral lands. Their mining features were crude and were superseded by the more detailed Act of May 10, 1872, 17 Stat. 91, in which, however, the policy of favoring local laws and granting mining rights in accordance therewith is adhered to. The water features of the original acts are still in force. That the Act of 1866 provides a means for the future acquisition of rights, water as well as mining, is the settled holding of the

courts, and made perfectly clear by the Act of 1870. *Jacob* v. *Lorenz*, 98 Cal. 332, 335; *Beaver Brook* v. *St. Vrain*, 6 Colo. App. 130, 138; Wiel, Water Rights, § 99, p. 116; Long, Irrigation, § 74, p. 134.

This legislation is the foundation of all water rights in the Western States today and provides a solution and, we think, the only solution, of the problem of interstate streams. Mineral lands are held open to "exploration and occupation", and he who occupies is given the right to take the other steps which lead to a grant. Water rights are protected and preserved to whoever has possessed them. Local laws, rules, and customs are used in both cases to define the right and provide the course that must be followed to acquire it. The mineralized vein is recognized, as it was before by the customs of the miners, as being the thing appropriated, and so the right is given to follow it regardless of the surface limits of the claim extending vertically downward, which ordinarily define the extent of land holdings. In the field of water rights, again in accordance with local customs, the one who first "appropriates," even for use on nonriparian lands, is given the better right. Both as to mining and water, however, the rights granted are only such as any proprietor of the whole property involved could grant, and the rule of priority is only that which necessarily follows from successive conveyances of defined parts of a whole.

Further, it should be observed that, under this act, the proprietor, the United States, in a way holds its landed estate for conveyance in three classes—mineral rights, water rights, and what may be called, for convenience, ordinary land rights. It holds all of these rights for conveyance separately or together, as the case may be. Consequently, and generally speaking, riparian rights pass or not, under a patent of riparian land, according to whether or not the riparian doctrine or the appropriation doctrine is the rule in the locality where the land is situ-

ated. Congress has provided that it shall be otherwise in the Black Hills Forest Reserve in South Dakota (34 Stat. 233, 234).

It is well understood that the local rules, whether found in miners' customs, court decisions, or legislative acts, were adopted merely to supplement the particular provisions and fundamental conditions of the act, in order to fit it to local conditions, including local preferences, and avoid unnecessary complexity and volume in the act itself. This plan of adopting local laws or rules as the laws and rules of Congress is familiar enough. It is seen in the legislation defining crimes on reservations under exclusive jurisdiction of the General Government; in the conformity provisions governing the federal courts in common-law cases; in various laws for the taking of affidavits, etc. Illustrations might be greatly multiplied. Lindley on Mines, 2d ed., § 249; *Butte City Water Co.* v. *Baker*, 196 U. S. 125; *Clason* v. *Matko*, 223 U. S. 646, 654.

It is somewhat astonishing to find *Broder* v. *Water Co.*, 101 U. S. 274, and *Jennison* v. *Kirk*, 98 U. S. 453, 456, cited in Colorado's brief as authority for the idea that the Act of 1866 recognized an independent title or power in the States. They hold exactly the reverse. See *Union Co.* v. *Ferris*, 2 Sawy. 176, 184; 1 Wiel, Water Rights, § 97, p. 113; § 155, p. 177 *et seq.;* Long, Irrigation, § 74, p. 134. The grant is made directly to the individual appropriator. It takes effect upon his bringing himself within its terms by complying with the local laws. No patent follows as in the case of mining claims, but the title passes by virtue of the statute itself and compliance with it, as is the case with grants of rights of way. Yale, Mining and Water Rights, p. 380.

The law of water rights in California and the numerous States which have followed her lead is based squarely upon the federal title. 1 Wiel, Water Rights, p. 226; *Lux* v. *Haggin*, 69 Cal. 255, 338; *Benton* v. *Johncox*, 17

Wash. 277, 289; *Morgan* v. *Shaw*, 47 Ore. 333, 337; *Smith* v. *Denniff*, 24 Mont. 20, 21; *Barkley* v. *Tieleke*, 2 Mont. 59, 64; *Cruse* v. *McCauley*, 96 Fed. 369, 373–374; *Howell* v. *Johnson*, 89 Fed. 556, 558. Colorado and the other pure appropriation States (1 Wiel, Water Rights, p. 226), endeavor to find some basis for water rights other than the federal title. In those States water rights are identical with appropriation rights in California and the other dual system States, and, of course, are derived, as they are there, from the United States by grants under this act. Subsequent acts of Congress contradict the theory that federal ownership has been abdicated. Kinney, Irrigation, § 637, and pp. 1091, 1095; *Hough* v. *Porter*, 51 Ore. 318; *Gutierres* v. *Albuquerque Land Co.*, 188 U. S. 545, 552–554; Acts of March 3, 1877, 19 Stat. 377; August 18, 1894, 28 Stat. 422; June 4, 1897, 30 Stat. 11, 36; February 26, 1897, 29 Stat. 599; March 2, 1897, 29 Stat. 603; June 17, 1902, 32 Stat. 388.

The legislation of Congress, with regard to water rights, all centers upon, and is intended to preserve, the policy adopted in the Act of 1866. It is the long continuance of subordinate state control, under a system that involves no recourse to the source of power, that has caused the fact that such control is subordinate sometimes to be lost sight of.

Ratification of state constitutions asserting state ownership of waters does not divest the United States of its property rights therein. Colo. Const., Art. XVI, § 6; *Coyle* v. *Oklahoma*, 221 U. S. 559, 568; *Ex parte Webb*, 225 U. S. 663, 690; *Wilcox* v. *McConnell*, 13 Pet. 498, 516; Kinney, Irrigation, § 388, p. 660.

The question whether the United States or the States own the water of innavigable streams in the West has never been directly passed upon by this court. The cases support federal ownership. Wiel, Water Rights, pp. 183, 194, 223; Kinney, Irrigation, § 640; Long, Irrigation, § 74,

p. 134; *Atchison* v. *Peterson*, 20 Wall. 507; *Basey* v. *Gallagher*, 20 Wall. 670; *Sturr* v. *Beck*, 133 U. S. 541; *United States* v. *Rio Grande Co.*, 174 U. S. 690, 704; *Gutierres* v. *Albuquerque Land Co.*, 188 U. S. 545; *Kansas* v. *Colorado*, 206 U. S. 46; *Winters* v. *United States*, 207 U. S. 564; *Boquillas Land Co.* v. *Curtis*, 213 U. S. 339.

Upholding of state ownership would disintegrate the law and destroy federal interests without working any practical good to the States.

This controversy, as one involving an interstate stream, should be decided upon the basis of the federal ownership of lands and waters, thereby confining the ownership of the States, as ultimate proprietors, to such water rights as have been or may be granted to the respective States for themselves or for use in connection with the lands within their borders. In practice the Federal Government disregards state lines in the use and control of waters for its own purposes; and state lines have been equally disregarded in the grant, and acquisition, and use, of private water rights in the Western States; so a division of water between the States, making state lines controlling, would interfere with the federal use of water and seriously modify, or destroy, existing vested rights. These rights, being grants from the paramount sovereignty, should be upheld as against the claim that the States, which enjoy a quasi sovereignty only, should be treated in this respect as independent Nations.

Mr. Justice Van Devanter delivered the opinion of the court.

This is an original suit in this court by the State of Wyoming against the State of Colorado and two Colorado corporations to prevent a proposed diversion in Colorado of part of the waters of the Laramie River, an interstate stream. The bill was brought in 1911, the evidence was

taken in 1913 and 1914, and the parties put it in condensed and narrative form in 1916 preparatory to the usual printing. The case has been argued at the bar three times. The court directed one reargument because of the novelty and importance of some of the questions involved, and the other because of an intervening succession in the office of Chief Justice. As the United States appeared to have a possible interest in some of the questions, the court also directed that the suit be called to the attention of the Attorney General; and, by the court's leave, a representative of the United States participated in the subsequent hearings.

The Laramie is an innavigable river which has its source in the mountains of northern Colorado, flows northerly 27 miles in that State, crosses into Wyoming, and there flows northerly and northeasterly 150 miles to the North Platte River, of which it is a tributary. Both Colorado and Wyoming are in the arid region where flowing waters are, and long have been, commonly diverted from their natural channels and used in irrigating the soil and making it productive. For many years some of the waters of the Laramie River have been subjected to such diversion and use, part in Colorado and part in Wyoming.

When this suit was brought the two corporate defendants, acting under the authority and permission of Colorado, were proceeding to divert in that State a considerable portion of the waters of the river and to conduct the same into another watershed, lying wholly in Colorado, for use in irrigating lands more than fifty miles distant from the point of diversion. The topography and natural drainage are such that none of the water can return to the stream or ever reach Wyoming.

By the bill Wyoming seeks to prevent this diversion on two grounds: One that, without her sanction, the waters of this interstate stream cannot rightfully be taken from

its watershed and carried into another where she never can receive any benefit from them; and the other that through many appropriations made at great cost, which are prior in time and superior in right to the proposed Colorado diversion, Wyoming and her citizens have become and are entitled to use a large portion of the waters of the river in the irrigation of lands in that State and that the proposed Colorado diversion will not leave in the stream sufficient water to satisfy these prior and superior appropriations, and so will work irreparable prejudice to Wyoming and her citizens.

By the answers Colorado and her co-defendants seek to justify and sustain the proposed diversion on three distinct grounds: First, that it is the right of Colorado as a State to dispose, as she may choose, of any part or all of the waters flowing in the portion of the river within her borders, "regardless of the prejudice that it may work" to Wyoming and her citizens; secondly, that Colorado is entitled to an equitable division of the waters of the river and that the proposed diversion, together with all subsisting appropriations in Colorado, does not exceed her share; and, thirdly, that after the proposed diversion there will be left in the river and its tributaries in Wyoming sufficient water to satisfy all appropriations in that State whose origin was prior in time to the effective inception of the right under which the proposed Colorado diversion is about to be made.

Before taking up the opposing contentions a survey of several matters in the light of which they should be approached and considered is in order.

Both Colorado and Wyoming are along the apex of the Continental Divide and include high mountain ranges where heavy snows fall in winter and melt in late spring and early summer,—this being the chief source of water supply. Small streams in the mountains gather the water from the melting snow and conduct it to larger streams

below which ultimately pass into surrounding States. The flow in all streams varies greatly in the course of the year, being highest in May, June and July and relatively very low in other months. There is also a pronounced variation from year to year. To illustrate, the gaging of the Cache la Poudre, a typical stream, for 1912 shows that the total flow for May, June and July was more than three times that for the nine other months, and the gaging for a period of 30 years shows that the yearly flow varied from 151,636 to 666,466 acre-feet [1] and was in excess of 400,000 acre-feet in each of four years and less than 175,000 acre-feet in each of five years. Both States have vast plains and many valleys of varying elevation where there is not sufficient natural precipitation to moisten the soil and make it productive, but where, when additional water is applied artificially, the soil becomes fruitful,—the reward being generous in some areas and moderate in others, just as husbandry is variously rewarded in States where there is greater humidity, such as Massachusetts, Virginia, Ohio and Tennessee. Both States were Territories long before they were admitted into the Union as States and while the territorial condition continued were under the full dominion of the United States. At first the United States owned all the lands in both and it still owns and is offering for disposal millions of acres in each.

Turning to the decisions of the courts of last resort in the two States, we learn that the same doctrine respecting the diversion and use of the waters of natural streams has prevailed in both from the beginning and that each State attributes much of her development and prosperity to the practical operation of this doctrine. The relevant views of the origin and nature of the doctrine, as shown in these decisions, may be summarized as follows: The

[1] An acre-foot is the quantity of water required to cover an acre to a depth of one foot—43,560 cubic feet.

common-law rule respecting riparian rights in flowing water never obtained in either State. It always was deemed inapplicable to their situation and climatic conditions. The earliest settlers gave effect to a different rule whereby the waters of the streams were regarded as open to appropriation for irrigation, mining and other beneficial purposes. The diversion from the stream and the application of the water to a beneficial purpose constituted an appropriation, and the appropriator was treated as acquiring a continuing right to divert and use the water to the extent of his appropriation, but not beyond what was reasonably required and actually used. This was deemed a property right and dealt with and respected accordingly. As between different appropriations from the same stream, the one first in time was deemed superior in right, and a completed appropriation was regarded as effective from the time the purpose to make it was definitely formed and actual work thereon was begun, provided the work was carried to completion with reasonable diligence. This doctrine of appropriation, prompted by necessity and formulated by custom, received early legislative recognition in both Territories and was enforced in their courts. When the States were admitted into the Union it received further sanction in their constitutions and statutes and their courts have been uniformly enforcing it. *Yunker* v. *Nichols,* 1 Colo. 551; *Schilling* v. *Rominger,* 4 Colo. 100; *Coffin* v. *Left Hand Ditch Co.,* 6 Colo. 443; *Thomas* v. *Guiraud,* 6 Colo. 530; *Strickler* v. *Colorado Springs,* 16 Colo. 61; *Oppenlander* v. *Left Hand Ditch Co.,* 18 Colo. 142; *Wyatt* v. *Larimer, & Weld Irrigation Co.,* 18 Colo. 298; *Crippen* v. *White,* 28 Colo. 298; *Moyer* v. *Preston,* 6 Wyo. 308; *Farm Investment Co.* v. *Carpenter,* 9 Wyo. 110; *Willey* v. *Decker,* 11 Wyo. 496; *Johnston* v. *Little Horse Creek Irrigating Co.,* 13 Wyo. 208.

As the United States possessed plenary authority over Colorado and Wyoming while they were Territories and

has at all times owned the public lands therein, we turn next to its action.

The Act of July 26, 1866, c. 262, § 9, 14 Stat. 251, contained a section providing: "Whenever, by priority of possession, rights to the use of water for mining agricultural, manufacturing, or other purposes, have vested and accrued, and the same are recognized and acknowledged by the local customs, laws, and the decisions of courts, the possessors and owners of such vested rights shall be maintained and protected in the same." The occasion for this provision and its purpose and effect were extensively considered by this court in the cases of *Atchison* v. *Peterson*, 20 Wall. 507, and *Basey* v. *Gallagher* 20 Wall. 670, the conclusions in both being shown in the following excerpt from the latter, pp. 681–682:

"In the late case of *Atchison* v. *Peterson*, we had occasion to consider the respective rights of miners to running waters on the mineral lands of the public domain; and we there held that by the custom which had obtained among miners in the Pacific States and Territories, the party who first subjected the water to use, or took the necessary steps for that purpose, was regarded, except as against the government, as the source of title . . . all controversies respecting it; that the doctrines of the common law declaratory of the rights of riparian proprietors were inapplicable, or applicable only to a limited extent, to the necessities of miners, and were inadequate to their protection; that the equality of right recognized by that law among all the proprietors upon the same stream, would have been incompatible with any extended diversion of the water by one proprietor, and its conveyance for mining purposes to points from which it could not be restored to the stream; that the government by its silent acquiescence had assented to and encouraged the occupation of the public lands for mining; and that he who first connected his labor with property thus situated

and open to general exploration, did in natural justice acquire a better right to its use and enjoyment than others who had not given such labor; that the miners on the public lands throughout the Pacific States and Territories, by their customs, usages, and regulations, had recognized the inherent justice of this principle, and the principle itself was at an early period recognized by legislation and enforced by the courts in those States and Territories, and was finally approved by the legislation of Congress in 1866. The views there expressed and the rulings made are equally applicable to the use of water on the public lands for purposes of irrigation. No distinction is made in those States and Territories by the custom of miners or settlers, or by the courts, in the rights of the first appropriator from the use made of the water, if the use be a beneficial one."

And on the same subject it was further said, in *Broder* v. *Water Co.*, 101 U. S. 274, 276:

"It is the established doctrine of this court that rights of miners, who had taken possession of mines and worked and developed them, and the rights of persons who had constructed canals and ditches to be used in mining operations and for purposes of agricultural irrigation, in the region where such artificial use of the water was an absolute necessity, are rights which the government had, by its conduct, recognized and encouraged and was bound to protect, before the passage of the act of 1866. We are of opinion that the section of the act which we have quoted was rather a voluntary *recognition of a pre-existing right of possession*, constituting a valid claim to its continued use, than the establishment of a new one."

The Act of July 9, 1870, c. 235, § 17, 16 Stat. 217, provided that "all patents granted, or preemption or homesteads allowed, shall be subject to any vested and accrued water rights" acquired under or recognized by the provision of 1866. These provisions are now §§ 2339 and 2340 of the Revised Statutes.

The Act of March 3, 1877, c. 107, § 1, 19 Stat. 377, providing for the sale of desert lands in tracts of one section each to persons undertaking and effecting their reclamation, contained a proviso declaring that "the right to the use of water by the person so conducting the same, on or to any tract of desert land of six hundred and forty acres shall depend upon *bona fide* prior appropriation: and such right shall not exceed the amount of water actually appropriated, and necessarily used for the purpose of irrigation and reclamation: and all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers and other sources of water supply upon the public lands and not navigable, shall remain and be held free for the appropriation and use of the public for irrigation, mining and manufacturing purposes subject to existing rights." Colorado was not at first included in this act, but was brought in by an amendatory act. Next came the Act of March 3, 1891, c. 561, § 18, 26 Stat. 1095, granting rights of way through the public lands and reservations for canals and ditches to be used for irrigation purposes, and containing a proviso saying, "the privilege herein granted shall not be construed to interfere with the control of water for irrigation and other purposes under authority of the respective States or Territories."

Of the legislation thus far recited it was said, in *United States* v. *Rio Grande Dam & Irrigation Co.*, 174 U. S. 690, 706: "Obviously by these acts, so far as they extended, Congress recognized and assented to the appropriation of water in contravention of the common law rule as to continuous flow"; and again, "the obvious purpose of Congress was to give its assent, so far as the public lands were concerned, to any system, although in contravention to the common law rule, which permitted the appropriation of those waters for legitimate industries."

June 17, 1902, c. 1093, 32 Stat. 388, the National Reclamation Act was passed, under which the United States entered upon the construction of extensive irrigation works to be used in the reclamation of large bodies of arid public lands in the western States. Its eighth section declared: "Nothing in this act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this Act, shall proceed in conformity with such laws, *and nothing herein shall in any way affect any right of any State or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof: Provided,* That the right to the use of water acquired under the provisions of this Act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right." The words which we have italicized constitute the only instance, so far as we are advised, in which the legislation of Congress relating to the appropriation of water in the arid land region has contained any distinct mention of interstate streams. The explanation of this exceptional mention is to be found in the pendency in this court at that time of the case of *Kansas* v. *Colorado,* wherein the relative rights of the two States, the United States, certain Kansas riparians and certain Colorado appropriators and users in and to the waters of the Arkansas River, an interstate stream, were thought to be involved. Congress was solicitous that all questions respecting interstate streams thought to be involved in that litigation should be left to judicial determination unaffected by the act,—in other words, that the matter be left just as it was before. The words aptly reflect that purpose.

The decision in *Kansas* v. *Colorado*, 206 U. S. 46, was a pioneer in its field. On some of the questions presented it was intended to be and is comprehensive, and on others it was intended to be within narrower limits, the court saying, "the views expressed in this opinion are to be confined to a case in which the facts and the local law of the two States are as here disclosed." On full consideration it was broadly determined that a controversy between two States over the diversion and use of waters of a stream passing from one to the other "makes a matter for investigation and determination by this court" in the exercise of its original jurisdiction, and also that the upper State on such a stream does not have such ownership or control of the waters flowing therein as entitles her to divert and use them regardless of any injury or prejudice to the rights of the lower State in the stream. And, on consideration of the particular facts disclosed and the local law of the two States, it was determined that Colorado was not taking more than what under the circumstances would be her share under an equitable apportionment.

As respects the scope and interpretation of the ultimate conclusion in that case it should be observed, first, that the court was there concerned, as it said, with a controversy between two States, "one recognizing generally the common-law rule of riparian rights" and the other the doctrine of appropriation; secondly, that the diversion complained of was not to a watershed from which none of the water could find its way into the complaining State, but quite to the contrary; and, thirdly, that what the complaining State was seeking was not to prevent a proposed diversion for the benefit of lands as yet unreclaimed, but to interfere with a diversion which had been practiced for years and under which many thousands of acres of unoccupied and barren lands had been reclaimed and made productive. In these circumstances, and after observing that the diminution in the flow of

the river had resulted in " perceptible injury " to portions of the valley in Kansas, but in " little, if any, detriment " to the great body of the valley, the court said, " it would seem equality of right and equity between the two States forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation; " and that, if the depletion of the waters by Colorado should be increased, the time would come when Kansas might " rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes." What was there said about " equality of right " refers, as the opinion shows (p. 97), not to an equal division of the water, but to the equal level or plane on which all the States stand, in point of power and right, under our constitutional system.

Like that case the one now before us presents a controversy over the waters of an interstate stream. But here the controversy is between States in both of which the doctrine of appropriation has prevailed from the time of the first settlements, always has been applied in the same way, and has been recognized and sanctioned by the United States, the owner of the public lands. Here the complaining State is not seeking to impose a policy of her choosing on the other State, but to have the common policy which each enforces within her limits applied in determining their relative rights in the interstate stream. Nor is the United States seeking to impose a policy of its choosing on either State. All that it has done has been to recognize and give its sanction to the policy which each has adopted. Whether its public land holdings would enable it to go further we need not consider. And here the complaining State is not seeking to interfere with a diversion which has long been practiced and under which much reclamation has been effected, but to prevent a proposed diversion for the benefit of lands as yet unreclaimed.

With this understanding of the case in hand and of some of the matters in the light of which it should be con-

sidered, we take up the several contentions, before noticed, which are pressed on our attention.

The contention of Colorado that she as a State rightfully may divert and use, as she may choose, the waters flowing within her boundaries in this interstate stream, regardless of any prejudice that this may work to others having rights in the stream below her boundary, can not be maintained. The river throughout its course in both States is but a single stream wherein each State has an interest which should be respected by the other. A like contention was set up by Colorado in her answer in *Kansas* v. *Colorado* and was adjudged untenable. Further consideration satisfies us that the ruling was right. It has support in other cases, of which *Rickey Land & Cattle Co.* v. *Miller & Lux*, 218 U. S. 258; *Bean* v. *Morris*, 221 U. S. 485; *Missouri* v. *Illinois*, 180 U. S. 208, and 200 U. S. 496, and *Georgia* v. *Tennessee Copper Co.*, 206 U. S. 230, are examples.

The objection of Wyoming to the proposed diversion on the ground that it is to another watershed, from which she can receive no benefit, is also untenable. The fact that the diversion is to such a watershed has a bearing in another connection, but does not in itself constitute a ground for condemning it. In neither State does the right of appropriation depend on the place of use being within the same watershed. Diversions from one watershed to another are commonly made in both States and the practice is recognized by the decisions of their courts. *Coffin* v. *Left Hand Ditch Co.*, 6 Colo. 443, 449; *Thomas* v. *Guiraud*, 6 Colo. 530; *Hammond* v. *Rose*, 11 Colo. 524; *Oppenlander* v. *Left Hand Ditch Co.*, 18 Colo. 142, 144; *Moyer* v. *Preston*, 6 Wyo. 308, 321; *Willey* v. *Decker*, 11 Wyo. 496, 529–531. And the evidence shows that diversions are made and recognized in both States which in principle are not distinguishable from this, that is, where water is taken in one State from a watershed leading into

the other State and conducted into a different watershed leading away from that State, and from which she never can receive any benefit. The principle of such diversions being recognized in both States, its application to this interstate stream does not in itself afford a ground for complaint, unless the practice in both be rejected in determining what, as between them, is reasonable and admissible as to this stream, which we think should not be done.

We are thus brought to the question of the basis on which the relative rights of these States in the waters of this interstate stream should be determined. Should the doctrine of appropriation, which each recognizes and enforces within her borders, be applied? Or is there another basis which is more consonant with right and equity?

The lands in both States are naturally arid and the need for irrigation is the same in one as in the other. The lands were settled under the same public land laws and their settlement was induced largely by the prevailing right to divert and use water for irrigation, without which the lands were of little value. Many of the lands were acquired under the Desert Land Act which made reclamation by irrigation a condition to the acquisition. The first settlers located along the streams where water could be diverted and applied at small cost. Others with more means followed and reclaimed lands farther away. Then companies with large capital constructed extensive canals and occasional tunnels whereby water was carried to lands remote from the stream and supplied, for hire, to settlers who were not prepared to engage in such large undertakings. Ultimately, the demand for water being in excess of the dependable flow of the streams during the irrigation season, reservoirs were constructed wherein water was impounded when not needed and released when needed, thereby measurably equalizing the natural flow. Such was the course of irrigation development in both

States. It began in territorial days, continued without change after statehood, and was the basis for the large respect always shown for water rights. These constituted the foundation of all rural home building and agricultural development, and, if they were rejected now, the lands would return to their naturally arid condition, the efforts of the settlers and the expenditures of others would go for naught and values mounting into large figures would be lost.

In neither State was the right to appropriate water from this interstate stream denied. On the contrary, it was permitted and recognized in both. The rule was the same on both sides of the line. Some of the appropriations were made as much as fifty years ago and many as much as twenty-five. In the circumstances we have stated, why should not appropriations from this stream be respected, as between the two States, according to their several priorities, as would be done if the stream lay wholly within either State? By what principle of right or equity may either State proceed in disregard of prior appropriations in the other?

Colorado answers that this is not a suit between private appropriators. This is true, but it does not follow that their situation and what has been accomplished by them for their respective States can be ignored. As respects Wyoming the welfare, prosperity and happiness of the people of the larger part of the Laramie valley, as also a large portion of the taxable resources of two counties, are dependent on the appropriations in that State. Thus the interests of the State are indissolubly linked with the rights of the appropriators. To the extent of the appropriation and use of the water in Colorado a like situation exists there.

Colorado further answers that she can accomplish more with the water than Wyoming does or can; that she proposes to use it on lands in the Cache la Poudre valley, and

that they with less water will produce more than the lands in the portion of the Laramie valley known as the Laramie Plains. It is true that irrigation in the Poudre valley has been carried to a higher state of development than elsewhere in the Rocky Mountain region and that the lands of that valley lie at a lower altitude than do those in the Laramie Plains and generally are better adapted to agriculture. In some parts they also require less water. It may be assumed that the lands intended to be reclaimed and irrigated in the Poudre valley conform to the general standard, although this is left uncertain. But for combined farming and stockraising those of the Laramie Plains offer opportunities and advantages which are well recognized. It is to this use that they chiefly are devoted. It is a recognized and profitable industry, has been carried on there for many years and is of general economic value. Many of the original ranchmen still are engaged in it,—some on the tracts where they first settled. With the aid of irrigation, native hay of a high quality, alfalfa, oats and other forage are grown for winter feeding, the live stock being grazed most of the year on unirrigated areas and in the neighboring hills and mountains. In this way not only are the irrigated tracts made productive, but the utility and value of the grazing areas are greatly enhanced. The same industry is carried on in the same way in sections of Colorado. In both States this is a purpose for which the right to appropriate water may be exercised, and no discrimination is made between it and other farming. Even in this suit Colorado is asserting appropriations of this class for 4,250 acres in the portion of the Laramie valley in that State, and is claiming under them an amount of water in excess of what she asserts will irrigate a like acreage in the Poudre valley.

Some of the appropriations from the stream in Wyoming are used for agriculture alone. One of the large projects, dating from territorial days, and constructed at

great cost, carries water from the river through a tunnel one-half mile long and canals several miles in length to the Wheatland District where it is used in irrigating 30,000 acres, all of which are very successfully and profitably farmed in small tracts. This project uses one very large and one comparatively small reservoir for storing water and equalizing the natural flow.

We conclude that Colorado's objections to the doctrine of appropriation as a basis of decision are not well taken, and that it furnishes the only basis which is consonant with the principles of right and equity applicable to such a controversy as this is. The cardinal rule of the doctrine is that priority of appropriation gives superiority of right. Each of these States applies and enforces this rule in her own territory, and it is the one to which intending appropriators naturally would turn for guidance. The principle on which it proceeds is not less applicable to interstate streams and controversies than to others. Both States pronounce the rule just and reasonable as applied to the natural conditions in that region; and to prevent any departure from it the people of both incorporated it into their constitutions. It originated in the customs and usages of the people before either State came into existence, and the courts of both hold that their constitutional provisions are to be taken as recognizing the prior usage rather than as creating a new rule. These considerations persuade us that its application to such a controversy as is here presented cannot be other than eminently just and equitable to all concerned.

In suits between appropriators from the same stream, but in different States recognizing the doctrine of appropriation, the question whether rights under such appropriations should be judged by the rule of priority has been considered by several courts, state and federal, and has been uniformly answered in the affirmative. *Conant* v. *Deep Creek Irrigation Co.*, 23 Utah, 627, 631; *Willey* v.

Decker, 11 Wyo. 496, 534–535; *Taylor* v. *Hulett*, 15 Idaho, 265, 271; *Howell* v. *Johnson*, 89 Fed. 556; *Hoge* v. *Eaton*, 135 Fed. 411; *Morris* v. *Bean*, 146 Fed. 423; *Bean* v. *Morris*, 159 Fed. 651. One of the cases came to this court and the judgment below was affirmed. *Bean* v. *Morris*, 221 U. S. 485. These decisions, although given in suits between individuals, tend strongly to support our conclusion, for they show that by common usage, as also by judicial pronouncement, the rule of priority is regarded in such States as having the same application to a stream flowing from one of them to another that it has to streams wholly within one of them.

The remaining questions are largely matters of fact. The evidence is voluminous, some of it highly technical and some quite conflicting. It has all been considered. The reasonable limits of an opinion do not admit of its extended discussion. We must be content to give our conclusions on the main questions and make such references to and comment on what is evidential as will point to the grounds on which the conclusions on those questions rest. As to minor questions we can only state the ultimate facts as we find them from the evidence.

The question first in order, and the one most difficult of solution, relates to the flow of the Laramie River, the common source of supply. The difficulty arises chiefly out of the fact that the flow varies greatly in the course of the year and also from year to year.

Colorado's evidence, which for convenience we take up first, is directed to showing the average yearly flow of all years in a considerable period, as if that constituted a proper measure of the available supply. We think it is not a proper measure,—and this because of the great variation in the flow. To be available in a practical sense the supply must be fairly continuous and dependable. No doubt the natural flow can be materially conserved and equalized by means of storage reservoirs, but this has

its limitations, both financial and physical. The construction of reservoirs of real capacity is attended with great expense, and unless an adequate return reasonably can be foreseen the expenditure is not justified and will not be made. The years of high water and those of low do not alternate. Often several of the same kind follow in succession. The evaporation of stored water in Colorado and Wyoming is from five to six feet per year. So, while it generally is practicable to store water in one part of the year for use in another, or in one year for use in the next, it often, if not generally, is impracticable to store it for longer periods. All this is recognized elsewhere in Colorado's evidence. One of her principal witnesses said:

"With regard to financial practicability of construction of reservoirs on Poudre River capable of conserving extraordinary floods, will state that they call for an expenditure that could be utilized only occasionally. It would be similar to financial proposition of people in Florida preparing to heat their houses in the same manner as those in the northern part of the United States. For years of unusually high flow in the Poudre River, conservation works, to utilize the excess waters in that stream, would have to count on carrying water over more than one year. The utilization of this water means the presence of population on the land; that population must have a living from year to year and they are not justified in going out on the land and settling to raise a crop only once in three or four years. They must have sufficient to make a living from one year to another, and consequently the investment must be such that there can be sufficient water every year to keep these people on the land, and when water can only be conserved once in every three to five years, there must be provision for carrying over water or the people cannot live. It is a question of population as well as investment. The population has to exist and stay on the ground. From standpoint of investment, con-

servation of flow such as extreme flow of 1884 would be impractical to the extent that it exceeded the ordinary high year. Of such character would be [also] the floods of 1885, 1900 and 1909, three [four] years in thirty." The same witness further said: "Aside from reasons which I have given why reservoirs designed to catch only these rare high water flows of Poudre River are not feasible, it is a fact that no farmer would be able to anticipate the high flow and therefore could not depend at all upon water for irrigation until it reached him. If he undertook to so divert water it would become a gamble rather than a safe guide for living."

Another of her witnesses said:

"The present storage capacity in the Poudre Valley is such that in some years the reservoirs are not all filled, while in some years they are filled and water runs to waste. . . . It would not be possible to inaugurate a scheme in the Poudre Valley to construct reservoirs to store water from one year of high flow to another where such water is the only source of supply, for the reservoirs would have to be constructed to hold the maximum amount, and if the water has to be carried over for three years the average diversion from the reservoir would be only one-third of its capacity, making the cost per acre prohibitive."

And still another of her witnesses, referring to the unused waters of the Poudre in years of high flow and also to what is contemplated by the defendants in respect of the Laramie, said:

"The really dependable water supply of the District [1] will come from the Laramie River, the amount secured from the Poudre River fluctuating greatly and being used to augument the supply from the Laramie. There will

[1] The reference is to the Greeley-Poudre Irrigation District, one of the defendants.

be years when the supply from the Poudre Riv · and its tributaries will be practically nothing. Our plan. contemplate taking all the water that it is possible for · to take from the Laramie River each year. It is possi e to get only a certain amount from that river, and I · not believe that we can absolutely depend on ore th half the required amount from the Laramie Riv . The ry great floods on that watershed we cannot co sider be ause we cannot construct works to take care of em."

In accord with these statements, bearing o what is susceptible of use in actual practice, is furthe evidence coming from Colorado's witnesses and exhib. s to the effect that, notwithstanding the great need fo water in the Poudre valley and the returns obtained fr. its use, large amounts of water pass down the stream w hout use or impounding in the years when the flow exce s what is termed the average. With the high state of irr ation development in that valley the full capacity of th eservoir system there provided when the proof was t ken was 146,655 acre-feet,—an evidence of the limitatio inhering in the practical storage of water from such stre as.

The Cache la Poudre River heads in the same ountain range as does the Laramie and the conditions w ch make for a pronounced variation in the natural flo. are largely the same with both. The following table com led from data relating to the Cache la Poudre, furnishe by Colorado, will be helpful in illustrating the view of the witnesses, and also ours. We add the third and f rth columns.

VARIATION IN ANNUAL NET DISCHARGE
OF
CACHE LA POUDRE RIVER.
April to October, both inclusive, for 30 years.
Taken from Colorado's Exhibit 124.

Year.	Run-off in acre-feet.	Variance from average of all.	Variance from average of all but four.
1884	666,466	+369,144	+403,883
1885	465,475	+168,153	+202,892
1886	290,392	− 6,930	+ 27,809
1887	286,840	− 10,482	+ 24,257
1888	155,970	−141,352	−106,613
1889	185,060	−112,262	− 77,523
1890	221,023	− 76,299	− 41,560
1891	257,236	− 40,086	− 5,347
1892	193,790	−103,532	− 68,793
1893	216,730	− 80,592	− 45,853
1894	309,444	+ 12,122	+ 46,861
1895	344,500	+ 47,178	+ 81,917
1896	162,340	−134,982	−100,243
1897	332,070	+ 34,748	+ 69,487
1898	172,290	−125,032	− 90,293
1899	388,591	+ 91,269	+126,008
1900	474,573	+177,251	+211,990
1901	339,155	+ 41,833	+ 76,572
1902	151,636	−145,686	−110,947
1903	345,150	+ 47,828	+ 82,567
1904	315,437	+ 18,115	+ 52,854
1905	361,652	+ 64,330	+ 99,069
1906	279,974	− 17,348	+ 17,391
1907	386,224	+ 88,902	+123,641
1908	252,843	− 44,479	− 9,740
1909	486,002	+188,680	+223,419
1910	157,514	−139,808	−105,069
1911	205,611	− 91,711	− 56,972
1912	297,722	+ 400	+ 35,139
1913	217,959	− 79,363	− 44,624

Average 297,322, including all years.
Average 262,583, omitting 1884, 1885, 1900, and 1909.

This table shows that during thirty years—1884 to 1913—the yearly flow of the Cache la Poudre ranged from 151,636 to 666,466 acre-feet, that in sixteen of the thirty it fell below the average, and that eight of the sixteen

were in immediate succession. Obviously it is not financially practicable, even by means of reservoirs, to equalize the flow of a stream subject to such variation so that it will have a fairly constant and dependable flow at the average of all years. For further illustration we have taken the average of the twenty-six years remaining after excluding the four described by the witness as extraordinary (these being left to take the average of the others) and on that basis have made a computation of the excess and deficiency, which is shown in the fourth column of the table. Even on this basis there were thirteen years in which the flow was below the average and, of these, six came in immediate succession. In four the deficiency exceeded 100,000 acre-feet and of the four only one followed a year in which there was an excess sufficient, if carried over in storage, to cover the deficiency. This suffices to show that the average of all years is far from being a proper or safe measure of the available supply. An intending irrigator acquiring a water right based on such a measure would be almost certainly confronted with drought when his need for water was greatest. Crops cannot be grown on expectations of average flows which do not come, nor on recollections of unusual flows which have passed down the stream in prior years. Only when the water is actually applied does the soil respond.

We have dealt with the matter of the average flow at this length because throughout Colorado's evidence and in her briefs it is treated as if it were a proper measure of the supply available for practical use. It is there applied to the Laramie not only directly, but indirectly by increasing the gaged flow for a particular year or period by percentages derived by comparing the flow of the Poudre for that year or period with the average for the thirty years, including those in which the flow was so extraordinary that concededly much of it neither was nor could be used. Thus water which is not part of the available supply is counted in measuring that supply.

When the evidence was taken, in 1913 and 1914, the Laramie had not been gaged so thoroughly nor for so long a period as had the Cache la Poudre. Such gaging as had occurred had been done at different places in different periods, partly by the United States Geological Survey, partly by Colorado and partly by Wyoming. Some of the gaging stations were in Colorado, but most were in Wyoming. The latter included Woods, nine miles north of the state boundary, and the Pioneer Dam, four miles north of Woods. The evidence centered largely around the flow and gaging at these places. Colorado's chief witness prepared and presented a table based on data, drawn from various sources, and bearing on the flow at Woods from April to October, both inclusive, for several years and made this table the principal basis of his testimony concerning the flow of the stream in that vicinity. We here reproduce the material part of the table, the third and fourth columns being ours.

DISCHARGE OF LARAMIE RIVER, WOODS, WYO.

April to October, both inclusive, for 9 years.

Taken from Colorado's Exhibit 127.

Year.	Acre-feet.	Variance from average.	Variance from average of all but 1899.
1895	220,239	+ 21,694	+ 45,730
1896	108,022	− 90,523	− 66,487
1897	251,074	+ 52,529	+ 76,565
1898	117,765	− 80,780	− 56,744
1899	390,730	+192,185	+216,221
1900	248,105	+ 49,560	+ 73,596
1911	138,240	− 60,305	− 36,269
1912	213,407	+ 14,862	+ 38,898
1913	99,221	− 99,324	− 75,288

Average, 198,533, including all years.
Average, 174,509, excluding 1899.

The data covered two widely separated periods, one of six years and the other of three. The witness took the average of the nine years, which he gave as 198,545 acre-feet, and made this the basis of further calculations. He estimated that the usual flow for the other months was one-tenth of that for the full year, or, putting it in another way, one-ninth of that from April to October, both inclusive; and on this basis he added to his average 21,945 acre-feet, making 220,490. Consulting the Cache la Poudre table, set forth above, he concluded that the nine years, in combination, fell below the full average for the thirty years covered by that table, and to bring the nine years up to a thirty-year average he added 9,510 acre-feet, making 230,000. Some water from Wyoming enters the river between the state boundary and Woods, and for this he deducted 13,000 acre-feet, leaving 217,000. Then, making a reservation as to Sand Creek, to be considered presently, he concluded that 217,000 acre-feet was the average yearly flow in that section of the river. He called it the "normal" flow, an evident misnomer. This did not include water diverted in Colorado, under recognized Colorado appropriations, which does not reach Wyoming.

Even if the computation was to be made along the lines of something approaching a general average, we think the witness's computation and conclusion are subject to objection in particulars which we proceed to state.

The table shows that the flow for 1899 was extraordinary, so much so that it should have been excluded in computing the average and left to take the general level of the others. Its flow was 216,221 acre-feet in excess of their average. The excess added nothing to the available supply,—that which in practice could be used. The flow for the next year was such that it required no augmentation from 1899. So, the inclusion of 1899 in the computation was, in effect, taking what was not available as a

measure of what was. The error raised the average of the other years 24,036 acre-feet, and was carried into the ultimate conclusion.

We do not doubt that it was admissible to compare the data relating to the Laramie with that relating to the Cache la Poudre and to give effect to such conclusions as reasonably were to be drawn from the comparison; but we think there was no justification for the addition which was made to bring the nine years up to the standard of an average year among the thirty covered by the Cache la Poudre table. The addition tended to distort rather than to reflect the available supply. Looking at the Cache la Poudre table, it is evident that the nine years, in combination, would not have appeared short in flow had the four extraordinary years in the thirty been excluded, as they should have been. Besides, a comparison of the two tables shows that the variation in yearly flow in the two streams is not the same and that the difference is such as to preclude a nice calculation such as was here made on the basis of an assumed uniformity. To illustrate: According to one table the flow of the Poudre from April to October, both inclusive, in 1900 was 85,982 acre-feet in excess of that for the same months in 1899, while according to the other the flow of the Laramie for those months in 1899 was 142,625 acre-feet in excess of that for the corresponding period in 1900; and according to one table the flow of the Poudre for those months in 1913 was 73.2 per cent. of that for the same part of 1912, while according to the other the flow of the Laramie for those months in 1913 was 46.5 per cent. of that for the same part of 1912.

Assuming that 13,000 acre-feet enter the river from Wyoming between the state boundary and Woods, and are part of the river at the latter point, we think this water should not have been deducted. It is part of the supply available to satisfy appropriations from the stream in Wyoming.

The witness treated the flow from April to October, both inclusive, in 1912 as being 213,407 acre-feet, and the flow in the same months in 1913 as being 99,221 acre-feet. In this we think he erred. The evidence establishes that the flow in the first period was not more than 191,820 acre-feet and in the second was not more than 94,369. Even with the year 1899 excluded, this error increased the average 3,305 acre-feet.

If we exclude the extraordinary flow of 1899, make the needed correction in the flow of 1912 and 1913, and assume the accuracy of the other data, the average becomes 171,204 acre-feet, instead of 198,545, as given by the witness. This requires that the 21,945 acre-feet which were added to cover the flow for the five other months be reduced to 19,023.

When these corrections are made in the witness's data and computation, the result is changed from 217,000 acre-feet to 190,227.

But we are of opinion that the computation and conclusion of the witness, even when revised in the way we have indicated, are based too much on the average flow and not enough on the unalterable need for a supply which is fairly constant and dependable, or is susceptible of being made so by storage and conservation within practicable limits. By this it is not meant that known conditions must be such as give assurance that there will be no deficiency even during long periods, but rather that a supply which is likely to be intermittent, or to be materially deficient at relatively short intervals, does not meet the test of practical availability. As we understand it, substantial stability in the supply is essential to successful reclamation and irrigation. The evidence shows that this is so, and it is fully recognized in the literature on the subject.

The same witness prepared and submitted another table embodying all the data he was able to secure from records

of past gaging and measurements at Woods. This included three years not shown in the nine-year table. They and their recorded flow from April to October, both inclusive, were: 1889, 132,349 acre-feet; 1890, 168,406 acre-feet, and 1891, 207,146 acre-feet. The witness pronounced the data for these years less accurate than that for the others, and, while his reason for doing so does not clearly appear, we shall assume he was right. Had the three years been included in the nine-year table that would have reduced the average from 198,545 to 189,371 acre-feet, counting all years, and from 174,509 to 171,066 acre-feet, counting all but 1899. It, however, would not have shown another year with a flow as low as that of 1913, nor as low as that of 1896.

Colorado presented other evidence in the way of general estimates, results of very fragmentary gaging, and opinions based on rough measurements of snow-drifts in the mountainous area about the head of the stream; but we put all of this aside as being of doubtful probative value at best and far less persuasive than the evidence we have been discussing.

Wyoming's evidence was based on the same recorded data that were used by Colorado, and also on actual gaging and measurements by an experienced hydrographer covering the period beginning April 1, 1912, and ending April 30, 1914. Shortly stated, her evidence was to the effect that the actual measured flow at the Pioneer Dam, four miles below Woods, was 198,867 acre-feet from April to December, both inclusive, in 1912, was 109,593 acre-feet for all of 1913 and was 19,181 acre-feet for the first four months of 1914; that the flow for 1912 was somewhat above the average, counting all years; that the flow for 1913 was somewhat more than fifty per cent. of the average, and that the average at Woods and in that vicinity, counting all years, was approximately 200,000 acre-feet. Wyoming's chief witness, the hydrographer, submitted

the following table giving the results of his gaging and measurements at the Pioneer Dam.

DISCHARGE OF LARAMIE RIVER AT PIONEER DAM, NEAR WOODS, WYO., (Including diversion just above dam by Pioneer Canal)

IN ACRE-FEET.

	1912	1913	1914
January	.....	2,650	3,283
February	.....	2,355	3,088
March	.....	3,296	4,003
April	5,534	12,674	8,807
May	40,643	38,307	.....
June	91,874	26,598	.....
July	34,863	6,825	.....
August	7,809	3,130	.....
September	4,641	3,023	.....
October	6,456	3,812	.....
November	4,403	3,677	.....
December	2,644	3,246	.....
Total	198,867	109,593	19,181

The evidence does not permit us to doubt the accuracy of these data. They were obtained by work which is shown to have been painstakingly and conscientiously done by one fully competent to do it. The place at which it was done was well adapted to obtaining accurate results and the observations were continuous, not merely occasional or intermittent.

As the gaging did not cover the first three months of 1912, it is necessary to arrive at the flow for those months. The proof shows that the flow for the same months in 1914 fairly may be taken for the purpose. That was 10,374 acre-feet, the addition making 209,241 acre-feet for 1912. The flow for 1913 was 109,593 acre-feet. Both should be increased 4,000 acre-feet to cover water diverted between Woods and the Pioneer Dam and not returning

to the stream above the gaging station. This gives a total of 213,241 acre-feet for 1912 and 113,593 acre-feet for 1913. Tested by the flow of these years, the available supply would be 163,417 acre-feet; that is to say, on that basis the excess in 1912 would match the deficiency in 1913. But a survey of more than two years is essential in arriving at a fair conclusion respecting the available supply. A year of low flow is not always preceded by one of high or moderate flow as was the case with 1912 and 1913.

In diverting and applying water in irrigation there is a material loss through evaporation, seepage and otherwise which is unavoidable. The amount varies according to the conditions,—chiefly according to the distance the water is carried through canals and ditches and the length of time it is held in storage. Where the places of use are in the same watershed and relatively near the stream, as is true of the lands on the Laramie Plains served by the greater part of the Wyoming appropriations, a substantial amount of water percolates back into the stream from irrigated areas and becomes available for further use lower down the stream. This is called return water. The amount varies considerably and there are no definite data on the subject. As respects irrigation on the Laramie Plains above the Wheatland diversion, the evidence satisfies us that the return water will certainly more than counter-balance the loss through evaporation and otherwise when the period of storage is not more than from one year to the next.

What has now been said covers the substance of the evidence, as we regard it, bearing on the available supply at Woods and in that vicinity, that is to say, the supply remaining after the recognized Colorado appropriations are satisfied.

We already have indicated that, as to such a stream as this, the average flow of all years, high and low, cannot

be taken as a proper or reasonable measure of what is available for practical use. What then is the amount which is available here? According to the general consensus of opinion among practical irrigators and experienced irrigation engineers, the lowest natural flow of the years is not the test. In practice they proceed on the view that within limits, financially and physically feasible, a fairly constant and dependable flow materially in excess of the lowest may generally be obtained by means of reservoirs adapted to conserving and equalizing the natural flow; and we regard this view as reasonable.

But Wyoming takes the position that she should not be required to provide storage facilities in order that Colorado may obtain a larger amount of water from the common supply than otherwise would be possible. In a sense this is true; but not to the extent of requiring that the lowest natural flow be taken as the test of the available supply. The question here is not what one State should do for the other, but how each should exercise her relative rights in the waters of this interstate stream. Both are interested in the stream and both have great need for the water. Both subscribe to the doctrine of appropriation, and by that doctrine rights to water are measured by what is reasonably required and applied. Both States recognize that conservation within practicable limits is essential in order that needless waste may be prevented and the largest feasible use may be secured. This comports with the all-pervading spirit of the doctrine of appropriation and takes appropriate heed of the natural necessities out of which it arose. We think that doctrine lays on each of these States a duty to exercise her right reasonably and in a manner calculated to conserve the common supply. Notwithstanding her present contention, Wyoming has in fact proceeded on this line, for, as the proof shows, her appropriators, with her sanction, have provided and have in service reservoir facilities which are adapted for the

purpose and reasonably sufficient to meet its requirements.

There is one respect, requiring mention, in which Colorado's situation differs materially from that of Wyoming. The water to satisfy the Colorado appropriations is, and in the nature of things must be, diverted in Colorado at the head of the stream; and because of this those appropriations will not be affected by any variation in the yearly flow, but will receive their full measure of water in all years. On the other hand, the Wyoming appropriations will receive the water only after it passes down into that State and must bear whatever of risk is incident to the variation in the natural flow. Of course, this affords no reason for underestimating the available supply, but it does show that to overestimate it will work particular injury to Wyoming.

The lowest established flow was that of 1913. There is no claim or proof that in any other year the flow fell so low. Had there been others some proof of it doubtless would have been presented. This is also true of the very low flow of 1896. Therefore we think it reasonably may be assumed that the flow of those years was so exceptional that it is not likely to recur save at long intervals.

We conclude in view of all the evidence, and of the several considerations we have stated, that the natural and varying flow of this stream at Woods, which is after the recognized Colorado appropriations are satisfied, is susceptible by means of practicable storage and conservation of being converted into a fairly constant and dependable flow of 170,000 acre-feet per year, but not more. This we hold to be the available supply at that point after the recognized Colorado diversions are made. The amount may seem large, but, considering what may be accomplished with practicable storage facilities, such as are already provided, and the use which may be made of

the return water, we are persuaded that the amount, while closely pressing the outside limit, is not too large.

The problem to be worked out in obtaining a fairly dependable supply in that amount is measurably illustrated by the following table covering all the years for which the evidence supplies the requisite data, the flow during the missing months being fairly estimated.

Year.	Acre-feet.	Variance from average of all.	Variance from average of all but 1899.	Variance from 170,000.
1889	151,349	−56,893	−38,576	−18,651
1890	187,406	−20,836	−2,519	+17,406
1891	226,146	+17,904	+36,221	+56,146
1895	239,239	+30,997	+49,314	+69,239
1896	127,022	−81,220	−62,903	−42,978
1897	270,074	+61,831	+80,149	+100,074
1898	136,765	−71,477	−53,160	−33,235
1899	409,730	+201,488	+219,805	+239,730
1900	267,105	+58,863	+77,180	+97,105
1911	157,240	−51,002	−32,685	−12,760
1912	213,241	+4,999	+23,316	+43,241
1913	113,593	−94,649	−76,332	−56,047

Average 208,242, including all years.
Average 189,925, including all years but 1899.

It of course is true that the variation in the flow will not always be just what it was in the years covered by the table, and yet the data obtained by the gaging and measurements in those years show better than anything else what reasonably may be expected in the future. We recognize that the problem which the table is intended to illustrate is not a simple one and that to work it out will involve the exercise of both skill and care. But in this it is not unlike other problems of similar moment. Our belief gathered from all the evidence is that, with the attention which rightly should be bestowed on a problem of such moment, it can be successfully solved within the limits of what is financially and physically practicable.

As to Sand Creek, Colorado's witness regarded it as a tributary of the river and estimated its yearly flow at 17,000 acre-feet. The creek rises in Colorado, extends into the Laramie Plains in Wyoming and discharges into Hutton Lake, a few miles from the river. In exceptional years—about one in five—the waters of the creek overflow the lake for a short period and find their way over the prairie into the river. Otherwise the river receives no water from the creek. The proof of this is direct and undisputed. The creek is nominally a tributary of the river, but only that. Besides, its flow does not appear to have been measured. The witness merely estimated it at what he thought would be the natural run-off of the adjacent territory. Other evidence suggests that the estimate is too high, but this we need not consider. A substantial part of the flow is diverted, through what is known as the Divide Ditch, for use in irrigating lands in Colorado, and the evidence suggests, if it does not establish, that existing appropriations in the two States take the entire flow. For these reasons the waters of this creek cannot be regarded as a factor in this controversy.

After passing Woods, and while traversing the territory wherein are the Wyoming appropriations with which we are concerned, the Laramie receives one large and some very small additions to its waters.

The large addition comes from the Little Laramie, a stream whose source and entire length are in Wyoming. Its natural flow is a little more than one-half of that of the main stream at Woods and is subject to much the same variations. Part of its flow is used under appropriations along its course and the remainder passes into the main stream. Including what is appropriated along its course, and excluding minor contributions by small creeks after it gets well away from its headwaters, we think the amount available for practical use is 93,000 acre-feet per year.

None of the small tributaries, whether of the Laramie or the Little Laramie, adds much to the available supply.

Their natural flow is small. As to some it is all used under old appropriations; as to some it is partly used under such appropriations; and as to some it is only seasonal, the channels being dry much of the year. Some creeks spoken of in Colorado's evidence as tributaries are otherwise shown not to be such, but to deliver their waters into lakes or ponds not connected with either of the principal streams. Colorado's evidence also takes into account some tributaries which discharge into the Laramie below the points of diversion of all the Wyoming appropriations with which we are concerned. One, of which much is said in the evidence, is the Sybille. It reaches the Laramie below the diversion for the Wheatland District (the lowest diversion we are to consider), but in its course passes through that district. A small part of its flow is used in that district and it is not practicable to use more. What is used should, for present purposes, be treated as if it reached the Laramie above the Wheatland diversion. Wyoming contends that none of these small tributaries, other than the Sybille, contributes any dependable amount to the available supply. We think there is in the aggregate a fairly dependable contribution of 25,000 acre-feet, but not more.

It results that, in our opinion, the entire supply available for the proposed Colorado appropriation and the Wyoming appropriations down to and including the diversion for the Wheatland District is 288,000 acre-feet.

In contending for a larger finding, Colorado points to the issue by Wyoming's State Engineer of permits, so-called, for appropriations in excess of that amount and insists that these permits constitute solemn adjudications by that officer that the supply is adequate to cover them. But in this the nature of the permits is misapprehended. In fact and in law they are not adjudications, but mere licenses to appropriate, if the requisite amount of water be there. As to many nothing ever is done under them by

the intending appropriators. In such cases there is no appropriation; and even in others the amount of the appropriation turns on what is actually done under the permit. In late years the permits relating to these streams have contained a provision, saying: "The records of the State Engineer's office show the waters of [the particular stream] to be largely appropriated. The appropriator under the permit is hereby notified of this fact, and the issuance of this permit grants only the right to divert and use the surplus or waste water of the stream and confers no rights which will interfere with or impair the use of water by prior appropriators." It therefore is plain that these permits have no such probative force as Colorado seeks to have attributed to them.

Colorado also comments on the amount of water stored in Wyoming reservoirs in 1912 and seeks to draw from this an inference that the available supply was greater than we have indicated. But the inference is not justified, and for these reasons: First, a part of what was stored was dead water, that is, was below the level from which water could be drawn off and conducted to the places of use. This is a matter commonly experienced in the selection and use of reservoir sites. Secondly, the flow of 1912 was above what could be depended on and prudence required that a substantial part be carried over to meet a possible shortage in the succeeding year. And, thirdly, the evidence shows that in 1912 the storing process was improvidently carried to a point which infringed the rights of small appropriators who were without storage facilities.

The available supply—the 288,000 acre-feet—is not sufficient to satisfy the Wyoming appropriations dependent thereon and also the proposed Colorado appropriation, so it becomes necessary to consider their relative priorities.

There are some existing Colorado appropriations having priorities entitling them to precedence over many of the

Wyoming appropriations. These recognized Colorado appropriations are, 18,000 acre-feet for what is known as the Skyline Ditch and 4,250 acre-feet for the irrigation of that number of acres of native-hay meadows in the Laramie valley in Colorado, the 4,250 acre-feet being what Colorado's chief witness testifies is reasonably required for the purpose, although a larger amount is claimed in the State's answer. These recognized Colorado appropriations, aggregating 22,250 acre-feet, are not to be deducted from the 288,000 acre-feet, that being the available supply after they are satisfied. Nor is Colorado's appropriation from Sand Creek to be deducted, that creek, as we have shown, not being a tributary of the Laramie.

The proposed Colorado appropriation which is in controversy here is spoken of in the evidence as the Laramie-Poudre tunnel diversion and is part of an irrigation project known as the Laramie-Poudre project. Colorado insists that this proposed appropriation takes priority, by relation, as of August 25, 1902, and Wyoming that the priority can relate only to the latter part of 1909. The true date is a matter of importance, because some large irrigation works were started in Wyoming between the dates mentioned, were diligently carried to completion, and are entitled to priorities as of the dates when they were started.

The Laramie-Poudre project is composed of several units, originally distinct, which underwent many changes before they were brought together in a single project. In its final form the project is intended to divert water by means of a tunnel from the Laramie River into the Poudre watershed, there to unite that water with water taken from the Cache la Poudre River and then to convey the water many miles to the lower part of the Poudre valley, where it is to be used in reclaiming and irrigating a body of land containing 125,000 acres. It is a large and ambitious project whose several parts, as finally brought

together, are adjusted to the attainment of that purpose. The parts were separately conceived, each having a purpose of its own. The project now is intended to draw on two independent sources of supply, each in a separate watershed.[1] The appropriations are necessarily distinct. Neither adds anything to, nor substracts anything from, the status of the other. We are concerned with only one of them.

The proposed tunnel diversion from the Laramie was conceived as a possibility by Wallace A. Link in 1897 and was explained by him to Abraham I. Akin in the spring of 1902. Later in the year they visited the headwaters of the two streams, looked over the ground, and agreed that Link's idea was a good one, that the undertaking was large and that they were without the means to carry it through. They concluded to promote the project together; and, thinking their chances of success would be improved by it, they also concluded to construct a ditch, known as the Upper Rawah, from the Laramie valley to a connection with an existing ditch, called the Skyline, and to take water through these ditches into the Cache la Poudre valley and there sell it. By this they hoped to demonstrate that water was obtainable from that source and to obtain money to be used in promoting their project. The Skyline was a fair-sized ditch leading over a low part of the divide to a branch of the Poudre, and they

[1] An engineer who had been connected with the work, and was a witness for the defendants, said: "This system has two distinct and independent sources of supply; that from the Laramie River and that from the Poudre River basin and the tributaries of the South Platte, and it was so designed that the Poudre Valley Canal could divert water from the Poudre River and also from the northern tributaries of the Poudre intercepted by the canal and from the tributaries of the South Platte as far east as Crow Creek and intercepted by the canal wherever there was surplus water. We estimated that the amount of water available outside of the Laramie River source would be between 80,000 and 100,000 acre-feet per annum as an average."

arranged with its owner for the carriage, on a percentage basis, of water from their ditch when constructed. They also conceived that the ditch could be used advantageously in collecting and carrying water to be sent through the tunnel, if and when the tunnel diversion was effected. In 1902, beginning August 25, they surveyed the line of the Rawah and in October of that year filed a statement of claim under it in the State Engineer's office. In the statement they said nothing about a tunnel diversion and made claim only to the amount of water expected to be carried through the Rawah and to the use of certain lakes or natural reservoirs for storage purposes. No work was done on the ditch that year. In 1903 they cleared some of the land over which it was to run, but did no excavating. In 1904 they constructed 6,000 feet of the ditch and did more clearing. No work was done on it in 1905 or 1906. Further work was done in 1907 and some washouts were repaired in 1908. That was the last work on the Rawah. Much more than one-half of the ditch was left unconstructed. No water was delivered through it to the Skyline, nor was any sold or used. Nothing appears to have been done with the lakes or natural reservoirs.

In 1903 Link and Akin gave to each of three others a one-fifth share in their project, in return for which the new partners were to carry on solicitations to get capitalists interested and to raise money. The results of the solicitations were disappointing, but some investors were brought in and became concerned about the preliminary plans. Differences of opinion arose and had to be dealt with. The plans were examined and reëxamined, alternative modes and places of diversion were considered and investigated, particular features were eliminated and others added, and in 1909, but not before, the project was definitely brought into its present form. A short reference to some of the details will serve to make this plain.

In the Upper Rawah filing of October, 1902, nothing was said about the proposed tunnel diversion, but a claim was made to the use of certain lakes or natural reservoirs described as having an aggregate capacity of 325,000,000 cubic feet. The tunnel diversion was merely a mental conception until 1904. In March of that year a survey was made of a tunnel site, a ditch from the west fork of the Laramie to the east fork, and a channel reservoir on the east fork above the tunnel site; and in May following a statement of claim under them was filed, in which the estimated cost of the tunnel and ditch was given as $189,200 and that of the reservoir as $20,000. Later in 1904 a survey was made of a tunnel site, three collecting ditches and two pipe lines, and in October of that year a statement of claim under them was filed, in which the estimated cost of the tunnel, ditches and pipe lines was given as $375,000. The location and dimensions of the tunnel in the second survey differed from those in the first. The difference was not pronounced, and yet was a real change. In September, 1906, another statement of claim was filed covering the Upper Rawah Ditch, the lakes connected therewith and the tunnel. This statement declared that the lakes were to be so enlarged that they would have an aggregate capacity of 1,250,000,000 cubic feet, instead of 325,000,000 as stated in the filing of 1902; and it again changed the location and dimensions of the tunnel,—this time more than before.

In 1905 and 1906 surveys were made to find a route for an open canal from the Laramie around the mountains, through a portion of Wyoming and back to Colorado, which would avoid the construction of a tunnel and the maintenance of ditches in the higher mountain levels; and in 1908 a statement of claim covering such a canal was filed, as was also a claim covering a large channel reservoir nine miles down the stream from the tunnel site. The estimated cost of the canal was given as $1,000,000

and that of the reservoir as $200,000. The plan evidenced by these filings was that of impounding the water in the reservoir and liberating it in an equalized flow into the canal, which was to carry it into the Poudre watershed without the aid of a tunnel. Late in 1908 and in the fore part of 1909 another survey along the same general line and with the same purpose was made at a cost of $15,000. Early in 1909 a statement of claim was filed covering a proposed reservoir near the tunnel site, the cost being estimated at $200,000.

In 1907 the Laramie-Poudre Reservoirs and Irrigation Company succeeded to whatever rights the promoters had acquired up to that time, and all subsequent surveys, investigations and filings were made by it. In April, 1909, the Greeley-Poudre Irrigation District, within which the water is intended to be used, was organized. At that time sufficient capital had not been obtained to carry the project through in any form. In September following the irrigation company and the irrigation district entered into a tentative contract, under which the company was to consummate the project in its present form, and, after doing the construction work, was to transfer the property to the district. Payment therefor was to be made in interest-bearing bonds of the district. By a vote taken the next month, the district ratified the contract and authorized the issue of the bonds. About the last of that month the work of boring the tunnel and making the diversion was begun.

It is manifest from this historical outline that the question of whether, and also how, this proposed appropriation should be made remained an open one until the contract with the irrigation district was made and ratified in 1909. Up to that time the whole subject was at large. There was no fixed or definite plan. It was all in an inceptive and formative stage,—investigations being almost constantly in progress to determine its feasibility and

whether changes and alternatives should be adopted rather than the primary conception. It had not reached a point where there was a fixed and definite purpose to take it up and carry it through. An appropriation does not take priority by relation as of a time anterior to the existence of such a purpose.

It no doubt is true that the original promoters intended all along to make a large appropriation from the Laramie by some means, provided the requisite capital could be obtained, but this is an altogether inadequate basis for applying the doctrine of relation.

No separate appropriation was effected by what was done on the Upper Rawah Ditch. The purpose to use it in connection with the Skyline was not carried out, but abandoned. This, as Link testified, was its "principal" purpose. The purpose to make it an accessory of the large project was secondary and contingent. Therefore the work on it cannot be taken as affecting or tolling back the priority of that project.

Actual work in making the tunnel diversion was begun as before shown, about the last of October, 1909. Thereafter it was prosecuted with much diligence and in 1911, when this suit was brought, it had been carried so nearly to a state of completion that the assumption reasonably may be indulged that, but for the suit, the appropriation soon would have been perfected. We conclude that the appropriation should be accorded a priority by relation as of the latter part of October, 1909, when the work was begun.

Applying a like rule to the Wyoming appropriations, several of them must be treated as relating to later dates, and therefore as being junior to that appropriation. Some of the projects in that State are founded on a plurality of appropriations, a part of which are senior and a part junior to that one.

The evidence shows that the Wyoming appropriations having priorities senior to the one in Colorado, and which

are dependent on the available supply before named, cover 181,500 acres of land and that the amount of water appropriated and reasonably required for the irrigation of these lands is 272,500 acre-feet. A much larger amount is claimed, but our finding restricts the amount to what the evidence shows is reasonably required, which is one acre-foot per acre for the larger part of the lands, two acre-feet per acre for a part and two and one-half acre-feet per acre for the remainder.

As the available supply is 288,000 acre-feet and the amount covered by senior appropriations in Wyoming is 272,500 acre-feet, there remain 15,500 acre-feet which are subject to this junior appropriation in Colorado. The amount sought to be diverted and taken under it is much larger.

A decree will accordingly be entered enjoining the defendants from diverting or taking more than 15,500 acre-feet per year from the Laramie River by means of or through the so-called Laramie-Poudre project.

It is so ordered.

STATE OF WYOMING *v.* STATE OF COLORADO ET AL.

IN EQUITY.

No. 3, Original. Final decree entered June 5, 1922.

This cause having been heretofore submitted on the pleadings and the evidence taken before and reported by the commissioners appointed for the purpose, and the court being now fully advised in the premises:

It is considered, ordered and decreed that the defendants, their officers, agents and servants, be, and they are hereby, severally enjoined from diverting or taking from the Laramie River and its tributaries in the State of Colo-

rado more than fifteen thousand five hundred (15,500) acre-feet of water per annum in virtue of or through what is designated in the pleadings and evidence as the Laramie-Poudre Tunnel appropriation in that State,

Provided, that this decree shall not prejudice the right of the State of Colorado, or of any one recognized by her as duly entitled thereto, to continue to exercise the right now existing and hereby recognized to divert and take from such stream and its tributaries in that State eighteen thousand (18,000) acre-feet of water per annum in virtue of and through what is designated in the pleadings and evidence as the Skyline Ditch appropriation in that State; nor prejudice the right of that State, or of any one recognized by her as duly entitled thereto, to continue to exercise the right now existing and hereby recognized to divert and take from such stream and its tributaries in that State four thousand two hundred and fifty (4,250) acre-feet of water per annum in virtue of and through the meadow-land appropriations in that State which are named in the pleadings and evidence; nor prejudice or affect the right of the State of Colorado or the State of Wyoming, or of any one recognized by either State as duly entitled thereto, to continue to exercise the right to divert and use water from Sand Creek, sometimes spoken of as a tributary of the Laramie River, in virtue of any existing and lawful appropriation of the waters of such creek;

And it is also considered, ordered and decreed that the State of Wyoming do have and recover from the defendants her lawful costs herein.

And it is further considered, ordered and decreed that the clerk of this court do transmit to the chief magistrates of the States of Colorado and Wyoming copies of this decree duly authenticated under the seal of this court.[1]

[1]A modified decree was entered October 9, 1922. It will be printed in Vol. 260 U. S., p. 1.